PEVoC 16

Pan European Voice Conference

VOICEISTANBUL

CONGRESS BOOK

March 25-28, 2026

ISTANBUL

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INVITATION

Dear Colleagues and Friends,

We are delighted to announce that the 16th Pan-European Voice Conference (PEVOC 16) and Voice Istanbul 2026 will take place in Istanbul between March 25–28, 2026.

PEVOC is a global interdisciplinary organization that provides a platform for voice professionals to exchange knowledge about the human voice. It continues to bring together ENT specialists, speech and language therapists, phoniatricians, singing teachers and voice coaches, singers, performing artists, and voice scientists from across Europe to share experiences, ideas, and engage in dynamic discussions.

As every year, we are honored to organize the Voice Istanbul Meeting, and this time, we are excited to hold it in conjunction with PEVOC 16.

Our aim is to bring these different specialties together to share knowledge and expertise in all aspects of the voice and to improve interdisciplinary collaboration. Panels, workshops, keynote lectures, case discussions, free paper presentations, and poster sessions will offer both scientific and artistic communities insights into the latest advances in voice science, voice care, and training.

Our congress will be held in Istanbul, one of the world's most vibrant cities, where East meets West, offering a rich blend of history, culture, and modern life.

We are confident that this meeting will be a great opportunity to reconnect with colleagues, discover or demonstrate new technologies and techniques, and build new friendships.

We look forward to seeing you in Istanbul.

Yours sincerely,

Prof. Dr. Kürşat Yelken
Pevoc16 Congress President

Prof. Dr. Hakan Birkent
Voice Istanbul Congress President

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SCIENTIFIC PROGRAM

25 MARCH 2026 | PRE-CONGRESS COURSE

TIME	FATİH ÖĞÜT HALL	SUSAN YARNALL MONKS HALL
	European Academy of Voice Crash Course on Voice For more information, write to info@european-academy-of-voice.org	
8:30-09:00	Gathering	
9:00-09:50	Anatomy, Physiology, Pathology **Filipa Lã**	
9:55-10:45	Endoscopy, Stroboscopy, VKG and High Speed Imaging **Markus Hess, Frank Müller**	
10:45-11:15	Coffee Break	
11:15-12:05	Aerodynamics and Voice Analysis **Nathalie Henrich, Frank Müller**	
12:10-13:00	Voice Acoustics, Microphones, Recording and Computers **Jan Švec, Christian Herbst**	
13:00-14:00	Lunch	
14:00-14:50	Principles of Voice Therapy **Jenny Iwarsson**	
14:55-15:45	Dissection and Phonosurgery **Markus Hess**	
15:45-16:15	Coffee Break	
16:15-17:05	Breathing and Pulmonary Function **Johan Sundberg**	
17:10-18:00	Analyzing Voices With Ears, Brain, and Heart **Brian Gill**	
18:00	Adjourn	

European Board Examination in Phoniatrics (EBE Phoniatrics)

The European Board Examination in Phoniatrics (EBE Phoniatrics) represents a major milestone in the harmonization and advancement of specialist training in Phoniatrics across Europe and beyond. Established under the umbrella of the E.B.E. ORL-HNS in cooperation with the European Academy of Phoniatrics (EAP), and the Union of European Phoniatricians (UEP), the EBE Phoniatrics ensures high-quality, standardized assessment of medical expertise in voice, speech, language, hearing, and swallowing disorders.

Successfully passing the examination leads to the prestigious title "Fellow of the European Board in Phoniatrics", recognizing excellence, professional competence, and international standards of care. The first Fellows were awarded in 2025, marking a historic step for the specialty.

EBE Phoniatrics 2026 - Save the Date

Written examination: March 6, 2026 (online)
Oral examination: March 25, 2026
(held before PEVoC16 / VOICEISTANBUL)
The following teaching materials are available to candidates as a basis for exam preparation.

The UEP–UEMS Phoniatrics Logbook
The Manual of Phoniatrics (Springer) in 3 volumes
EAP Training Courses 2026
Vienna, Austria: February 12–14, 2026
Kajetany, Poland: November 19–21, 2026
EBE Phoniatrics stands for excellence, transparency, and the future of phoniatric training in Europe and beyond.

For more information: EAPT

SCIENTIFIC PROGRAM

26 MARCH 2026

TIME	FATİH ÖĞÜT HALL	SUSAN YARNALL MONKS HALL	JURGEN WENDLER HALL	HALL 4	HALL 5	HALL 6
8:00-8:30	REGISTRATION OPENS					
8:30-9:30	**UEP SESSION on Voice Surgery** Chair: Dirk Mürbe Moderator: Haldun Oğuz Glottoplasty - lessons learned **Markus Hess** Stickler: Thyroplasty type 1 **Berit Schneider-Stickler** Vascular polyps of the Vocal Folds: Cold steel to LASER **Soumitra Gosh** Intraoperative computed tomography imaging for laryngoplasty **Ichiro Tateya** Surgery for benign vocal fold lesions **Taner Yılmaz** Voice deepening surgery - current scientific and clinical aspects **Dirk Mürbe**	**COMET SESSION** **Artistic Voice Specialists Inform** Chair: John Rubin Moderator: Marco Fantini Expression codes in singing **Johan Sundberg** Vocal damping: history, physiology and new perspectives **Marco Fantini** Assessing the Performer's Voice: A Wild-Goose Chase for Acoustic Equivalence, or Redefining the Goal? **Pedro Pestana** The challenges of maintaining a performance voice in idiopathic stenosis. **Julian Mc Glashan** Effects of hypertonic saline nebulization on voice quality: literature review and pilot investigation **Ana Danic Hadžibegović**	**ALP SESSION** **(Phoniatrics Committee)** Chair: Gürsel Dursun Moderator: Tamer Abou-Elsaad Singing Voice Therapy. **İlter Denizoglu** The neurophysiological basis of voice therapy. **Paulina Krasnodebska** Benefits, scope and limits of voice rehabilitation. **Carlos Manzano** Auditory-vocal feedback. Neurophysiological basics and their significance for quality of voice. **Karol Myszel** The role of LEMG in the management of unilateral vocal folds paresis. **Matthias Leonhard**	**ELS SESSION** Chair: Ferhan Öz Moderatör: Marc Remacle Gender-affirming Anterior Commissure Glottoplasty **Laura-Elizabeth Gosselin** Surgical treatment of anterior glottic web **Necati Enver** Outdoor flap for the anterior commissure **Kürşat Yelken**	**SKYBD SESSION** **Multidisciplinary Approach to Professional Voice Disorders** Chair: Seyhun Topbaş Moderator: Hakan Birkent Common Voice Disorders in Professional Voice and Clinical Warning Signs **Emel Çadallı Tatar** Role of speech therapy in other professional voice users **Esra Özcebe** Approaching Voice Disorders in Professionals: The Role of the Vocal Coach **Ayhan Helvacı** Role of speech therapy in elite voice users **Ümit Daşdöğen** Phonosurgery Tips in Professional Voice Users **Reinaldo Yazaki**	**CWASOS SESSION** **Physiological Features of the Voice of Turkish Folk Artists, Problems and Solutions** Chair: Özgür Yiğit Moderator: Ramil Hashimli Endoscopic Analysis of Laryngeal Biomechanics in Mugham Singing **Ramil Hashimli** Throat singing of kazakhs: phoniatric aspects **Dinara Toguzbayeva** Prevention of Dysphonia in Kazakh Folk Vocalists: Risk Assessment and Physiological Features of Traditional Singing under High-Intensity Loads. **Zhanel Begungutova** Functional state of the larynx in the performers of the "Manas" epic. **Alfisa Orozaliyeva** Acoustic strategies in the Azerbaijani ghazal-romance **Alexandria Sultan von Bruseldorff**
9:30-10:00		OPENING CEREMONY				
10:00-11:00		**Opening Lecture** Johan Sundberg Why Research On Singer Voices? Bernhard Richter & Dirk Murbe & Johan Sundberg				
11:00-11:30	Coffee Break - **Poster Session 1**					
11:30-13:00	**PANEL** **Breathing and Respiratory Support** Chair: Esra Özcebe Moderator: Lisa Popeilt Relevance of subglottal pressure **Johan Sundberg** Is the tracheal pull a factor affecting the glottal voice source? **Jenny Iwarsson** Fine tuning Respiration and Support in the training of Classical Singers **Carlos Aransay** Comparative Breath Support Strategies **Lisa Popeil** Breathing Pattern Dysfunction: When Breathing Mechanics Go Wrong **Claudio Milstein** **Anne Marie Speed**	**PANEL** **Seeing and Hearing the Voice** Chair: Sevtap Akbulut Moderator: Matthias Echternacht Auditive and proprioceptive control of phonation **Ivana Aras** Dynamic Flexible Laryngoscopic Evaluation of Voice **Sevtap Akbulut** Auditory diagnostic signs for voice disorders **James Thomas** Beyond the Surface: 3D MRI as a New Window into Vocal Fold Dynamics **Lousia Traser**	**PANEL** **Post Operative Rehabilitation of Singing Voice** Chair: İsmail Koçak Moderator: Markus Hess Speakers: **Jale Papilla** **Sara Gulzov** **Veronica Segler** **Monique Verguts**	**PANEL** **IALP Voice Committee Session** **Voice Assessment and Treatment: An International Perspective** Chair: Tamer Abou-Elsaad Moderator: Estella Ma Investigating ultrasound settings for laryngeal imaging **Ciarán Kenny** Survey of referral patterns in southwestern mainland China: How do pediatricians manage children with dysphonia **Lyu Dan** Assessment and management of vocal fold sulcus: Perspectives from SLPs in India **Zainab Nagree** The clinician is the instrument: Voice assessment and therapy without tools **Debra Phyland** How is artificial intelligence changing the vocal demands of occupational voice users **Lady Catherine Cantor-Cutiva**	**PANEL** **Vocal Phytotherapy and Applications** Chair: Selmin Özgürsoy Moderator: Orietta Calcinoni Botanic and active principle categorization **Orietta Calcinoni** **Maria Isaeva** Integrating Ayurveda and Indian Traditional Medicine into Contemporary Laryngology Practice **Raghavi Vishnu - Prasanna**	**PANEL** **Taking Care of Your Voice as a Voice Professional: Do's and Dont's** Chair: Ayhan Helvacı Moderator: Tülün Malkoçoğlu Profesyonel Ses Kullanımında Doğru Teknikler ve Doğru Alışkanlıklar **Seta Kürkçüoğlu** The Relationship Between Vocal Identity and Vocal Health **Özlem Kılıç** Longevity over loudness **Canan Özgür**

SCIENTIFIC PROGRAM

26 MARCH 2026

TIME	FATİH ÖĞÜT HALL	SUSAN YARNALL MONKS HALL	JURGEN WENDLER HALL	HALL 4	HALL 5	HALL 6
13:00-13:30	**WORKSHOP** **Chair: Julian Mc Glashan** It's All About Pressure **Speaker:** **Pedro Melo Pestana**	**WORKSHOP** **Chair: Filipa La** PROEL1: For the RESONANCE of the Voice: Working With Facilitating Postures and Gadgets **Speakers:** **Carles Exposito** **Greta Vernizzi**	**WORKSHOP** **Chair: Engin Başer** APDVoice: From Unstructured Notes to AI-Ready Voice Clinic Data Standardized data capture, outcomes tracking, AI-ready analytics **Speaker:** **Ramil Hashimli** **Ali Hashimli**	**UEP Workshop on Artificial Intelligence** **Chair: Haldun Oğuz** Minimizing AI Hallucinations in Voice Research: Practical Methods and Metrics **Speaker: Khalid AlMalki**	**ORAL PRESENTATIONS** **Chair: Ceki Paltura** Vocal fatigability and handicap in teachers: a cross-sectional study **Silvia Contreras Regatero** **Laura González Sanvisens** **Josep Vila Rovira** Evidence for the Stimulation Vocal Tract Articulators with 2D MRI Videos **Patrick Hoyer, Sophia Hoyer** **Martin Blaimer** Association between diagnosed respiratory allergies and vocal symptoms – a cross-sectional population-based study **Sofia Helena Holmqvist Jämsén, Hanna Wakene** **Patrick Jern** **Susanna Simberg** Evaluation of rough vocals using phase synchrony **Mario Fleischer, Dirk Mürbe** **Matthias Echternach** **Bernhard Richter** **Marie Kölberlein** **Louisa Traser**	**ORAL PRESENTATIONS** **Chair: Volkan Sunter** Voice Quality in Multiple Sclerosis: Insights from Acoustic and Cepstral Analyses **Gamze Yesilli Puzella** **Ayşe Şehidhamza** Semi-Occluded Vocal Tract Exercises for Voice Rehabilitation in Unilateral Vocal Fold Palsy: an observational study focusing on semi occluded bubble mask (SOBM) technique and semi occluded ventilation mask (SOVM) technique **Vittoria Carlino** **Marco Fantini** Examination of Voice Hygiene Awareness, Perceived Voice Handicap and Acoustic Voice Parameters According to Academic Year in Preservice Music Teachers **Polen Su Sağlam, Ceyda Güler, Dilber Aleyna Garip** **Aslan Görkem Yenigezer** **Aysu Papurcu Anılır** Investigation of the prevalence of dysphagia and laryngopharyngeal reflux in patients with rheumatoid arthritis: its relationship with serological markers, impact on quality of life and endoscopic swallowing evaluation results **Bahadır Gençtürk** **Emine Ceren Ersöz Ünlü** **Gülçimen Aslan, Seda Çolak** **Emre Tekgöz, Nimet Evin** **Levent Yücel**
13:30-14:30	Lunch					
14:30-15:00	**KEYNOTE** **Chair: Katrin Neumann** Countertenor Voices Between Art and Clinic: Repertoire, Technique, and Vocal Load **Speaker: Philipp Mathman**	**KEYNOTE** **Chair: Haldun Oğuz** EBE Phoniatrics **Speaker:** **Berit Schneider Stickler**				
15:00-16:30	**PANEL** **Vocal Tract: Devil or Angel?** **Chair: Eren Balo** **Moderator: Bernhard Richter** Is the vocal tract relevant in bridging vocal registers in professional singers? **Matthias Echternacht** Performing vocally with a regained vocal tract **David Howard** When the "angel" becomes the "devil" **Thomas Moors** 3D Physical Vocal Tract Modeling: Applications and Challenges **David Meyer** Endoscopic Vocal Tract Evaluation in a Tenor Performing Bel Canto vs. Non-Bel Canto Vocal Exercise **Ewelina Sielska-Badurek** The vocal tract and vocal registers – neither angelic nor demonic, just physics **Christian Herbst**	**SPECIAL SESSION** **Colors of the World: Vocal Styles and Ornaments - I** **Chair: Kathrin Sadolin** **Moderator: Jayakumar Menon** **Speakers:** **Raghavi Vishnu Prasanna** **Dinara Toguzbayeva** **Lisa Popeil** **H. Steven Sims** **Laçin Modiri**	**PANEL** **Management of Singing Voice Problems** **Chair: Elif Aksoy** **Moderator: Elif Aksoy** Acute Voice Problems in Singers: Clinical Challenges and Interdisciplinary Management **Rodica Muresan** Eight Shows a Week – Not Just Surviving but Thriving: The Rigours of a West End Musical Schedule **Anne-Marie Speed** Voice Training Approaches in the Management of Singing Voice Problems. **Özlem Mutlu Öner** Managing the outcomes of maladaptive coping behaviors related to stage fright: a behavioral perspective **Korhan Sezin**	**PANEL** **Destructive Lesions (Sulci, vergeture) in Singers: What to do and How to do?** **Chair: Kezban Gürbüz** **Moderator: Małgorzata Wierzbicka** Is less better than more?? **Camille Finck** Sulcus Vocalis - A Wide Range of Surgical Approaches? **Dirk Murbe** Management Algorithm for Professional Voice Users with Sulcus Vocalis **İsmail Koçak** Sulcus Vocalis: How Classification Guides Treatment **Volkan Sunter** Approach to Sulcus Vocalis Incidentally Detected During Phonosurgery **Erhan Demirhan** Destructive Lesions (Sulci, vergeture) in Singers: Is there a role for voice therapy? **Rehab Awad**	**PANEL** **Vocal Rehabilitation in Head and Neck Cancer Patients** **Chair: Hakan Korkmaz** **Moderator: Bengü Çobanoğlu** From Surgical Dogma to Personalized Indications: Primary TEP in Complex Laryngectomy **Francesco Bussu** The clinical management of challenging cases using voice prosthesis' (hypertonicity/hypotonicity etc.) **Fatma Esen Aydınlı** Impact of Surgical Approaches on Voice Outcomes. **Serap Şahin Önder** Clinical strategies in esophageal speech therapy **Gülsün Adsız** Alaryngeal Voice Restoration: TE Speech, Electrolarynx, Esophageal Voice **Barış Büyük** The Pivotal Role of the Data Manager in Standardized Clinical Data Collection within Head and Neck Oncology. **Sebastiana Lai**	**PANEL** **Current Concepts in Vocal Pedagogy** **Chair: Tülün Malkoç** **Moderator: Ayhan Helvacı** **Speakers:** **Elif Şahin Orhon** **Gül Fahriye Evren** **Ardan Beyarslan**

SCIENTIFIC PROGRAM

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TIME	FATİH ÖĞÜT HALL	SUSAN YARNALL MONKS HALL	JURGEN WENDLER HALL	HALL 4	HALL 5	HALL 6
16.30-17.00	Coffee Break					
17:00-18:00	**PANEL** **Surgical Decision Making in Professional Voice** Chair: Marc Remacle Moderator: Haldun Oğuz A case-based discussion: to operate or not, a team decision **Nick Gibbins** Pitch, Stroboscopy and the decision for surgery **James Thomas** Sulcus and polyp: Is there a causal relationship? **Markus Hess** Preventive care do help avoid surgery **H. Steven Sims** Case examples of professional voice surgery. **Taner Yilmaz**	**PANEL** **Acoustic Evaluation of the Singing Voice** Chair: Mehmet Akif Kılıç Moderatör: Claudia Manfredi Biomarkers for the Singing Voice **Mette Fog Pedersen** VRP Recording and Voice Quality Measurement: A Match Made in Heaven? **Peter Pabon** Acoustic Markers of Singing Styles: Early Music and Opera **Silvia Capobianco** Study of the Singing Voice with Objective Techniques: Its Usefulness and Limits **Claudia Manfredi**	**ROUND TABLE** **The Future of Voice Training** Chair: Burak Bilgili Moderator: Ana Flavia Zuim Oyunculuk Becerilerine Odaklanarak Operada Tiyatroyu Anlamak **Güzin Gürel** The shifting ecology of singing-and what voice teachers must now do differently. **Kari Ragan** Using Immersive Virtual Reality in Singing Training **Ana Flavia Zuim** **Kim Steinhauer**	**CWASOS SESSION** Chair:Shoira Maxamadaminova Moderator: Ramil Hashimli Mutational dysphonia **Kassymzhanova Zhanar** Results of treatment of subglottic stenosis in children **Nadjimutdinova Nozima** Results after immunotargeted treatment in laryngeal papillomatosis **Ismoilov Mansurbek** Treatment of spasmodic dysphonia **Maxamadaminova Shoira** Multidisciplinary Approach in the Rehabilitation of Patients with Laryngeal Paresis: From Diagnosis to Functional Recovery **Gulnur Nukusbekova** AI in phoniatrics **Kamil Suleymanov**	**PANEL** **Multidisciplinary Approach to Functional Voice Disorders** Chair: Saime Sağıroğlu Moderator: Özlem Cangökçe Yaşar Ses Terapisinde Görünmeyen Güç: Dolaylı Yaklaşımların Sese Etkisi **Elçin Tadıhan Özkan** Fonksiyonel Ses Bozukluklarının Yönetiminde Botulinum Toksinin Yeri **Esma Altan** Fonksiyonel Ses Bozukluklarında Doğrudan Ses Terapisi Yaklaşımları **Elif Meryem Ünsal Akkaya** Terapi ve Cerrahi: Ne zaman? **Ziya Saltürk** Fonksiyonel Ses Bozukluklarında Tanı ve Klinik Bulgular: Güncel Yaklaşımlar **Rukiye Özçelik**	**ORAL PRESENTATIONS** Chair: Engin Başer Ethics in voice teaching: a five-part paradigm for sustainable pedagogy **Justin John Moniz** Renato Bruson: The art of singing, authenticity and discipline. Connections between opera and chamber music **Sergiu Garabajiu** The Lower Thoracic Angle as a Biomechanical Marker of Breath Management in Classical Singing **Carles Expósito Rovira, María Borragán Salcines**
18:00-18:30		**WORKSHOP** Chair: Raghavi Vishnu Prasanna PROEL2: To Find ELASTICITY For the Voice: Working With Unstable Balance and Virtual Reality Speakers: **Carles Exposito** **Greta Vernizzi**	**WORKSHOP** Chair: Paulina Krasnodebska Body & Voice Speakers: **Vedrana Zrnic** **Ana Djanic Hadzibegovic**	**WORKSHOP** Chair: Leman Birdane Basic Voice Training For SLPs Speakers: **Ardan Beyarslan** **Seta Kurkcuoglu**	**ORAL PRESENTATIONS** Chair: Katarszyna Godzisz Body posture and voice production **Jenny Iwarsson** Facilitating behavioral learning **Jenny Iwarsson** Breathing exercises for voice therapy **Jenny Iwarssona**	
18:30-19:00	**UEP Session on Fundamentals of Phoniatrics** Chair: Matthias Leonhard Moderator: İlter Denizoğlu	**WORKSHOP** Chair: Carlos Manzano PROEL3: Real Cases Solved by PROEL From the Clinics to the Stage Speakers: **Carles Exposito** **Greta Vernizzi**	**WORKSHOP** Chair: Buket Ayça Sözüçok Forward Singing and the Poussé-Tiré Technique: Control of Airflow, Harmonics and Vocal Directivity Speaker: Erkki Bianco	**ORAL PRESENTATIONS** Chair: Arzubetül Duran Choral intelligibility: performers' and listeners' perspectives **Anastasia Kananovich** Effects of the hypertonic saline nebulization on voice quality **Ana Danic Hadzibegovic, Stela Markovic**	**ORAL PRESENTATIONS** Chair: Esma Altan Going beyond the register - Vocal Mode Categorisation Across Four Octaves in Professional Male and Female Singing Voice Using Voice Range Profile, EGG, Acoustic, and Vibroacoustic Measurements: double case study **Mathias Aaen, Marek Fric** SOVTE effects on laryngeal gestures in singing observed during and after 4 interventions using stroboscopy and EGG: (mis)match between SOVTE and vocal technique **Mathias Aaen** **Mari Leppävuori** **Tero Ikävalko** **Cathrine Sadolin** **Julian Mcglashan** Opening the 'Black Box' of Voice Therapy: Investigating CVT-Voice Therapy in pMTD using Thematic Analysis and the Rehabilitation Treatment Specification System **Mathias Aaen, Anna White** **Guro Von Germeten** **Cathrine Sadolin** **Julian Mcglashan**	**WORKSHOP** Chair: Karol Myszel Team Approach to Singing Voice Rehabilitation Speakers: **Nicholas Gibbins** **Rehab Awad** **Michael Vickerst**

SCIENTIFIC PROGRAM

27 MARCH 2026

TIME	FATİH ÖĞÜT HALL	SUSAN YARNALL MONKS HALL	JURGEN WENDLER HALL	HALL 4	HALL 5	HALL 6
08:00-8:30			**ORAL PRESENTATIONS** **Chair: Maral Yesilyurt** The Contribution of Voice Therapy to Voice Quality and Quality of Life in Patients With Early Glottic Cancer Treated With Transoral CO2 Laser Microsurgery **Elisavet Elsa Papadopoulou, Efthymios Kyrodimos, Andriana Razou, Sotirios Karamagkiolas, Eleni Lada, Giorgos Sideris, Flora Anagnostou, Ioannis Giotakis, Pavlos Maragoudakis, Alexander Delides** VoxApp: A Smartphone Tool for Multilingual Clinical AVQI and ABI Measurement **Tiago Cruz** Real-Time Visual Feedback in Singing Lessons: Learning Processes, Student Perspectives, and Pedagogical Implications **Glòria Vila Aymerich**	**ORAL PRESENTATIONS** **Chair: Önal İncebay** Gender role effects on phonatory flow rate in spanish speakers **Filipa M B Lã, Paula Barriendo, Nuria Polo** When the jaw sets the tone: exploring the impact of TMD on the speaking and singing voice **Annelies Labaere** Dynamic Real-Time MRI of Vocal Tract Configurations During Estill Voice Figures **Stefanie Rummel, Fiona Stritt, Johannes Fischer, Michael Bock, Bernhard Richter, Louisa Traser**	**ORAL PRESENTATIONS** **Chair: Korhan Sezin** Comparative Analysis of Vocal Hygiene Behaviors in Opera and Theatre Students **Asena Başan, Müge Müzeyyen Çiyiltepe** Examination of Voice and Swallowing Characteristics in Individuals with and Without Chronic Obstructive Pulmonary Disease (COPD): A Preliminary Study **Yaren Çomak, Serkan Bengisu, Nurcan Alpüran Kocabıyık**	**ORAL PRESENTATIONS** **Chair: Meltem Demirdağ Çevikkan** Can Artificial Intelligence Sing Bel Canto? **Ewelina Sielska-Badurek** Voice production and occupational voice disorders in manaschy **Alfisa Moldakmatovna Orozalieva, Shaik Asrar Shareef** Injectable nanogel-stem cell spheroids for swallowing muscle repair **Hideaki Okuyama, Mika Brown, Meghana Munipalle, Sara Nejati, Ran Huo, Hibiki Sasaki, Kazunari Akiyoshi, Hiroe Ohnishi, Yo Kishimoto, Koichi Omori, Jianyu Li, Nicole Y K Li Jessen** Swallowing outcomes after total laryngectomy: subjective complaints, objective findings and surgical determinants **Stela Markovic, Ana Danic Hadzibegovic**
08:30-09:20	**KEYNOTE** **Chair: İlter Denizoglu** Benefits From Vocalizing With a SOVT **Speaker: Ingo Titze**	**KEYNOTE** **Chair: Güzin Gürel** From Manuel Garcia to Modern Voice Rehabilitation: Evolving Models and the Singing Voice Rehabilitation Specialist **Speaker: Kari Ragan**				
09:30-10:30	**PANEL** **Water Resistence Therapy and New Frontiers** **Chair: Elçin Tadıhan Özkan** **Moderator: İlter Denizoğlu** A Novel High-Technology Device for Active Positive, Negative, and Alternating Pressure Modulation of the Vocal Tract: Bridging Voice Therapy, Respiratory Training, and Autonomic Regulation **Pedro Melo Pestana** Incorporating water resistance exercises in training singers **Filipa La** Water Resistence: What Else ? **İlter Denizoglu** Water resistance ventilation masks: evidences and perspectives **Marco Fantini**	**PANEL** **Posture and Voice** **Chair: Omer Devlioglu** **Moderator: Allan Vurma** How body balance contributes to vocal health: a holistic approach to voice therapy **Sara Forer-Kaufmann** Posture and the Singers **Rehab Awad** Beyond Posture: A Feldenkrais Approach to Functional Vocal Organisation **Anita Morrison** The Silent Architecture of Voice: The Role of Fascia **Carla Stecco** The Larynx in a Cage: How Posture Silences or Frees the Voice **Önal İncebay**	**PANEL** **State of the Art in Phonosurgery** **Chair: Ferhan Öz** **Moderator: Gürsel Dursun** General Anesthesia in Phonosurgery: What Works Best? **Dalia Larsen** General principles of laryngeal microsurgery topic **Mehmet Burak Aşık** Advantages of the blue laser for very small vocal fold lesions in singers. **Markus Hess** Phonomicrosurgery in Singers to Preserve Their High-Pitched Tones **Reinaldo Yazaki** The Quest for the Scarless Vocal Fold: Current Frontiers in Regenerative Phonomicrosurgery **Nicolas Ropert**	**PANEL** **Emerging Technologies and Future Directions in Laryngeal Surgery** **Chair: Engin Dursun** **Moderator: Necati Enver** Intraoperative computed tomography imaging for laryngoplasty **Ichiro Tateya** The injection laryngoplasty with minced autologous fascia lata in unilateral vocal cord paralysis. **Engin Başer** Office based True Blue Laser treatment of recurrent laryngeal papillomatosis **Matthias Leonhard** PRP and Hyaluronidase injections for various diseases of the vocal folds. **Necati Enver**	**WORKSHOP** **Chair: Anja Kwakkestein** Reclaiming the women's voice **Speaker: Elizabeth Ebbink**	**PANEL** **Dysphagia Management in Head and Neck Cancer Patients** **Chair: Elif Altuntaş** **Moderator: Kayhan Öztürk** The Role of Surgery in the Management of Dysphagia in Head and Neck Cancer Patients **Mustafa Şahin** Early predictors of dysphagia in head and neck cancers – risk factors and acute toxicities **Arzubetül Duran** Clinical Approach to Post-Radiotherapy Dysphagia in Head and Neck Cancer **Selen Avcı Can** Using FEES to Guide Dysphagia Management in Head and Neck Cancer Patients **Elif Aksoy**
10:30-11:00					**WORKSHOP** **Chair: Engin Başer** Management of Laryngeal Hypersensitivity **Speaker: Claudio Milstein**	
11:00-11:30	Coffee Break					

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11:30-12:30	**PANEL** **Acoustics and psychoacoustics: New dimensions for vocal production and perception in singing** **Chair: Tolga Sözüçok** **Moderator: Allan Vurma** Some Acoustical Aspects Influencing Sung Text Intelligibility **Allan Vurma** Default Postures, Default Timbres: Exploring the Role of Articulatory Settings in Vocal Training. **Lori Şen** Vowel modification in belting and other singing styles - a formant tuning perspective **Christian Herbst** [Adsız] Vowel modification in belting and other singing styles - a formant tuning perspective **Harald Jers**	**PANEL** **Current Perspectives on Management of Benign Vocal Fold Pathologies** **Chair: Ozan Özgürsoy** **Moderator: Dinara Tonguzbayeva** **Gayem Köprücü** **Arzu Tüzüner** The use of CO2 and Truble lasers in a management of benign vocal folds lesions **Polina Shamkina** Management of Reinke's edema **Saime Sağıroğlu** Management of Vocal Fold Cysts **Ramil Hashimli** Bening Vocal Fold Pathologies **Zaur Nagiyev**	**PANEL** **Professional Voice and Hormones** **Chair: Bengü Çobanoğlu** **Moderator: John Rubin** The acoustic performance of a transgender singer under testosterone treatment **Berit Schneider Stickler** Guidelines for training the menopausal singer: A science-informed approach **Mauro Fiuza** Menopause and neuromotor aspects of voice and speech production **Filipa La** Sex hormones and effects on the voice **Ceki Paltura**	**WORKSHOP** **Chair: Fatma Esen Aydınlı** Laryngeal Physiotherapy Methods **Speaker:** **Maria Isaeva** **Eva Lukavcová** Vibrato solutions **Lisa Popeil** The influence of expectation: exploring the expectation effect for clinical and educational outcomes **Jenevora Williams** The Guarded Larynx **Jenevora Williams** Soul-training: riffs runs and r&B **Lisa Popeil** Tracheoscopic Evaluation of Aspiration during Swallowing **Raghavi Vishnu Prasanna** Visualizing Voice in Performance: The Singing Endoscopy **Raghavi Vishnu Prasanna**	**PANEL** **Current Concepts in Management of Vocal Resonance Disorders** **Chair: Mehmet Akif Kilic** **Moderator: Erhan Demirhan** Velopharyngeal Insufficiencies in Pediatric Patients and Management **Semih Yazla** The Hypernasality Trap: Adenoidectomy in Occult Submucous Cleft Palate **Meltem Demirdağ Çevikkan** Surgical Management of Velopharyngeal Insufficiency **Ozan Tüysüz** From Nose to Voice: Acoustic and Perceptual Markers of Nasal Obstruction in Resonance Disorders **Gamze Yeşilli Puzella**	**ORAL PRESENTATIONS** **Chair: Elif Altuntaş** When a Benign Lesion Threatens the Airway: Giant Uvular Squamous Papilloma Presenting with Intermittent Airway Obstruction **Esma Altan, Gökhan Toptaş, Mehmet Hakan Korkmaz** Within-day voice variability during fasting: A comparison of state and trait measures using an EMA-based design **Saliha Kuşoğlu Atalay, Celil Göçer, Engin Dursun, Haldun Oğuz** Mechanism-oriented acoustic profiling of dysphonia: structural glottic loss compared with radiation-related changes **Arzubetül Duran, Barış Büyük** Large Language Models' Performance in Complex Phoniatric Case Management **Oğuzhan Katar, Büşra Kaplan, İbrahim Emir Yeşil, Müge Karadaş** Translation of Voice-Related Training into Voice Hygiene Behaviors Among Otolaryngology (ENT) Residents: A Comparison with Other Residents and Medical Students **Tuba Doğan Karataş** Effectiveness of the DoctorVox therapy technique for voice habilitation in primary school teachers **Tuba Kaya, Ismail Ilter Denizoğlu, Saime Seyhun Topbaş, Ismail Demir** Investigation of the Effectiveness of High-Pressure Semi-Occluded Vocal Tract Exercises in the Treatment of Obstructive Sleep Apnea Syndrome **Ekrem Turan, Ilter Denizoğlu, Mustafa Buğra Çoşkuner** The Effect of Foot Arch Morphology in Different Postures on Craniovertebral Angle and Acoustic Voice Parameters: A Pilot Study **Buket Ayça Sözüçok, Ilter Denizoğlu, Tolga Sözüçok, Seher Özyürek, Atakan Songurlu, Elif Şahin Orhon**
12:30-13:00						

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12:30-13:00				**ORAL PRESENTATIONS** **Chair: Emel Tahir** Vibrato solutions Lisa Popeil The influence of expectation: exploring the expectation effect for clinical and educational outcomes **Jenevora Williams** The Guarded Larynx **Jenevora Williams** Soul-training: riffs runs and r&B **Lisa Popeil** Tracheoscopic Evaluation of Aspiration during Swallowing **Raghavi Vishnu Prasanna** Visualizing Voice in Performance: The Singing Endoscopy **Raghavi Vishnu Prasanna**		
13:00-13:30	**WORKSHOP** **Chair: Lisa Popeil** Flowball Technique **Speaker: Filipa La**	**WORKSHOP** **Chair: Youri Maryn** Voice Range Profile A Course for Singers **Speaker: Peter Pabon**	**ROUND TABLE** **Chair: Christian Herbst** Tuning in Choral Singing **Speakers:** **David Howard** **Tudor Ionescu**		**UEP Board Meeting**	**ORAL PRESENTATIONS** **Chair: Hakan Gölaç** Dil ve Larenks Pozisyonlarının Ses Üretimi ve Vokal Performansa Etkileri **Ardan Beyarslan, Seta Kürkçüoğlu** Investigation of the Relationship Between Physical, Mental and Vocal Fatigue in Medical Secretaries: Preliminary Findings **Elif Meryem Ünsal Akkaya, Arbela Şayeste Durgun** Short-Term Effects of Vocal Therapy Techniques: Perceived Vocal Effort and Cepstral Changes Following Acapella and Lax Vox Exercises **Elanur Işeri, Göksu Tarakçı, Selina Aratemur** **Irem Gönüldaş**
13:30-14:30	Lunch					
14:30-15:00	**KEYNOTE** **Chair: Mauro Fiuza** Myofascial System: Anatomical Hints and Manupilation Regarding Vocal Functions **Speaker: Carla Stecco**	**KEYNOTE** **Chair: Sten Ternström** Nonlinear Dynamics of Voice **Speaker: Jan Svec**				
15:00-16:00	**PANEL** **Vocal Emergencies** **Chair: Arzu Tüzüner** **Moderator: Kristel Kalling** Performance Fitness Criteria (How Do We Decide Whether We Recommend They Perform or Not) **Debra Phylland** Navigating Vocal Emergencies in Musical Theatre and Professional Voice Users: The Role of Accelerated Rehabilitation Algorithms **Ekaterina Osipenko** Emergency Treatment of Vocal Fold Hemorrhage **Erkki Bianco** Red Flags in Vocal Emergencies: When to Call the Surgeon? **Engin Dursun**		**PANEL** **Tissue Regeneration and Wound Healing: Advancing Recovery Through Innovative Therapies** **Chair: Arzubetül Duran** **Moderator: Nicole Li Jessen** Regenerative Strategies for Vocal Fold Repair **Aysegul Batioglu Karaaltin** A Pilot Study on Morphometric Changes Post-Endoscopic Glottoplasty: Evaluation and Insights **Ümit Daşdöğen** Molecular Dynamics of Voice Production: Oxidative Stress, Inflammation, and Genetic Response Mechanisms **Cihan Taştan** Injectable Biomaterials for Vocal Fold Regeneration **Nicole Li jessen** **Benjamin Laitman**	**ORAL PRESENTATIONS** **Chair: Ebru Karakaya Gojayev** Vocal Health and Voice Problems in Dog Agility Trainers **Ciarán Kenny, Yvonne Lynch, Amy O'Toole** Demonstration of epithelial oscillation at small glottal orifices in phonation frequencies above 1000 Hz **Marie Christine Köberlein, Angela Wingerath, Jonas Kirsch, Matthias Echternach** The influence of ventricular fold position on vocal fold oscillation: initial findings from dynamic 3D magnetic resonance imaging of phonation **Fiona Stritt, Paula Jordan, Johannes Fischer, Stefanie Rummel, Michael Bock, Bernhard Richter, Louisa Traser** "It reminds me – ah, right, you're supposed to do it this way": Patients' Experiences of a Voice Therapy App **Karin Huss, Viveka Lyberg Åhlander, Liza Bergström, Sofia Strömbergsson** Estonian Swimming Coaches' Voice Quality and Factors Affecting It **Lagle Lehes, Linda Söber, Kaisa Pollisinski** Do parents, teachers and voice therapists perceive children's voices differently? **Carole Chiers, Kristin Daemers, Kristin Daemers, Annelies Bockstael** Outcome of Neurotization of thyroarytenoid muscle in Unilateral vocal fold palsy with anterior phonatory gap- Our experience **Anjana Sivamani, Jayakumar R Menon, Manju E Issac, Gaurav Kumar, Ojus P Raj**		
15:00-16:00	**ORAL PRESENTATIONS** **Chair: Dilek Gülmez** Putting loudness on the voice map **Christian Thomas Herbst, Peter Pabon** Can Cryotherapy Help to Accelerate Healing of Vocal Fold Tissues? **Jitka Vydrova, Eva Lukavcova, Eva Lukesova, Olga Bendova, Frantisek Sram, Jan G. Svec**	**SPECIAL SESSION** **Colors of the World: Vocal Styles and Ornaments – II** **Chair: Özlem Kılıç** **Moderator: Lisa Popeil** Breathing and Support in Professional Singers **Carlos Manzano** In Conservatories of Turkish Music, A Model Study on Individual Voice Training Course Content: From Macro Perspective to Micro Approach **Tugçem Kar** Brazilian Pop Music represented by Samba: otorhinolaryngological and physiological aspects in our brazilian portuguese **Reinaldo Yazaki** **Kim Steinhauer**			**PANEL** **Multidisciplinary Approach on Swallowing Problems** **Chair: Kayhan Öztürk** **Moderator: Ozan Özgürsoy** Surgical treatment of swallowing disorders **Ömer Erdur** Treatment of swallowing disorders due to systemic and neurological diseases **Emel Tahir** Diagnostic examination and videofluoroscopy in swallowing disorders **Hakan Gölaç** Fiberoptic endsocopic evaluation of swallowing **Elif Altuntaş**	**Instructional Course** **Voice Therapy Techniques** **Chair: Müge Müzeyyen Çiyiltepe** **Speakers:** **Özlem Cangökçe Yaşar** **Fatma Esen Aydınlı**

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16.30-17.00	Coffee Break					
17:00-18:00	**PANEL** **Aging of Singing Voice** **Chair: Engin Dursun** **Moderator: Ralph Haddad** What is presbyphonia ? With a focus on aging singing voice **Mariline Santos** Impact of aging for an operatic singer **Dirk Murbe** Aging of the singing voice : the room for speech therapy **Aude Julien-Laferriere** Regenerative medicine for aging singers **Ralph Haddad**	**PANEL** **Professional Voice Training: A Multidisciplinary Approach** **Chair: Ardan Beyarslan** **Moderator: Jale Papila** The role of speech and language therapist in management professional voice **Ilias Papathanasiou** Building a Vocal Nexus: How Interdisciplinary Dialogue Transforms Voice Training and Habilitation **Lori Şen** Vocal Performance Process in Professional Voice Training **Gül Fahriye Evren** **Kim Steinhauer**	**UEP Session on Voice Therapy** **Chair: Aude Lagier** **Moderator: İlter Denizoğlu** Freeing the root of tongue in patients with dysphonia **Rehab Awad** The power of touch in voice disorders **Rehab Awad** Changing Models of Voice Therapy: Increase Access/Reduce Waitlist at the largest Voice Centre in Canada **Jennifer Anderson** Pediatric Voice Therapy **Lizzie Nash** Voice Therapy - Muscle-Specific Voice Therapy **İlter Denizoğlu** Special speech-therapy technique for vocal fold paralysis **Erkki Bianco**	**WORKSHOP** **Chair: Arzubetül Duran** Phoniatric treatment of psychosomatic voice disorders **Speaker: Katrin Neumann** **WORKSHOP** **Chair: Canan Özgür** Feldenkrais Method: A Practical Approach for Vocal Professionals **Speaker: Anita Morrison**	**ORAL PRESENTATIONS** **Chair: Oğuzhan Katar** Previous Musical Training and Vocal Self-Concept in Preservice Teachers: beliefs and perceptions about singing **Laura González Sanvisens, Silvia Contreras Regatero, Laura López Blanco, Cecila Gassull** Validation of Cepstral Peak Prominence Smoothed (CPPS) and Acoustic Voice Quality Index (AVQI) for the Acoustic Analysis of Substitution Voices **Marco Fantini, Margherita Meloni, Gabriella Borrelli, Erika Crosetti, Giovanni Succo** How to sound loud(er) at a given SPL? **Peter Pabon, Christian T. Herbst** Measurement of vocal tract resonances during phonation: experimentation on replicas **Alice Launet, Fabrice Silva, Timothée Maison, Philippe Guillemain, Nathalie Henrich Bernardoni** Vibrational modes of the vocal folds in subharmonic phonation **Zuzana Stanclova, Leonardo Fuks, Jan G. Svec**	**PANEL** **Management of Psychogenic Voice Disorders** **Chair: Çiler Büyükatalay** **Moderator: Gayem Köprücü** **Speakers:** **Güzide Atalık** **Dilek Gülmez** **Ebru Karakaya Gojayev** **Hakan Gölaç** **Jaklyn Çarkçı**
18:00-18:30	**WORKSHOP** **Chair: Ralph Haddad** Musical performance Anxiety: Diagnosis and Management Strategies **Speaker: Claudia Spahn**	**MASTERCLASS** **Chair: Elif Şahin Orhon** Classical Singing with Insight – Unlocking Expression, Musical Depth, and Vocal Wellbeing **Speaker: Jale Papila**		**ORAL PRESENTATIONS** **Chair: Mehmet Ekrem Zorlu** Phoniatric treatment of psychosomatic voice, speech, and fluency disorders **Katrin Neumann, Sophie Hoffmann, Markus Ramm, Rupert Conrad, Tobias Brix, Bettina Pfleiderer, Philipp Mathmann** Addressing cognitive and emotional factors in pediatric voice therapy **Charlotte Van de Pol** Recurrence plots of vibrato signals **Gerardo Acosta Martinez, Helena Daffern** Breathiness severity in common dysphonia diagnoses: vocal fold nodules, muscle tension dysphonia and vocal fold paralysis **Ayşe Nur Demirci, Ayşen Köse, Fatma Esen Aydınlı, Önal Incebay, Taner Yılmaz** Treatment Response of Primary versus Secondary Muscle Tension Dysphonia - [Adsız]ective Observational Study **Zainab Mushtaque Nagree, Dr. Shiva Saikiran Venkateshwarrao Joga, Dr. Nupur Kapoor Nerurkar** When Listening Becomes Feeling: Linking Neural Patterns in Vocal Emotion Perception to Subjective Experience **Gláucia Laís Salomão**	**ORAL PRESENTATIONS** **Chair: Müge Özcelik Korkmaz** Rapid Voice Recovery in Aphonia: Two Clinical Cases **Aigul Saparadievna Baizhumanova, Rais Kazhkenovich Tulebaev, Natalya Mikhailovna Papulova** Gender Perception of Trans and Cis Speakers: A Comparison Across Listener Groups **Damlasu Yağçıoğlu, Fatma Esen Aydınlı, Önal Incebay, Koray Başar, Isa Tuncay Batuk, Merve Öğülmüş Uysal, Taner Yılmaz** VibratoScope: An open-source Python toolkit for vibrato analysis in the singing voice **Tiago Cruz, Pedro Andrade** Effectiveness of intonation training in transgender and gender diverse individuals **Tine Papeleu, Jennifer Oates, Guy T'sjoen, Peter Tomassen, Dominique Morsomme, Evelien D'haeseleer** Glottal awareness and breath flow for a balanced voice in clean and distorted vocal qualities **Eleonora Bruni** Case reports in singers: Hearing, seeing, and treating voice disorders **Jale Papila, Markus Hess**	**ORAL PRESENTATIONS** **Chair: Emel Çadallı Tatar** The effect of resonant voice therapy on reducing middle ear effusion: Preliminary results **Fatih Öner** The acute effect of submaximal exercise on vocal performance in healthy young adults **Elif Meryem Ünsal Akkaya, Nilüfer Bozbıyık, Kadirhan Özdemir** Diagnostic Performance of Acoustic Voice Parameters in Laryngeal Mass Lesions: Emphasis on Shimmer Analysis **Rukiye Özçelik Erdem, Hamdi Arbağ** Vocal Fatigue in Multiple Sclerosis: Patient-Reported vs Perceptual and Objective Measures **Emel Tahir, Özlem Yaşar, Sedat Şen, Naci Murat, Murat Terzi**
18:30-19:00	**WORKSHOP** **Chair: Catherine Sadolin** Bubble Mask in Voice Therapy **Speaker:** **Marco Fantini** **Vittoria Carlino**		**WORKSHOP** **Chair: Carlos Manzano** Assessment and Management Considerations for Speech and Language Therapists When Working with the Hypermobile Performer **Speaker: Tori Burnay**			

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8:00-9:00	**ORAL PRESENTATIONS** **Chair: Elad Azizli** Menopause effects on maximum phonation time **Filipa M. B. Lã** **Johan Sundberg** Will teachers sing in the future? **Núria Molins Macau** **Ivet Farrés Cullell** **Manuela Del Caño Espinel** **Josep Vila Rovira** Nose resonance and voice **Miriam Havel** **Johan E F Sundberg**	**ORAL PRESENTATIONS** **Chair: Elife Barmak** Multiphonics – Workshop for Experimental Vocal Techniques **Angela Wingerath** Voice Training Workshop & Dynamic Real-Time MRI Of Vocal Tract Movements Using Estill Voice Figures **Stefanie Rummel** Longitudinal analysis of anamnestic data and examination results on anatomical preconditions and vocal characteristics of prospective vocal students between 1981 and 2025 **Marie Bieber, Reuben Walker, Hartmut Zabel, Mario Fleischer, Dirk Mürbe**	**ORAL PRESENTATIONS** **Chair: Eylül Birkent** Digital support for vocal practice between lessons: design and evaluation of the Vocaly app **Dominika Plonka, Karolina Borner Gogolewska, Bartosz Postulka** Influence of water resistance exercise on vocal vibrato in classically trained singers **Marie Christine Köberlein, Theresa Pilsl Isabella Gantner, Sophia Gantner, Jonas Kirsch Matthias Echternach** Bone-conduction auditory feedback for vocal fatigue prevention in professional voice users **Laura Pasquarella** **Chiara Falanga** Vibrato development during conservatory training: a retrospective longitudinal study **Reuben Scott Walker, Mario Fleischer, Marie Bieber, Hartmut Zabel, Dirk Mürbe** Pedagogical training for resonance: "orologio della risonanza" **Chiara Petrelli** **Erennio Natale** Traditional Romanian Singing and Voice Therapy: Exploring Vocal Style and Therapeutic Approaches **Ioana Mandoiu, Rodica Muresan, Loredana Ghiuzan, Iulia Vatafu, Veronica Macarie Moldovan**	**ORAL PRESENTATIONS** **Chair: Rukiye Özçelik** The Agreement Between a Contact-Based Piezoelectric Transducer and a Standard Microphone for in vivo Acoustic Voice Analysis **Pedro Pestana, Rita Alegria, André Araújo, Nádia Santos, Miguel Vicente, Celso Melo** Voice-related challenges experienced by transgender and gender diverse individuals in Belgium **Tine Papeleu, Jennifer Oates, Joz Motmans, Dominique Morsomme, Guy T'sjoen, Evelien D'haeseleer** Exploring the role of outcome predictors in gender-affirming voice care for transgender women **Clara Leyns, Evelien D'haeseleer** Short- and Longer-Term Effects of Three Intensive Straw Phonation Interventions on the Voice of Female Speech-Language Pathology Students With Mild Dysphonia: A Randomized Controlled Trial **Casey Dewanckele, Evelien D'haeseleer, Peter Tomassen, Frederick Dochy, Kristiane Van Lierde, Iris Meerschman** Psycho-Vox as a new questionnaire in the differential diagnosis of functional voice disorders **Agata Szkielkowska, Iwona Pilchowska, Beata Miaskiewicz, Paulina Krasnodebska** Autonomic regulation as an adjunct to voice therapy in functional dysphonia: an exploratory randomized controlled trial **Iris Meerschman, Evelien D'haeseleer, Marie Anne Vanderhasselt, Riet Vergauwe, Sofie Claeys, Kristl Vonck, Gwen Van Nuffelen, Gauthier Desuter, Lierde**	**ORAL PRESENTATIONS** **Chair: Elif Meryem Ünsal Akkaya** Study of the singing voice with objective techniques: its usefulness and limits **Claudia Manfredi, Philippe Henri Dejonckere, Giovanna Baracca, Federico Calà, Pietro Tarchi, Lorenzo Frassineti** CepstralVox: An Open Source User-Friendly Tool for Cepstral Voice Analysis **Tiago Cruz** The Derkay Scale as a predictor of voice dysfunction in recurrent respiratory papillomatosis: correlations with acoustic and patient-reported outcomes **Beata Miaskiewicz, Elzbieta Gos, Aleksandra Panasiewicz Wosik, Paulina Krasnodebska, Dominika Ozieblo, Monika Oldak, Agata Szkielkowska** Case series: learning outcomes after Training Bruni® for MO and supraglottic extreme voice Eleonora Bruni, Chiara Perciballi, Marco Fantini Clinical Effects of Voice Therapy on Vocal Outcomes in Unilateral Vocal Fold Paralysis: Proof-of-Concept Study for Two SOVT-Based Treatment Protocols Kristiane Magdalena Van Lierde, Imke Kissel, Iris Meersman, Evelien D'haeseleer, Tine Papeleu, Peter Tomassen, Sofie Claeys, Clara Leyns, Gwen Van Nuffelen	**ORAL PRESENTATIONS** Chair: Serap Şahin Önder Warming up wisdom: vocal interventions for the aging female voice Kristiane Magdalena Van Lierde, Liese Bostyn, Evelien D'haeseleer, Fanny Verstappen, Ewout Pieters, Iris Meerschman From semi-occlusion towards an open vocal tract: a practical workshop Gertie Van Den Driessche, Carole Chiers Voice Health in Teachers: The Relationship Between Quality of Life, Acoustic Parameters, and Occupational Variables **Maral Yeşilyurt, Büşra Çınar, Ayşe Buse Saraç** **İrem Gönüldaş** Effectiveness of behavioral voice therapy approaches in adults with vocal fold nodules: A systematic review **Büşra Akça, Haldun Oğuz** Assessment of the Need for Voice Therapy after Type 3 Thyroplasty: Experience of 31 Patients **Buse Demir**
9:00-9:55	**KEYNOTE** Chair: Seyhun Topbaş Motor Learning Principles Exploded: Recent Applications in Voice Training Speaker: Katherine Verdolini	**KEYNOTE** Chair: Bernard Richter How our Unique Vocal Abilities Came to be: The Evolution of the Vertebrate and Human Larynx Speaker: Jeffrey T. Laitman				

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10:00-11:30	**PANEL** **Psychological Realities of the Performing Artist** Chair: Eylül Birkent Moderator: John Rubin Music Performance Anxiety in Singers **Claudia Spahn** Why Performers Need Holistic Healthcare **Jenevora Williams** Trauma and its relationship with voice (and trauma-informed practices) **Elisa Monti** Performance anxiety and stress **John Rubin**	**PANEL** **IATVS Session: Trans Voice and Vocal Performance** Chair: Markus Hess Moderator: Kursat Yelken Tensioning Glottoplasty **Hakan Birkent** Health equity and implications for trans performers **H. Steven Sims** Feminization laryngoplasty **James Thomas** History of voice feminization surgery **Mark Remacle** Acoustic aspects of TransVoice Surgery **Dirk Mürbe**	**ROUND TABLE** **Computational Analysis and Simulation of the Human Voice: Back to Dagstuhl** Chair: Nathalie Henrich Bernardoni Moderator: Sten Ternström Speakers: Sten Ternström Filipa La Helena Daffern Johan Sundberg Nathalie Henrich Bernardoni	**PANEL** **Management of Neurogenic Voice Disorders** Chair: Esra Özcebe Moderator: Mehmet Burak Aşık Voice therapy approaches for unilateral vocal fold paralysis **Eren Balo** Voice assessment in neurogenic voice disorders **Elif Meryem Akkaya** The role of SLP in the assessment and management of laryngeal dystonia: A tertiary London hospital perspective **Tori Burnay** Effect of non selective reinnervation on malpositioned arytenoid in unilateral vocal cord palsy **Jayakumar Menon** Dysphonia cases in neurological diseases **Emel Tahir** Management and surgical options of Spasmodic dysphonia **Anagha Joshi**	**PANEL** **Difficult Cases in Laryngology** Chair: Erhan Demirhan Moderatör: Emel Çadallı Tatar Speakers: Erhan Demirhan Sevtap Akbulut Beata Miaskiewicz	**PANEL** **Approach to Geriatric Voice Disorders** Chair: Taner Yılmaz Moderatör: Bengü Çobanoğlu Özel durumlar ve tedavi **Mehmet Ekrem Zorlu** Presbifonide danışmanlık becerilerin terapide önemi **Özlem Cangökçe Yaşar** Yaşlılıkta kendi seslerine bakış: bakım merkezlerinde dile getirilenler... **Müge Müzeyyen Çiyiltepe** Fizyopatoloji ve ardından tanı **Ebru Karakaya Gojayev**
11:00-12:00	Coffee Break - Poster Session 3					
[Adsız] 12:00-13:00	**ROUND TABLE** **Neuromodulation** Chair: Nurcan Alpuran Moderator: Jean Paul Marie Neuromodulation approaches in laryngeal dystonia **Berit Schneider Stickler** Neuroscientific update on voluntary and involuntary mechanisms of voice control **Boris Kleber** Diagnostic electrostimulation in vocal fold immobility with the ECE50 **Matthias Leonhard**	**PANEL** **Upper Aerodigestive Tract Disorders** Chair: Beata Miaskiewicz Moderator: Sevtap Akbulut Management strategies in LPR and laryngeal hypersensitivity **Oğuzhan Katar** **Mustafa Aslıer** aryngeal hypersensitivity syndromes affecting voice **Furkan Kaya** 24-hour pH monitoring in laryngopharyngeal reflux: clinical value and pitfalls in adults and children **Elzbieta Wlodarcyzk** The patient with possible LPR - All Round Approach **Renata Taimrova**	**ROUND TABLE** **Use and misuse of supraglottic structures and distortion in singing** Chairs: Mauro Fiuza Moderator: Nathalie Henrich Bernardoni When ventricular folds join the party **Nathalie Henrich Bernardoni** Intentional voice distortions in music: the road to our understanding **Mauro Fiuza** The bigger picture of vocal distortions: parallels with animal bioacoustics and chaos theory **Christian Herbst** The healthy use of rough vocal effects in singing: toward a taxonomy with terminological clarity **Mathias Aaen** The healthy use of rough vocal effects in singing: toward a taxonomy with terminological clarity **Cathrine Sadolin** Training for supraglottic vocality and distortions. Could this improve conventional singing and balance excessive constriction in the artistic voice? **Eleonora Bruni** To Creak or Not to Creak - Variations of Fry **Toni Linke** **Aliki Katriou**	**PANEL** **Physiologic Variables in Voice Assasement** Chair: Katerina Shchennikova Moderator: Burak Aşık Breath-Based Biomarkers of Vocal Fatigue: A New Noninvasive Approach **Maral Yeşilyurt** Quantifying Vocal Anaerobic Capacity Using Blood Lactate Measurements **Göksu Tarakçı** Laryngeal Electromyography **Alise Adovica** Normal and Pathological Superficial Vascular Pattern Based on Contact Endoscopy Investigation **Natalia Chuchueva** Thermal Signatures of Vocal Load: Insights into Heat, Fatigue, and Tissue Stress **Ceren Söğüt** From Voice Physiology to Molecular Genetics **Cihan Taştan**	**PANEL** **Gender-Affirming Voice Care** Chair: Mustafa Gerek Moderator: Katherine Yung Current surgical approaches to voice masculinization (deepening) **Hakan Birkent** Gender affirming voice and commination therapy **Eylül Birkent** Voice Feminization: A Combined Surgical Approach **Elad Azizli** Voice therapy after glottplasty - the multidisciplinary approach **Sarah Guelzow**	**PANEL** **Approach to Pediatric Voice Disorders** Chair: Saime Güzelsoy Modarator: Selmin Özgürsoy Efficiency of Current Therapeutic Approaches: "Are we really improving voice quality or just managing symptoms? **Berkay Arslan** **Özgül Gergin** The Importance of Vocal Hygiene Programs: Family-Child and Therapist Collaboration **Elife Barmak** Treatment in Pediatric Voice Disorders- Surgical Approaches **Müge Özçelik Korkmaz** **Zhanna Chuchkalova**
13:00-13:30	**WORKSHOP** Chair: Rodica Muresan Tips and Tricks in Belting Speaker: Lisa Popeil	**WORKSHOP** Chair: Orietta Calcinoni DoctorVox Voice Therapy Technique Speaker: İlter Denizoğlu		**WORKSHOP** Chair: Filipa La Gender Affirming Voice Therapy Speaker: Eylül Birkent	**WORKSHOP** Chair: Sara Forer Kaufman Estill Figures: Vocal Styles, 2D MRIs & Vocal Practice Speaker: Stefanie Rummel	**ORAL PRESENTATIONS** Chair: Oğuzhan Katar Controllable vocal tract shapes for the Vocal Tract Organ **Naomi Parfitt, David Howard, Anush Yardim, Thomas Moors, David Meyer** Formant tuning in the Persian singing style of avaz **Hama Biglari** **Johan Sundberg** Warm up for singers: from whistle to belt **Erika Biavati**
13:30-14:30	Coffee Break - Poster Session 3					
14:30-15:00	**WORKSHOP** Chair: H. Steven Sims Myofascial Voice Therapy: Method and Rationale Speaker: İsmail Koçak	**WORKSHOP** Chair: Matthias Leonhard Accent Voice Therapy Speaker: Tamer Abou-Elsaad	**WORKSHOP** Chair: Stefanie Rummel Voice Distortions for Contemporary Music: from Practice to Science Speaker: Fernando Zimmerman	**WORKSHOP** Chair: Maria Isaeva The Body Behind the Voice: An Osteopathic Approach to Professional Singing Speakers: Asude Özkaya Elif Şahin Orhon	**WORKSHOP** Chair: Rehab Awad Artistic Audiology Speakers: Orietta Calcinoni Lionel Lejeune	**UEP Voice Committee**

SCIENTIFIC PROGRAM

28 MARCH 2026

TIME	FATİH ÖĞÜT HALL	SUSAN YARNALL MONKS HALL	JURGEN WENDLER HALL	HALL 4	HALL 5	HALL 6
15:00-16:00	**PANEL** **Whistle Register** Chair: Müge Özcelik Korkmaz Moderator: Markus Hess Speakers: Ingo Titze Alexandra Craescu Erica Biavati Elanora Bruni	**SPECIAL SESSION** **Colors of the World: Vocal Styles and Ornaments - III** Chair: Laçin Modiri Moderator: Rodica Muresan From Songlines to Pop Charts: Understanding Australian Voices Across Cultures Debra Phylland Traditional Romanian Singing and Voice Therapy: Exploring Vocal Style and Therapeutic Approaches Ioana Mandoiu Traditional Romanian Singing and Voice Therapy: Exploring Vocal Style and Therapeutic Approaches Iulia Vătafu Traditional Highland Singing from the Polish Mountains Katarzyna Godzisz Traditional Romanian Singing and Voice Therapy: Exploring Vocal Style and Therapeutic Approaches Veronica Macaria Moldovan Lucyna Stoch	**PANEL** **Surgical Approaches in Professional Voice** Chair: Mustafa Gerek Moderator: Dirk Mürbe Evaluating the outcome of phonosurgery James Thomas Kürşat Yelken	**ORAL PRESENTATIONS** Chair: Ceki Paltura Acoustic strategies in the Azerbaijani ghazal-romance Sevgili Canan: performances by singers representing operatic, chamber, and mugham traditions Alexandria Sultan Von Bruseldorff The Vocal Tract Organ and the UK Alaryngeal Choir David Howard, Thomas Moors, David Meyer, Evangelos Himonides How to teach the invisible? An MRI Case Study Patrick Hoyer, Sophia Hoyer, Martin Blaimer Voice Difficulties and Vocal Congruence Following Radiotherapy for Head and Neck Cancer Ciarán Kenny, Ella Byrne Decoding Vibrato Regularity in a Century of Western Classical Singing Tiago Cruz, Pedro Andrade, Manuel Brandner, Christian Herbst From the body to the voice: acoustic and self-perceptive analysis of the impact of bodywork on the singing voice Núria Molins Macau	**PANEL** **Current Concepts in Management of Vocal Fold Paralysis** Chair: Haldun Oğuz Moderator: Taner Yılmaz Shoira Maxamadaminova Laryngeal reinnervation Necati Enver Non-Selective Reinnervation in the management of Unilateral vocal fold palsy Manju Issac Decision making in vocal fold paralysis. Lega Natto Reconstructive laryngology for unilateral laryngeal paralysis. Lily Budelkina Surgical treatment of Bilateral vocal fold paralysis Ismail Guseynov	**WORKSHOP** Chair: Sarah Guelzow Introduction to CVT Voice Rehabilitation Speakers: Catherine Sadolin
16:00-16:30						**WORKSHOP** Chair: Semih Yazla Building infrastructure for Auditory-Perceptual Voice Evaluation in Research and Education Speaker: Neus Calaf
16:30-17:00	Coffee Break					
				UEP Workshop on Office Procedures for Voice Chair: Berit Schneider-Stickler Moderator: Ralph Haddad Botox into vocal folds and ventricular folds in ADSD Markus Hess Botulinum neurotoxin injection into the LCA in synkinesis type 3 after UVF Berit Schneider-Stickler Botulinum Toxin Injection for Contact Granuloma Taner Yılmaz Office-based injection laryngoplasty: patient selection, technique, and clinical outcomes Esma Altan In office procedure with Trublue Laser for treatment of vocal fold cysts Ralph Haddad Application of therapeutic ultrasound in dysphonia due to vocal nodules Jaime Bracho		
17:00-18:00	**PANEL** **Aerodynamics - Acoustics - Reproducibility** Chair: Müge Müzeyyen Çiyiltepe Moderator: Johan Sundberg Aspects of Aerodynamics - Acoustics - Reproducibility of Voice Measurement Jan Svec The room is not flat – spectral effects of the recording environment Sten Ternström	**ROUND TABLE** **Vocal Feminization: A Dilemma for Singers** Chair: James Thomas Moderator: Filipa La What Is Possible? Managing Expectations in Vocal Feminization for the Singing Voice Katherine Yung Glottoplasty – a No-Go for Professional Singers? Jale Papila	**ROUND TABLE** **AI in Voice Field** Chair: M. Akif Kılıç Moderator: Khalid El Malki AI Applications in Laryngeal Imaging Necati Enver Non-Invasive AI Voice Assessment Based on Acoustic Signals Youri Maryn Generative AI in Voice Disorders Research Khalid El Malki From Screening to Diagnosis: Defining the Clinical Role of AI in Voice Disorders Banu Erdoğan		**PANEL** **Management of Vocal Fold Premalign Lesions** Chair: Mehmet Külekçi Moderatör: Ana Djanic Hadzibegovic Speakers: M. Burak Aşık Selmin Özgürsoy Özlem Önerci Çelebi Bengü Çobanoğlu Çiler Büyükatalay	**ROUND TABLE** **Estill Voice Training** Chair: Debra Phylland Moderator: Stefanie Rummel Estill Voice Training Solutions for Vocal Challenges Kim Steinhauer Estill Pedagogic Perspectives: Teaching Thyroid Tilt Without Saying "Thyroid Tilt" Julia Booth I don't need help with the acting, I just need help with the voice", How Estill helped me coach elite actors without interfering in their performance or direction. Anna Maria Speed Estill Voice Training: Links between Science and Pedagogy Stefanie Rummel Anne Marie Speed
18:00-18:30		[Adsız]				

SCIENTIFIC PROGRAM

28 MARCH 2026

TIME	FATİH ÖĞÜT HALL	SUSAN YARNALL MONKS HALL	JURGEN WENDLER HALL	HALL 4	HALL 5	HALL 6
18:00-18:30	**Difficult Diagnosis in Professional Voice** **Chair: H. Steven Sims** **Moderator: Camille Finck** **Irina Katsarava** What to do next in this challenging case of a singer with a vascular appearing mass **John Rubin** **Lionel Lejune** Finding the tiny nodule **James Thomas**	**WORKSHOP** **Chair: Nathalie Henrich Bernardoni** Vocal Distortions: From Science to Practice **Speaker: Mauro Fiuza**		**WORKSHOP** **Chair: Maral Yeşilyurt** Beyond individual therapy: group voice therapy in teachers Speakers: Nataša Prebil **Rozalija Kušar**	**ORAL PRESENTATIONS** **Chair: Volkan Sunter** Voice workload management in vocal athletes: Application of exercise physiology principles in clinical and studio settings **Marci Rosenberg** Vocal training, hydration and lubrication: a combined and effective action for the voice **Nunzia Carrozza** **Raffaella Misiti** The Role of Teaching Vocology Lesson in Vocal Education: The Experience of the School of Arts of Karabakh University **Ramil Hashimli** **Turkar Gasimzada** Diversity in choirs By Heike Henning and Vincent Jorda, Mozarteum Universität Salzburg **Heike Henning** **Vincent Jorda** Artistic Voice: the importance of Self-Awareness in the use of the singing voice **Dario Tartaglione** Articulatory settings in voice training: a cross-linguistic approach Lori Sen	
18:30-19:00			**WORKSHOP** **Chair:Tuğçem Kar** Anatomical and physiological foundations of efficient classical singing technique **Speaker: Miha Zabret**			
19:15-19:45		CLOSING CEREMONY				

FULL Text

RENATO BRUSON: THE ART OF SINGING, AUTHENTICITY AND DISCIPLINE. CONNECTIONS BETWEEN OPERA AND CHAMBER MUSIC

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SUMMARY. This article explores the artistry of the renowned baritone Renato Bruson, emphasizing the interpretative authenticity and discipline that have ensured his long-lasting career. Based on a direct interview conducted with the maestro in Parma during a vocal interpretation masterclass organized through the Renato Bruson Foundation, the research highlights essential themes such as the evolution of the baritone voice, the significance of chamber music in vocal development, and the role of textual interpretation in opera. Additionally, it examines the impact of this approach on the training of future performers and his perspective on vocal discipline and artistic authenticity. By integrating historical and musicological perspectives, the study establishes connections between operatic and chamber music practices, emphasizing their reciprocal impact on the evolution of a lyrical artist. The conclusions underline the necessity of balancing natural vocal talent with rigorous study while maintaining fidelity to the composer's intentions, simultaneously developing a unique interpretative style.

Keywords: Renato Bruson, baritone voice, opera singing, vocal technique, artistic authenticity, chamber music, opera interpretation, musical discipline.

Baritone (i) (from Gk. Barytonos; Fr. baryton; Ger. Bariton; It. baritono)[2] (βαρύτονος), meaning "deep sound" (bary- = low, deep; tonos = tone).

The interview with the great baritone Renato Bruson, conducted in Parma at the maestro's museum-house, took place during a masterclass he was offering. On this occasion, the maestro agreed to answer questions related to the doctoral research titled "The Variability of the Baritone Voice Throughout the Stylistic Evolution of the Opera Genre." The interview provided deep insight into essential themes for lyrical singing: vocal technique, authentic interpretation, the importance of the word, and the longevity of a successful career. The baritone Ion Budoiu[3] states that, the baritone voice, now a welldefined category in the opera world, emerged as a distinct classification only at the beginning of the 19th century. Previously, it was alternatively associated with tenors or basses, depending on the tessitura of the role.

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[2] O. Jander, J.B.Steane, E.Forbes, E.T.Harris, andG. Waldman, "Baritone(i),"inTheNew Grove Dictionary of Music and Musicians (accessed from a local PDF file on January 2, 2025)

[3] Ion Budoiu (1930–1992) was an exceptional baritone, performing major roles from the universal classical repertoire, ranging from Mozart and Rossini to Verdi, Wagner, and Puccini. He also distinguished himself in Romanian opera, taking the lead role in Pană Lesnea Rusalin by Paul Constantinescu and performing Enescu's lieder in Berlin under the baton of Kurt Masur. See "95 de ani de la nașterea solistului de operă Ion Budoiu," Cotidianul HD, January 3, 2025, https://hd.cotidianul.ro/95-de-ani-de-la-nasterea-solistului-de-opera-ion-budoiu/. Accessed February 7, 2025.

[4] However, the first uses of the term baritonans date back to the 15th century: "the term 'baritonans' was first used in Western music towards the end of the 15th century, principally in French sacred polyphony, where it may signify a voice lower in pitch than the bassus."[5] In the 17th century, "in 17th-century Italy, the term 'baritono' takes up its modern position between the tenor and bass parts", with its use becoming more frequent in both sacred music and opera.[6] In the 19th century, baritone was solidified as a distinct vocal category with the introduction of prominent characters in the operas of Romantic composers. Verdi created roles that "demonstrated the dramatic flexibility and power of this voice," such as Germont (La Traviata, 1853) and Macbeth (Macbeth, 1847).[7] In the 20th century, Italian baritones continued to define excellence in the Verdian repertoire: "Piero Cappuccilli was regarded as the leading Italian Verdi baritone; other Italians eminent in the Verdi and Donizetti repertories have included Giuseppe Taddei and Renato Bruson."[8] These transformations contributed to the diversification of the repertoire and directly influenced the evolution of the careers of great opera artists. Renato Bruson (b. Granze, Padua, January 13, 1936) is one of the most remarkable baritones of the 20th century, renowned for his exceptional interpretations of Verdi and Donizetti operas. His impressive career, spanning over five decades, is the result of rigorous training and outstanding vocal development.

Renato Bruson began his vocal studies at the C. Pollini Conservatory in Padua under the guidance of Professor Elena Fava Ceriati, considered "one of the most respected voice teachers in Italy."[9] His official debut took place in 1961 in Spoleto, in Giuseppe Verdi's Il trovatore, where he performed the role of Count di Luna.[10] This achievement came as a result of winning the Concorso Nazionale Giovani Cantanti Lirici in Spoleto that same year.[11] From that moment on, he embarked on an increasingly acclaimed and recognized career. One of the most significant events that propelled him to international fame was his debut in La forza del destino at the Teatro Regio di Parma in 1967. This success opened the doors of the Metropolitan Opera in New York and marked the beginning of an exceptional series of debuts on the stages of the world's most prestigious theaters.

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[4] I. Budoiu, "The Baritone in Opera," in Musicology Studies (Vol. 17-18, p. 190; Cluj-Napoca, 1985).
[5] O. Jander, J. B. Steane, E. Forbes, E. T. Harris, and G. Waldman, "Baritone (i)," in The New Grove Dictionary of Music and Musicians (accessed from a local PDF file on January 2, 2025).
[6] Ibid.
[7] Ibid.
[8] Ibid.

[9] GBOpera, "Album of Memories: Renato Bruson (b. 1936)," accessed on January 1, 2025, from https://www.gbopera.it/2022/01/album-dei-ricordi-renato-bruson-n-1936.
[10] Teatro Lirico Sperimentale di Spoleto "A. Belli," "Docenti del Corso di Canto," accessed on January 1, 2025, from https://www.tls-belli.it/docenti-del-corso-di-canto. [11] Claudio Del Monte and Vincenzo Raffaele Segreto, Stagione Lirica (1991-1992). Renato Bruson. Trent'anni di carriera, p. 9 (Parma: Teatro Regio, 1992).

[12] In the book by Maestro Bruson's wife, Tita Tegano[13], published on the occasion of his 25th career anniversary, numerous posters and reviews of his performances were compiled. Among them is a 1986 review from Rome, in which conductor Giuseppe Sinopoli stated that, for him, Renato Bruson represented the ideal realization of musical sensitivity and intelligence. Even then, it was foreseen that Bruson would remain in the history of Italian opera as a benchmark baritone, thanks to his elegance and refined interpretative style.[14] Today, 39 years later, the maestro's career remains a compelling example of continuity and the preservation of essential qualities for an opera singer. Moreover, these traits have not only been maintained but also cultivated and passed on to future generations through non-formal education, making him a model of perseverance and excellence in the field.

Among the most important theaters where Maestro Bruson has performed are Teatro alla Scala in Milan, the Metropolitan Opera in New York, the Wiener Staatsoper, the Royal Opera House Covent Garden in London, the Bayerische Staatsoper in Munich, the Teatro di San Carlo in Naples, and many others, including the Romanian National Opera in Cluj, where he performed the title role in Rigoletto in 1970.[15]

In 1970, he collaborated for the first time with conductor Riccardo Muti in Verdi's Un ballo in maschera at the Teatro Comunale in Florence, marking the beginning of a long-lasting artistic relationship. In 1972, he made his debut at Teatro alla Scala in Milan in Gaetano Donizetti's Linda di Chamounix. In 1986, in Ravenna, Maestro Riccardo Muti described Renato Bruson as an authentic, expressive, and refined artist, emphasizing that any conductor would wish to have him as a collaborative partner in the demanding preparation and realization of an opera production. This recognition is also mentioned in Tita Tegano's book, dedicated to the maestro's career.[16] Among his numerous distinctions, one of the most notable is the honorary title of Kammersänger, awarded by the Vienna State Opera.[17]

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[12] Ibid.

[13] Tita Tegano was a set designer, costume designer, and author of books, many of which were published by Grafiche Step in Parma, dedicated to the art and career of her husband, baritone Renato Bruson. She collaborated with Teatro Regio di Parma, designing the set for I due Foscari (1984–1985, directed by Anna Proclemer) and contributing to numerous opera productions. In 2014, together with Bruson, she donated an important art collection to the Cariparma Foundation, including 70 works by renowned artists such as Giovanni Boldini and Giovanni Segantini. See "Addio a Tita Tegano, scenografa, costumista e moglie di Renato Bruson," Gazzetta di Parma, March 10, 2022, https://www.gazzettadiparma.it/spettacoli/2022/03/10/news/addio-a-tita-tegano-scenografa-costumista-e-moglie-di-renato-bruson-632027/, accessed February 7, 2025.

[14] Tita Tegano, ed., Renato Bruson: 25 anni di teatro in musica, with testimonies and critical notes by Carlo Belli, Maurizio Arena, Gianandrea Gavazzeni, Gianluigi Gelmetti, Carlo Maria Giulini, Giuseppe Morelli, Franco Mannino, Riccardo Muti, Giuseppe Sinopoli, Alberto Antignani, Gioacchino Lanza Tomasi, Giuseppe Negri, Roman Vlad, Piero Rattalino, Sylvano Bussotti, Rodolfo Celletti, Giuseppe Puglisi, Giorgio Gualerzi, Bruno Cernaz, Presto Moli, Bruno Cagli, Francesco Canessa, Sergio Segalini, Daniele Rubboli, Christian Springer, Angelo Foletto, Maurizio Modugno, Marcello Conati, Michelangelo Zurletti, and Elvio Giudici, p. 21 (Bologna: Edizioni Bongiovanni, 1986)

[15] Ibid., p. 95.

[16] Ibid., p. 20.

[17] Istituto della Enciclopedia Italiana, founded by Giovanni Treccani, "Renato Bruson," accessed on January 1, 2025, from https://www.treccani.it/enciclopedia/renato-bruson/.

This stands as both a testament to Maestro Bruson's Professional excellence and a reflection on the complexity of the operatic profession. It is a continuous process of exploration, preparation, and construction-an endless formation. Despite this, it is an imperfection that becomes perfect through the lived experience of the performance. An emotion can never be repeated with absolute precision; it is a feeling that can be relieved, but always through the
lens of new preparation. Renato Bruson began his responses in the interview by emphasizing that his artistic development was profoundly influenced by a teacher for whom he holds deep respect and gratitude. As mentioned in the maestro's biography, this refers to Professor Elena Fava Ceriati. "I learned from my teacher, who had been a chamber music singer. From her, I acquired taste and sensitivity. And I must thank her even today because she taught me how to interpret and sing." This approach, rooted in chamber music, helped him develop a solid vocal technique and a deep awareness of the semiotics of artistic interpretation.
Chamber music is a highly exposed environment without the support of an orchestra, every detail becomes fragile and delicate, and even the beating of the heart seems to take on a perceptible presence. Accompaniment in chamber music represents an essential relationship, a collaboration and synchronization between the performer and the accompanist because the accompaniment does not merely provide support but complements the interpretation through specific musical motifs and phrases. This further underscores the necessity of thorough education and rigorous preparation. Another essential aspect mentioned by the maestro was the importance of discipline. Renato Bruson emphasized: "For a long career, you must know how to choose what to do and stay within your repertoire," warning about the risks singers take when exploring a repertoire that exceeds the natural limits and possibilities of their voice. "You don't have to do everything today; many take on anything just to make money. No, if you want a long career, there must be humility, seriousness, and complete dedication." In his view, the ability to maintain a proper balance in repertoire selection is a quality that sustains the longevity of an opera singer. This idea of discipline and balance resonates with Professor Paul Popovici's[18] statement that "passion must meet vocation and natural gifts," [19] emphasizing that success in a career cannot exist without an alignment between inner desire and natural abilities. Moreover, the concept of discipline extends to daily practice, which is regarded as "moral hygiene" for those who approach their profession with such commitment.[20] In addition to these observations, the maestro emphasized the importance of understanding the stages of vocal maturation. "Just as the body matures, so does the voice," he said, highlighting that each stage of a singer's life must be approached naturally and appropriately.

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[18] Paul Popovici is an associate professor and a specialist in law, actively engaged in legal education and intellectual property. He served as vice dean (2020–2022) at the Faculty of Law, Dimitrie Cantemir Christian University in Bucharest (Faculty of Law in Cluj-Napoca) and as a master's program director (2013–2015). Since 2023, he has been an associate professor at Vasile Goldiș Western University of Arad. In addition to his academic work, he is a judicial technical expert, arbitrator, and mediator in the field of intellectual property. See Curriculum Vitae – Paul Popovici, Vasile Goldiș Western University, https://www.uvvg.ro/docs/ Facultati/cv_profesori/facultate_juridice/POPOVICI_PAUL.pdf, accessed February 7, 2025.

[19] P. Popovici, "The Ethics of Scientific Research and Academic Integrity," online course held at the Gheorghe Dima National Academy of Music, Sigismund Toduță Doctoral School, Cluj-Napoca, December 2, 2024.

[20] P. Popovici, "The Ethics of Scientific Research and Academic Integrity," online course held at the Gheorghe Dima National Academy of Music, Sigismund Toduță Doctoral School, Cluj-Napoca, November 25, 2024.

An excerpt from an academic paper presented at the Academy of Sciences in Paris, Manuel García Jr.[21] supports the following idea: "L'insieme della voce umana va soggetta ad innumerevoli modificazioni sotto l'influenza dell'età, dei sessi, delle costituzioni." ("The human voice, as a whole, is subject to an infinite number of modifications influenced by age, sex, and physical constitution.").[22] As Robert Thayer Sataloff[23] and Karen M. Kost[24] emphasize in their article "The Effects of Age on the Voice, Part 1," published in the Journal of Singing, the official journal of the National Association of Teachers of Singing, a U.S.-based organization, voice teachers "should be familiar with many of the more important, clinically relevant age-related changes that occur in the human voice."[25] This approach helps singers adapt their repertoire and technique according to the specific characteristics of each stage of vocal development. This perspective is supported by specialized literature. In the book This is a Voice, authors Jeremy Fisher[26] and Gillyanne Kayes[27] explain that:

Your voice is a biomechanism that changes with the rest of the body, growing and maturing – along with your lung capacity and the ability to control breath – as part of the life cycle from child to adult. The positioning and size of the larynx are important factors, as well as the relative firmness of the cartilages."[28] This description highlights the importance of selecting the appropriate repertoire while respecting the body's natural development, allowing the voice to grow and mature alongside it in a balanced manner.

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[21]Manuel García Jr. (1805–1906) was a singer, pedagogue, and researcher of the human voice, renowned for his revolutionary contributions to the study of vocal mechanisms. In 1840, he presented his paper Mémoire sur la voix humaine at the Academy of Sciences in Paris, demonstrating a profound understanding of the physiological phenomena of the voice. In 1854, he became the first to use the laryngoscope, which allowed him to confirm his theories on vocal production. His singing method had a significant impact on vocal education, and his observations on vocal registers and timbre remain fundamental in modern vocal pedagogy. See Michèle Castellengo, "Manuel Garcia Jr: A Clear-Sighted Observer of Human Voice Production," Logopedics Phoniatrics Vocology, DOI: 10.1080/14015430500298131, PMID: 16287657.

[22] M. Garcia Jr., Scuola di Garcia. Trattato completo dell'arte del canto (Part 1, p. 14; Milan: Ricordi, 1970).

[23] Robert T. Sataloff is a specialist in otolaryngology, professor, and chairman of the Department of Otolaryngology–Head and Neck Surgery at Drexel University College of Medicine. He is also a professional singer, holding a Doctor of Musical Arts (DMA) degree in vocal performance. He has published approximately 1,000 works, including 62 books, and serves as Editor-inChief of the Journal of Voice and the Ear, Nose and Throat Journal. [24] Karen M. Kost is a professor of otolaryngology at McGill University and the director of the Voice and Dysphagia Laboratory at the same institution. A specialist in ENT oncology, airway disorders, and voice, she served as president of the Canadian Society of Otolaryngology– Head and Neck Surgery (2013) and the American Society of Geriatric Otolaryngology (2012–2014). She has delivered over 400 international presentations and has published extensively on topics related to voice and tracheostomy. See https://www.nats.org/_ Library/JOS_On_Point/JOS-077-01-2020-63.pdf, accessed February 7, 2025.

[25] R. T. Sataloff and K. M. Kost, "The Effects of Age on the Voice, Part 1," Journal of Singing 77, no. 1 (2020): 63.

[26] Jeremy Fisher is an award-winning musician and performance coach with over 30 years of experience working with actors and singers. He is a multimedia vocal educator, having developed numerous training DVDs and professional development tools for Vocal Process and the Science Museum. He has co-authored four books and written approximately 300 articles on classical and commercial singing.

[27] Dr. Gillyanne Kayes is a voice expert and vocal pedagogue with 35 years of experience inspiring singers and teachers. She holds a PhD in voice research and has authored seven books, including Singing and the Actor. Recognized as a pedagogue and presenter at international conferences, she has also contributed as a curriculum advisor for institutions such as CSSD, RCS, and DMusics Barcelona.

The maestro also described the decisive role of constant study, emphasizing that only through sustained effort and discipline can one achieve remarkable results. “Otherwise, you remain mediocre.” This insistence on study reflects a deep perspective on discipline, seen as the foundation of continuous development. In this regard, it is perfectly complemented by the observation of Manuel Garcia Jr., who highlights that natural predispositions are not enough: “Le più belle disposizioni hanno d’uopo d’essere nella loro applicazione coltivate e dirette da uno studio lento e ragionato.” (“The most beautiful predispositions need to be cultivated and directed in their application through slow and rational study.”)[29] These perspectives emphasize that in singing, success depends on the combination of natural talent and rigorous study. Vocal technique cannot be left to chance, and every detail from body posture to breath control must be consciously practiced transforming innate gifts into a balanced vocal expression. At the same time, text interpretation, whether in opera, chamber music, or other genres and the understanding of a character’s psychological portrait are fundamental. These elements provide the emotional depth and authenticity necessary to move and inspire the audience. Regarding the negative influences affecting new generations, Renato Bruson observed: “Because nowadays, what ruins young singers even though the voices exist is the influence of radio, television, and the recording industry.” Lack of patience, along with these influences, is another major issue: “Young people want everything here and now. That’s not how opera singing works.” For the maestro, patience and seriousness remain the keys to long-term success.

This idea reminds me of my professor, Greta Benini[30] , who taught me at the Musik und Kunst Privat Universität der Stadt Wien. In her classes, there was a clear condition: we were not allowed to listen to recordings, especially when preparing a role or facing the risk of “plagiarizing” an interpretative dramaturgy practices that strip us of our individuality. This approach aligns with what my professor, Iulia Augusta Suciu[31], from the Gheorghe Dima National Academy of Music in Cluj-Napoca, used to tell me. I have always valued her guidance and support.
On the other hand, one of my voice teachers, Michail Lanskoi[32] , who sang alongside Renato Bruson 30 years ago at the Ludwigsburg Festival in Verdi’s operas I masnadieri and Giovanna d’Arco, told me that it is important to listen to reference baritones.

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[28] J. Fisher and G. Kayes, This is a Voice: 99 Exercises to Train, Project and Harness the Power of Your Voice (p. 40; London: Wellcome Collection, 2016).
[29] M. Garcia Jr., Scuola di Garcia. Trattato completo dell’arte del canto (Part 1, p. 21; Milan: Ricordi, 1970).
[30] Greta Benini is an Italian pianist specializing in vocal and opera accompaniment. She studied in Ravenna, Florence, and Bologna and has been a laureate of several international competitions. She has worked as a repetiteur at Wiener Kammeroper and Volksoper Wien, collaborating with renowned artists and performing on major stages across Europe and the United States. Currently, she is a professor of opera repetition at Musik und Kunst Privat Universität der Stadt Wien. See https://muk.ac.at/studienangebot/lehrende/details/greta-benini.html, accessed February 2025.
[31] Univ. Prof. Dr. Habil. Iulia Augusta Suciu is the Vice-Rector responsible for academic activities and a repetiteur at the Gheorghe Dima National Academy of Music in Cluj-Napoca. Throughout her career, she has performed numerous recitals and concerts, participating in national and international festivals. Due to her pedagogical work, many of her graduates now perform on some of the world's most prestigious stages, including the Metropolitan Opera, Vienna State Opera, Munich Opera, Royal Opera House, and others.
[32] Michail Lanskoi was born in Moscow and studied at the Bolshoi Theatre Singing School and the Gnessin Institute. He earned a doctorate in musicology from the Tchaikovsky Conservatory in Moscow (1990). A laureate of vocal competitions in Russia, Spain, and Austria, he has performed leading roles in operas by Mozart, Verdi, Puccini, Rossini, and Tchaikovsky on major stages in Germany, Austria, Switzerland, England, and Russia. He has collaborated with renowned conductors such as Helmuth Rilling, Valery Gergiev, and Gianandrea Bramall. See https://muk.ac.at/veranstaltung/meisterklasse-gesang-mit-michaillanskoi.html, accessed 7 February 2025.

[33] Some studies conducted by R. Harris and B. M. de Jong[34] suggest that this process, known in science as "mirror neurons", has a clear impact on auditory-motor transformations. As the authors emphasize: "Passive listening to music evoked auditory-parietal-premotor activations when subjects had attentively listened to this music before, while the premotor activation even further increased when such music pieces had actually been practiced." [35]

This listening of musical literature helps to raise awareness of the technical and stylistic aspects and to understand the diversity within the subcategory of the baritone voice a true culture of variability. Recordings of great baritones can serve as a "passive school" that inspires and provides new perspectives, but they do not absolve us from the search for our own path. However, in interpretative and dramaturgical terms, it is crucial to pay special attention to the composer, respecting the semiotics of the score. Authenticity and personal development remain essential, and inspiration should be used as a starting point, not as a substitute for individual work. Vocal technique was a central theme in the interview. Renato Bruson explained: "Singing is always singing; only the style changes – Italian style, German style, American style, etc., but singing always remains singing." Chamber music taught him to breathe correctly and develop artistic taste: "Because I first sang chamber music and learned to sing with style and sensitivity." This reflects a constant concern for details and artistic authenticity, where every performance must be faithful to both the text and the emotion it conveys.

In this context, the maestro also highlighted the importance of the word in lyrical singing: "You must capture the audience's attention; otherwise, you won't have a career, it's over. That's why the word is very important, and I care deeply about the word." This observation emphasizes that the text and its interpretation are fundamental in creating an authentic connection with the audience. As Paul Higgins notes in an article about the importance of the word, interpretation is not merely an imitative rendering of the text on a musical platform; it is a profound analysis of the text, which is essential and must address the "poetic, formal, semantic, and aesthetic complexities of a song." [36] This relationship between music and the word is also highlighted by the idea that "music is a syncretic whole and addresses the eye, the ears, and the senses."[37] In this whole, the word is not just a means of communication, but an element that gives depth and meaning to the artistic act. Gestures, movement, and other visual elements contribute to this unity, creating a synthesis that leads to the "attainment of moral perfection" and to harmony with the Cosmos through ethos.[38] Thus, the word plays an essential role, as it is the one that facilitates catharsis – the purification of the soul through art.[39] In this regard, B. V. Asafiev[40] emphasizes the importance of emotional expressiveness in music: "One must be able to sing anger, compassion, pain, jest, mockery, tenderness, kiss, cunning, bravery-in a word, the entire range of emotions."

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[33] M. Lanskoi, voice teacher at the Hochschule für Musik in Berlin and MUK in Vienna, personal correspondence, October 20, 2024.

[34] R. Harris and B. M. de Jong are researchers in the Department of Neurology at the University Medical Center Groningen and the University of Groningen, Netherlands. They are also affiliated with the BCN Neuroimaging Center, where they specialize in neuroimaging and neurology

[35] R. Harris and B. M. de Jong, "Cerebral Activations Related to Audition-Driven Performance Imagery in Professional Musicians," PLOS ONE 9, no. 4 (2014): https://doi.org/10.1371/journal.pone.0093681.

[36] P. Higgins, "Benjamin Britten: Art Song, a Synthesis of Words and Music – Issues and Approaches to Text-Setting," Maynooth Musicology, Maynooth University, Maynooth, Ireland, January 1, 2009, cited in Rosenwald, "Theory, Text-Setting, and Performance," p. 53.

[37] L. Olărașu, "Music in Antiquity," personal blog, October 27, 2011, accessed on January 9, 2025, from https://olarasuloredana.wordpress.com/2011/10/27/muzica-in-antichitate.

[38] Ibid.

[39] Ibid.

[40] Boris Vladimirovich Asafiev (July 29 [O.S. July 17], 1884 – January 27, 1949) was a Russian and Soviet composer, musicologist, music critic, and writer, recognized as one of the founders of Soviet musicology. He was the dedicatee of Prokofiev's Symphony No. 1. He was born in Saint Petersburg. See https://www.discogs.com/artist/2905491-Boris-Asafiev, accessed February 2025.

[41] This idea reflects the fact that interpretation is not merely a reproduction of sound, but a complex process of transposing emotions, where every detail contributes to the authenticity of the interpretative act. From Renato Bruson's perspective, the variability of the baritone voice is a natural phenomenon, determined by the gifts received from God. "It is what God or nature has given you, there's nothing you can do about it. After that, you just have to study, study, and study." Timbre is "a distinct and unmistakable vocal fingerprint," which makes the opera singer authentic. Manuel Garcia Jr., who was a Spanish opera singer (baritone), voice teacher, and music pedagogue, also known as the inventor of laryngoscopy,[42] defines timbre as: "quel carattere proprio e variabile all'infinito" ("that unique and infinitely variable characteristic"). [43] Maestro Bruson made an interesting comparison between opera and chamber music, explaining the fundamental differences in the relationship with the audience: "In chamber music, you are exposed; the audience is focused solely on you." This observation highlights the need for an authentic connection, an essential element for success on stage: "Otherwise, you won't have a career, it's over."

In conclusion, baritone Renato Bruson offers a clear vision of lyrical singing, based on authenticity, discipline, and respect for the word. His response "No." to the question about the need "to learn from a Maestro to become a Maestro" reflects his belief that learning is a personal process of discovery and assimilation, not merely imitation. The relationship between opera and chamber music, as reflected in the maestro's artistic journey, emphasizes an essential idea: music is not just about the difficulty of the repertoire, but about how we succeed in moving the audience through authenticity and emotion. The variability of the baritone voice transcends nationality, tradition, or origins; it consists in the broad realization of the same essential idea, which is the sharing and co-involvement in a great encounter with the Creator of creation, manifested through the diversity of the subcategories of the baritone voice throughout the entire opera genre repertoire. The predominant common factor (vocal authenticity) lies in the difference of timbral individuality, with each vocal instrument adapted according to the parameters that the individual naturally possesses. The problem of the present is that each opera artist, in one way or another, tries to imitate someone based on the success that individual has had. However, the reality is that this represents an illusory image that tends to reach a form of bovarism-the desire to live a foreign identity that is disconnected from one's own authenticity. True virtue lies in discovering one's "own heart," through which you can give value to the "word" and, with intelligence, overall, know how to use your voice. Therefore, authenticity is essential; accepting the voice that the opera artist possesses, the body, the color, and the timbre is the most beautiful thing, because it makes you unique. Furthermore, the connection between chamber music and opera highlights the complementarity of these genres. While opera allows for an expansive development of vocal and dramatic storytelling, chamber music brings intimacy and special attention to detail. This complementarity was essential in the artistic development of baritone Renato Bruson, who learned to combine the sensitivity and technical precision of chamber music with the dramatic emotion specific to opera. Together, these genres enrich the interpretation, placing a common and essential element at their core: the word.

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[41] B. V. Asafiev, cited in V. P. Morozov, Искусство резонансного пения. Основы резонансной теории и техники (The Art of Resonant Singing. Fundamentals of Resonance Theory and Technique) (p. 247; Moscow: IP RAN, P. I. Tchaikovsky State Conservatory, "Art and Science" Center, 2002). Original quote: "Надо уметь петь гнев, сострадание, боль, шутку, насмешку, ласку, поцелуй, лукавство, смелость – словом, всю гамму чувствований."

[42] "Inventos españoles: el laringoscopio," HC Energía (Summer Edition, 2011), accessed on January 9, 2025, from http://web.archive.org/web/20150222042346 http://www.hcenergia.com/boletinhc/verano2011/cultural.htm.

[43] M. Garcia Jr., Scuola di Garcia. Trattato completo dell'arte del canto (Part 1, p. 17; Milan: Ricordi, 1970).

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CHORAL INTELLIGIBILITY: PERFORMERS' AND LISTENERS' PERSPECTIVES

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ABSTRACT

The intelligibility of sung speech is a well-known issue among listeners of vocal, and particularly classical, music. Scientific interest in this topic has been constant but researchers have mostly concentrated on performances by soloists. However, choral singing and its practitioners may need more consideration, as it has been found that choirs are even less intelligible than soloists6 . In the present study, intelligibility (as opposed to comprehensibility) is understood as a characteristic of a text sung in a way that spectators can distinguish its individual sounds independently of understanding the meaning of the words. An online survey was carried out for 361 practitioners of choral singing (choristers, conductors, vocal teachers and composers), which permitted establishing a ranking of the factors perceived as most important for the intelligibility of choirs. The highest rating was attributed, almost unanimously (87% of the respondents), to the conductor's preparatory work, followed by hall acoustics, balance between the choir and the instrumental accompaniment, then the pronunciation of consonants. The experimental phase of this study included recording a four-part classically trained choir (11 singers) who sang vowel-consonant-vowel and vowel-consonant syllables comprising Italian, English and German consonants. 24 choral practitioners and 38 laypersons then participated in a pilot perception test in which they were asked to identify eight consonants in the intervocalic and final positions recorded by the choir. Overall results of the pilot study are presented in a confusion matrix. The ongoing acoustic analysis of the abovementioned recordings and the results of the subsequent perception test, held in November 2025, could shed more light on relevant factors of choral intelligibility and hence suggest possible practical solutions for the actors of choral singing.

KEYWORDS: *Speech Intelligibility, Singing, Classical Music, Phonetics, Teaching*

INTRODUCTION

Listeners of vocal, in particular classical, music are often faced with the issue of reduced intelligibility of sung lyrics. Numerous possible explanations of this phenomenon include vocal technique, in particular lowered larynx and singer's formant, characteristic of Western classical singing[1] ; fundamental frequencies and intensity levels unusual for speech[2,3]; vibrato[2] ; distortion of the syllabic structure in the sung text[2] ; "musical rhythm not match[ing] the prosodic speech rhythm"[4] ; reverberant hall acoustics[3] ; the masking effect of orchestral accompaniment[5] ; distance between spectators and singers[3] ; listeners' auditory abilities[5] , etc. The multiplication of voices singing simultaneously further decreases intelligibility by around 10% in comparison to a soloist's voice[6]. Some possible reasons cited in the literature include the so-called chorus effect, which "arises when many voices, all with flutter and pitch scatter, combine and create a quasirandom sound of such complexity that the normal mechanisms of auditory localization and fusion are disrupted"[7], as well as polyphony and polytextuality of choral pieces[8]. At the same time, the number of singers (chorus size) does not seem to have any significant effect on the intelligibility of a choir[6] . This article offers an overview of the methodology and preliminary results of an ongoing research at the intersection of phonetics and language didactics dedicated to the intelligibility of choral sung speech. The main objectives of this research are to: (1) collect opinions and best practices of the international choral community regarding the issue of intelligibility; (2) establish possible factors of the intelligibility of choirs; and (3) suggest practical solutions to increase the intelligibility of texts sung by choirs.

In this study, intelligibility (as opposed to comprehensibility) is understood as a characteristic of a text sung in a way that spectators can distinguish its individual sounds – in the phonetic sense of the term – independently of understanding the meaning of the words. The research concentrates on choirs as groups of singers who sing together regularly (as opposed to ad hoc choirs created for one-shot projects) and perform in the Western classical tradition.

METHODS

The research has unfolded in two consecutive and interconnected phases, the first one based on the empirical methodology, the second one being experimental.

The empirical methodology focused on the research objective (1) and included:

- an anonymous online survey for choral practitioners (choristers, conductors, vocal teachers working with choirs and choral composers): the survey was constructed on the LimeSurvey platform (https://www.limesurvey.org/) which permitted to script the questionnaire, displaying questions in accordance with the respondent's role in choral practice. The largest group of questions asked to all the respondents concerned the perceived importance ("very / relatively / not at all important") of various intelligibility factors (following a 2014 study carried out by Philip Fine and Jane Ginsborg8); among other queries, the respondents were questioned about the main languages of classical choral singing;
- semi-constructed interviews of sixteen highly experienced representatives of the choral community (conductors, composers, language coaches), with the purpose of obtaining more detailed and substantiated contributions regarding the research subject.

The experimental phase included:

- recordings: nonsense vowel-consonant-vowel (CVC) and vowel-consonant (VC) syllables set on a four-part musical phrase were sung in a soundproof room by eleven classically trained singers (sopranos, altos, tenors and basses), led by a choral conductor. The syllables comprised the /i/ - /a/ - /u/ vowels and German, Latin/Italian and English consonants. The choice of the consonants was determined by the responses to the online survey regarding the main languages of Western classical choral music. The musical material had been validated by previous research done by Johan Sundberg and Sten Ternström1 . The recordings were preceded by pedagogical work with the conductor and the singers on the IPA (International Phonetic Alphabet) transcriptions of the corpus and on the correct articulation of the sounds;
- perception test: the tracks recorded by the choir were then cut into stimuli (separate syllables) with a view to their use for an online perception test following a pilot study. For the pilot study, eight CVC and VC stimuli were presented to the choral practitioners ("experts") during a webinar held on the Zoom platform and to laypersons, mostly university linguistics students without any singing experience ("non-experts"), during an in-person event. The participants listened to each stimulus twice and were invited to identify the consonant in each stimulus choosing among five options, without being obliged to give a response regarding each stimulus when unsure of the response to be given.

RESULTS

Online Survey

361 choral practitioners from more than thirty countries (France, Italy, New-Zealand, UK, USA and others) responded to the online questionnaire. One of the most salient results of this survey is the ranking of the factors of choral intelligibility perceived as more or less important by representatives of the choral community (Figure 1). The highest importance was attributed, almost unanimously (87,1% of the respondents evaluating it as "very important"), to the choral conductor's preparatory work, followed by hall acoustics (79,2%), balance between the choir and the instrumental accompaniment (76,2%) and then the pronunciation of consonants (72,6%), which, unsurprisingly, is considered to be more important for intelligibility than the pronunciation of vowels (62,5%). The lowest positions in this classification are occupied by listeners' musical and vocal experience (7,4% of the respondents considering it as "very important", 56,2% as "not at all important") and the number of choristers (6,0% as "very important" and 47,7% as "not at all important").

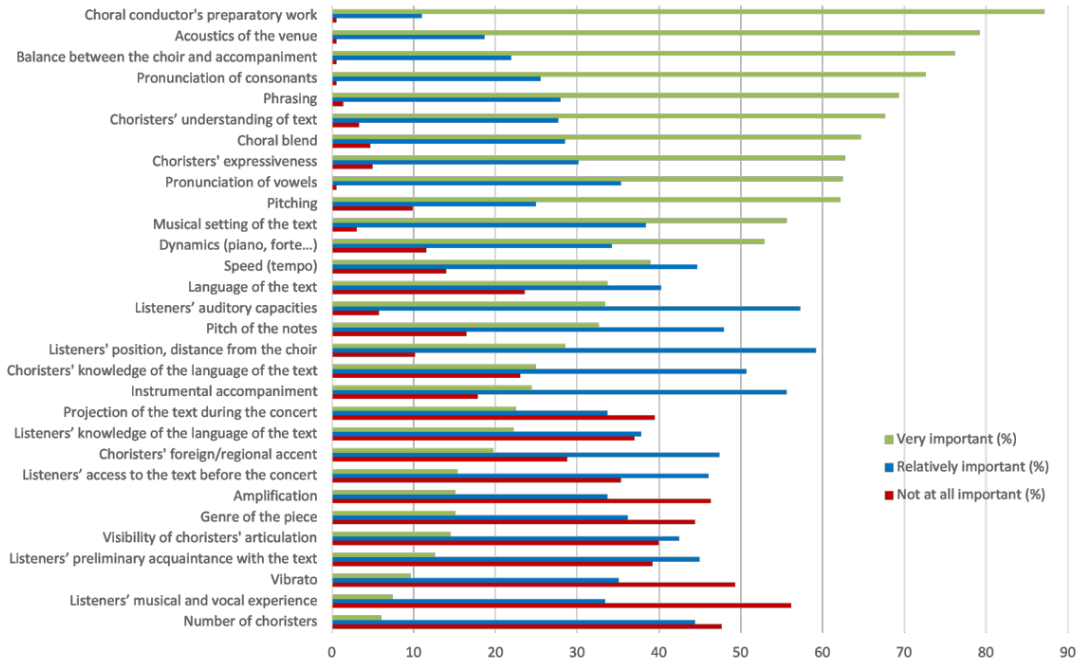

Figure 1. Perceived factors of choral intelligibility. Results of the online survey in percentages (%) of the responses. The colours are specific to this graph and are purely illustrative.

The results of the semi-constructed interviews, which complemented the responses to the online survey, will be featured in further publications.

Pilot Perception Test

Twenty-four experts and thirty-eight non-experts participated in the pilot perception test. The results of the test are best illustrated by a confusion matrix (Figure 2), where the targets are displayed vertically and the responses horizontally; the numbers in the boxes correspond to the percentage of the responses for each target-response pair. The highest identification scores are characteristic of the fricative consonants /ʃ/ (91,9% of correct responses) and /f/ (88,7%), as well as of the nasal /m/ (80,6%). The lowest score is that of the German uvular /ʁ/ (30,6%).

The confusion matrix reveals several tendencies in the perception of sung consonants, like voiceless to nasal confusion (labial /p/ -> /m/), nasal to oral confusion (labial /m/ -> /b/). Confusion is also observed in place of articulation such as labial to velar (stop /p/ -> /k/), labial to dental (nasal /m/ -> /n/). Voiceless consonants tend to be perceived as their voiced counterparts (fricatives /f/ -> /v/, /s/ -> /z/, /ʃ/ -> /ʒ/; stop /p/ -> /b/). One exception among fricatives is the case of uvulars, where the voiced consonant is confused with its voiceless counterpart (uvular /ʁ/ -> /χ/). Interestingly, the German uvular consonants /ʁ/ and /χ/ are confused with /v/ in 40,3% and 24,2% of cases, respectively.

Figure 2. Confusion matrix for consonants sung in choir (pilot study). The y-axis: target sounds with the presented stimuli (in italics). The x-axis: responses. The numbers in the boxes correspond to the percentage of the responses for each target-response pair.

The results did not clearly reveal whether musical experience had a significant effect on response accuracy. Therefore, the confusion matrix reflects the combined responses of experts and non-experts.

DISCUSSION

The results of the online survey show, in particular, that a number of the practitioners' perceptions regarding the intelligibility factors correspond to previous scientific findings, for example to those stating the decrease in the intelligibility of sung voice due to reverberant acoustics3 or to the masking effect of orchestral accompaniment5 . The low importance attributed to the number of choristers corresponds to the abovementioned study on the chorus size and its insignificant effect on the intelligibility of a choir6 . The respondents' answers are also in line with most trends observed in the 2014 study carried out by Philip Fine and Jane Ginsborg (see our previous publication9 for a more detailed comparison of the results). At the same time, the survey reveals high importance attributed to a factor specific to choral singing, that of the conductor's preparatory work with singers.

The results of the pilot study echo some previous research on speech intelligibility concerning, for example, high intelligibility of fricative consonants and consonant confusions by place of articulation10, among other studies. At the same time, they reveal the confusion of voiceless consonants with their voiced counterparts, a trend which normally is not observed in the intelligibility of spoken voice and may be proper to sung speech. The one-off confusion of the uvular /ʁ/ with /v/, not fitting into a tendency, had been observed in at least one previous study10, however no explanation was suggested. Further analysis will be necessary in case these identification errors are reiterated in the results of the principal perceptual study.

CONCLUSION AND RECOMMENDATIONS

The conclusions of this ongoing research on the intelligibility of choirs are:

1. from the performers' perspective:

- the choral conductor's preparatory work is perceived to be the main factor of the intelligibility of choirs;
- the number of singers is perceived to be the least important intelligibility factor;
- the pronunciation of consonants is perceived to be more important for intelligibility than the pronunciation of vowels;

2. from the listeners' perspective (preliminary results):

- fricative consonants /ʃ/ and /f/ sung by a choir seem to be highly intelligible;
- the German uvular /ʁ/ sung by a choir appears to be the least intelligible;
- voiceless consonants tend to be confused with their voiced counterparts (/p/ with /b/, /s/ with /z/, /f/ with /v/, and so on).

From the perspective of further research, the online survey has modelled the experimental phase orienting it towards issues relevant for the actors of choral singing. The pilot perception study has permitted, in particular, to evaluate and refine the test methodology and revealed certain consonant confusions to be verified on the basis of more representative sample data used in the principal perception test. The latter was held in November 2025, the analysis of its results as well as the acoustic analysis of the choir recordings are ongoing. The conclusions made at the outcome of this research should be able to shed more light on the relevant factors of choral intelligibility, inform pedagogical strategies and suggest possible practical solutions for the actors of choral singing.

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STUDY OF THE SINGING VOICE WITH OBJECTIVE TECHNIQUES: ITS USEFULNESS AND LIMITS

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ABSTRACT

Aims: Develop and implement objective acoustical parameters related to some perceptual characteristics of the singing voice. PARAMETERS: Vibrato: frequency F0, extension, (ir)regularity (Vibrato jitter, Vibrato shimmer), Duration, Vocal intonation (mean value between the maximum and the minimum frequency value in each vibrato cycle). Standard deviation is computed for all parameters to account for the subject ability to "sustain" vibrato and tone. Singer's formant (range and amplitude): Quality Ratio – QR (area under the first two formants F1 e F2 divided by that of formants F3, F4, F5) with adaptive estimation of varying thresholds. Ideally QR=1.

ANALYSIS: Methods: Parameters are implemented in the BioVoice tool. Free download at: https://github.com/ClaudiaManfredi/BioVoice. Moreover, both statistical and classification (Machine Learning) techniques were applied.
SUBJECTS AND MATERIAL: Forty-two professional singers: 11 male operatic, 5 male jazz, 12 female operatic and 14 female jazz singers were asked to sing "Summertime" from Gershwin's opera Porgy and Bess. It involves singers at a deep emotional level, stimulates expressivity and is suited for interpretation both in western operatic and in jazz style.
RESULTS show differences/similarities among groups and points out the most relevant acoustical parameters according to gender and singing style.
LIMITS: The study concerns a few subjects. Selection of the audio frame is made manually, as the analysis should be performed on the steady state part only. The analysis is made offline.
FINAL REMARKS: Vibrato develops as voice training proceeds. Its objective evaluation may give useful information about the quality of the performance and the singing style. Singer's formant and QR may help singing pedagogy to e.g. refine vocal tract resonances. Objective analysis could be helpful for educational and training purposes to objectify typically perceptive quantities. However, the singing teacher's experience remains fundamental. Combined audio and video analysis could improve the results, adding facial characteristics related to expressive skills.

Keywords: *singing voice analysis, objective parameters, operatic vs jazz singing style, statistics, classification*.

INTRODUCTION

Objective acoustical analysis of the singing voice has become an increasingly important complement to the perceptual evaluation made by expert singing teachers. While perceptual assessment remains central in pedagogy and performance assessment, it is inherently subjective and difficult to quantify across singers, training level, and singing styles. Quantitative measures such as vibrato characteristics, spectral energy distribution, and resonance features provide objective descriptors of voice production and have been shown to correlate with perceptual qualities, both in pedagogical and musicological areas [1]. Vibrato features quantified by rate, extent, and cycle-to-cycle regularity can highlight differences between trained and untrained voices and provide metrics for tracking the effects of voice training[2]. Similarly, spectral characteristics such as the singer's formant and the Quality Ratio (QR) offer insight into vocal tract resonance shaping and overall timbral quality, which are crucial for operatic and jazz singers[1].

In addition to these time- and frequency-domain measures, Voice Range Profiles (VRPs)[3,4,5], offer a holistic representation of a singer's vocal capabilities by mapping dynamic range (sound pressure level) across the full pitch range achievable by the individual. VRPs have been shown to reflect both physiological and performance aspects of the singing voice, including the influence of training duration, style, and pedagogical context[6]. By capturing global vocal capacity in terms of pitch and loudness potential, VRPs could effectively integrate objective analyses. The present study concerns a set of acoustical parameters, including vibrato metrics and singer's formant, implemented in the open-source BioVoice analysis tool[7]. Using statistical and machine learning techniques, differences and similar features are exploited in the acoustic profiles of professional operatic and jazz singers of both genders, with the goal of identifying parameter sets that may reflect stylistic and physiological variations in singing voice production.

METHODS

Dataset

The dataset concerns 42 professional singers: 26 females (sopranos or mezzo-sopranos) and 16 males (tenors or baritones). Specifically: 23 specialized in Western operatic singing and 19 in jazz (males operatic: 11; males jazz: 5; females operatic: 12; females jazz: 14). Age range: 21 - 32 years for females and 21 - 54 years for males. All participants received advanced vocal and musical training with a minimum of three years of professional experience and reported no voice problems or related complaints. All singers were trained in both classical and jazz singing styles, which enabled stylistic comparisons among them. They were recruited at the Luigi Cherubini Conservatory (Firenze, Italy) and at private singing schools in Milano (Italy) and Ravenna (Italy). Each singer provided informed consent to take part in the study.

The selected excerpt was the well-known line from Porgy and Bess: "Summertime, and the livin' is easy." After completing a vocal warm-up, each singer was asked to perform a cappella, expressing the piece in both operatic and jazz style. Each singer performed the excerpt twice, and the best one was chosen for analysis. No specific key was assigned; singers were free to choose the pitch range they found most comfortable. For objective vibrato analysis, the sustained /aɪm/ vowel sound from the word /sʌmətaɪm/ ("Summertime") was selected.

The recordings were made using a Tascam US-144 MK2 soundboard (Tokyo, Japan) and a Shure SM58 cardioid unidirectional microphone (frequency response: 50–15,000 Hz), both connected to a computer. The microphone was positioned at a fixed distance of 20 cm from the singer's mouth. The sampling rate was set at 44.1 kHz.

BioVoice analysis

The sustained /aɪm/ vowel sound was manually segmented, and analysed using the opensource BioVoice software7 . According to Manfredi et al.1 , the following 40 features were extracted:

- From F0 to F5, where F denotes the fundamental frequency and formants extracted by BioVoice:
  - o Fx-median, Fx-mean, Fx-std, Fx-min, Fx-max (Fx=Formants F0, F1-F5)
  - o Peaks in the power spectrum for each formant: pks1_PSD (for F1), pks2_PSD (for F2), pks3_PSD (for F3), pks4_PSD (for F4), pks5_PSD (for F5).
- Vibrato features:
  - o Mean and standard deviation of the Vibrato rate (VRate-mean, VRate-std), mean and standard deviation of Vibrato extent (Vext-mean, Vext-std), Vibrato jitter (jVrate), Vibrato shimmer (sVext). jVrate and sVext are analogous to the well-known voice parameters jitter and shimmer and they are used to assess vibrato regularity1 .
- Mean value of the cents of semitone for the analysed frame (Cmean).
- Quality ratio (QR): is defined as the ratio of the area of the power spectral density below (F1+F2) and that of (F3+F4+F5 = singer's formant)1 . A specific procedure is implemented for the adaptive estimation of the two varying thresholds that separate (F1+F2) from (F3+F4+F5). This is indeed a new and relevant aspect for the estimation and automatic calculation of the singer's formant.

- Time domain features: Voiced duration (V-Duration), percentage of voiced parts inside the signal (%V-Duration), unvoiced duration (U-Duration), percentage of unvoiced parts inside the signal (%U-Duration), signal duration (Total-Duration).

Specifically, Vibrato rate is shown in Eq.(1). The female range [4.2 – 8.1] Hz was applied to both styles and genders.

$$Vrate = \frac{1}{N}\sum_{i=1}^{N-1} \left| \frac{1}{t_{F0_{max}}^{i+1} - t_{F0_{max}}^{i}} \right| \quad (1)$$

In Eq. (1), t^{i}_{F0max} is the time instant corresponding to the i-th maximum of F0 and N is the number of F0 maxima. Moreover, the following relation between cent and F0 was considered: *(i) = 1200*3.322028403 * log_{10}* ($F0^{i}_{max}$ / $F0^{i}_{min}$) where *i* represents the *i*-th cycle.

Vibrato extent (Vext) is shown in Eq. (2). Is defined as the mean frequency difference between the maximum and minimum F0 values within a single cycle (i.e., the cycle amplitude).

$$Vext = \frac{1}{N}\sum_{i=1}^{N} (F0_{max}^{i} - F0_{min}^{i}) \quad (2)$$

Further details in Manfredi et al.[1] .

All the features extracted by BioVoice were evaluated to compare the two styles across the four groups considered (hereinafter: male classical, male jazz, female classical, and female jazz). The assumption of normality was assessed using the Kolmogorov–Smirnov test. A oneway analysis of variance (ANOVA) was applied to identify any statistically significant differences (significance level = 0.05). For the pairwise comparisons Tukey's honestly significant difference (HSD) test was used as a post-hoc procedure (specifically, male classical vs. male jazz and female classical vs. female jazz).

Machine learning analysis

Machine learning (ML) algorithms were implemented to perform separate binary classification experiments for the female and male datasets and the two singing styles. Signal processing was made in the MATLAB 2021b environment (The MathWorks, Inc., Natick, MA, USA). Specifically, the following classification experiments (hereinafter referred to as Tasks) were performed:

- Task1 Male singers vs. Female singers
- Task2 Classical style vs. Jazz style
- Task3.1 and Task3.2: Classical style vs. Jazz style, male and female singers separately.

Furthermore, the same ML experiments were repeated after excluding the F0–F5 features. The aim was to assess whether specific quantitative singing features (e.g., vibrato rate or QRrelated features) would allow discriminating between the considered classes. This approach also allowed a potential reduction in model complexity and could improve their interpretability[8] . The AdaBoost and Bagging supervised ensemble classifiers were trained and validated using a k-fold cross-validation framework (k = 10), both using decision trees as weak learners. During optimization, the following hyper-parameters were tuned: number of learning cycles, minimum leaf size, maximum number of splits, and learning rate (for AdaBoost only). Model performance was evaluated in terms of classification accuracy (ACC), and the models were validated by selecting the configuration achieving the highest average ACC across the cross-validation folds. In addition, the Area Under the Receiver Operating Characteristic Curve (AUC) was computed and used as a complementary metric to further assess the discriminative capability of the ML models. Moreover, predictor importance estimates were computed for each model after the validation step in order to evaluate how the features computed by BioVoice contributed to class discrimination.

RESULTS

Table 1 shows the descriptive statistics (mean (standard deviation - std)) of the acoustic features computed with BioVoice for classical and jazz singers, for males and females separately. Significant differences between styles emerged mainly for pitch, vibrato extent, vibrato jitter, vibrato shimmer, quality ratio, and duration, while vibrato rate was relatively stable across groups. Classical female singers exhibited statistically significant higher pitch values, greater vibrato extent, and longer note duration as compared to jazz singers. In contrast, jazz singers showed higher vibrato jitter, vibrato shimmer, and quality ratio values, indicating greater signal variability and singer's formant differences.

Table 1 – Classical vs Jazz. Statistically significant differences between singing style for each gender are highlighted in bold. Mean and (std).

	Male Classical	Male Jazz	Female Classical	Female Jazz
Pitch [Hz]	284 (54)	212 (28)	**602 (119)**	**340 (119)**
VRate-mean [Hz]	6.00 (0.90)	6.10 (0.60)	5.80 (0.80)	6.20 (0.70)
Vext-mean [cents]	82 (35)	67 (20)	**145 (52)**	**59 (17)**
jVrate [%]	**7.00 (3.30)**	**16.00 (7.30)**	**7.50 (2.90)**	**12.70 (3.70)**
sVext[%]	**24.00 (8.10)**	**56.00 (24.30)**	**21.10 (10.40)**	**41.50 (10.10)**
QR	**0.60 (0.95)**	**1.60 (0.67)**	1.50 (0.50)	1.60 (0.80)
V-Duration [s]	**2.34 (0.77)**	**1.09 (0.32)**	**2.60 (0.70)**	**1.20 (0.70)**

Table 2 reports the results of the machine learning classification experiments in terms of average Accuracy (ACC) and Area Under the Curve (AUC). Task1 (male vs. female) achieved the highest performance (ACC = 95%, AUC = 99%) using AdaBoost, confirming a strong discrimination between genders. Task 2 (modern vs. classical style) reached an accuracy of 80% (AUC = 85%), while style discrimination within each gender (Tasks 3.1 and 3.2) showed good performance, particularly for females (ACC = 88%, AUC = 94%). When the F0–F5 features were excluded, a slight decrease in performance was observed in most tasks (notably Task1), although classification accuracy remained satisfactory overall. Interestingly, Task3.2 (female jazz vs. female classical) showed a further improvement in accuracy (ACC = 92%), suggesting that style-related quantitative features alone may be sufficient to separate female singing styles.

Table 2 – Results of ML classification for all the proposed Tasks (average Accuracy=ACC, and AUC)

Task	**Subjects**	**Model**	**ACC**	**AUC**
Task1 – Male vs. Female	42	AdaBoost	95%	99%
Task2 – Jazz vs. Classical	42	Bag	80%	85%
Task 3.1 – Male Jazz vs. Male Classical	16	Bag	81%	78%
Task 3.2 – Female Jazz vs. Female Classical	26	Bag	88%	94%
F0-F5 excluded				
TASK1 – Male vs. Female	42	AdaBoost	86%	91%
TASK2 – Jazz vs. Classical	42	Bag	78%	87%
TASK 3.1 – Male Jazz vs. Male Classical	16	Bag	75%	78%
TASK 3.2 – Female Jazz vs. Female Classical	26	Bag	92%	89%

Figure 1(a) and 1(b) illustrate the predictor importance estimates for Task 2 with and without the F0–F5 features respectively, highlighting the relative contribution of the acoustic parameters to style discrimination.

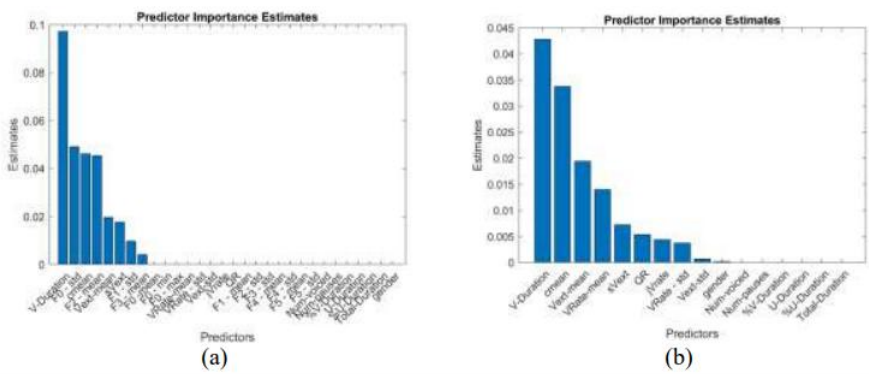

Figure 1. Predictor importance estimates for (a) Task2 Jazz vs Classical and (b) Task2 without using F0-F5 features

DISCUSSION

The aim of the present work was to investigate whether a multidimensional set of quantitative acoustical parameters could reliably characterize stylistic (operatic vs. jazz) and physiological (male vs. female) differences in professional singers, and whether statistical and machine learning approaches could identify interpretable discriminative patterns. The statistical analysis shows systematic stylistic differences, particularly in vibrato extent, perturbation measures (jitter and shimmer), quality ratio, and voiced duration, confirming that operatic and jazz singers adopt distinct phonatory and resonance strategies. At the same time, vibrato rate remained relatively stable across groups. These findings are consistent with earlier work showing the relevance of vibrato and spectral measures in the assessment of singing voice quality[1].

The ML analysis further confirmed the discriminative power of the selected features. High classification performance, especially for gender discrimination (Task 1) and for female style discrimination (Task 3.2), indicates that the extracted acoustical parameters encode meaningful stylistic and physiological information. Note that, even after excluding F0–F5 features, classification performance remained satisfactory, suggesting that vibrato-related descriptors alone provide substantial information for style recognition.

Predictor importance highlighted that the most relevant parameter to discriminate between jazz and operatic singing styles, regardless of gender, was the duration of the voiced acoustic segment (Fig. 1a). Indeed, the latter determines a significant increase in both duration and F0 variability, therefore explaining the importance of F0std as well[9] . When removing F0 and formants related features, the most relevant metric was given by Cmean (Fig. 1b), a somewhat normalizing parameter between genders and styles. On the other hand, vibrato pattern differences, defined here by its extent, rate and shimmer, have been consistently associated with music genres, highlighting that jazz singers usually show a more multiphasic, complex behaviour and greater extent and rate[2].

These findings on vibrato characteristics give an objective insight into micro-acoustic behaviours of singing voice analysis, as compared to the VRP approach that describes overall vocal features and capacity[3,6].Therefore, their combination could provide a comprehensive and multidimensional evaluation of the singing voice, integrating global performance with fine-grained control and stylistic specificity.

In future, adding features related to the emotional dimension[10] could further enhance its explanatory power. Singing is intrinsically driven by expressive intent, and emotional states systematically influence respiratory patterns, phonation stability, vibrato modulation, and temporal organization. Incorporating emotion-related markers into ML models, together with perceptual and acoustic evaluations, would likely enable a more comprehensive characterization of the singing voice.

Some limitations should be pointed out. The sample size, was relatively small especially for male jazz singers, and the analysis focused on a single musical excerpt. Future studies could expand the repertoire, include longitudinal data, and combine VRP acquisition with excerptbased acoustic analysis to further validate the complementary nature of these approaches. The use of ensemble ML models provided high classification performance, but further work is needed to explore model generalizability across larger and more heterogeneous singer populations.

CONCLUSION AND RECOMMENDATIONS

This study shows that quantitative acoustical analysis, using statistical and machine learning techniques, can reliably distinguish between two singing styles in professional singers. Vibrato parameters, spectral features and temporal measures emerged as meaningful indicators of stylistic and training-related differences.

As vibrato develops with vocal training, its objective assessment may provide valuable information about performance quality and stylistic control. These techniques could add a fine-grained information on how vocal capacity is used in actual performance contexts. Quantitative acoustical analysis may therefore support pedagogical practice with objective parameters. Such tools could assist the perceptual judgment of both the teacher and the singing student. Future work should consider integrating audio and video analysis to include expressive facial features and further enhance the multidimensional evaluation of the singing voice.

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INVESTIGATION OF THE PREVALENCE OF DYSPHAGIA AND LARYNGOPHARYNGEAL REFLUX IN PATIENTS WITH RHEUMATOID ARTHRITIS: ITS RELATIONSHIP WITH SEROLOGICAL MARKERS, IMPACT ON QUALITY OF LIFE AND ENDOSCOPIC SWALLOWING EVALUATION RESULTS

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ABSTRACT

Background

Rheumatoid arthritis (RA) is a chronic systemic inflammatory disease that may affect the oropharyngeal and laryngeal structures, potentially leading to dysphagia and laryngopharyngeal reflux (LPR). However, the prevalence of these conditions and their association with diseaserelated parameters remain unclear.

Objective

To determine the prevalence of dysphagia and LPR in patients with RA, to evaluate their impact on swallowing-related quality of life, to investigate their relationship with serological markers and disease activity, and to present fiberoptic endoscopic evaluation of swallowing (FEES) findings.

Methods

This prospective study enrolled patients with rheumatoid arthritis who were followed at a tertiary referral rheumatology outpatient clinic. Demographic data, serological findings, laboratory parameters, treatments, and disease activity scores (DAS28-CRP) were recorded. Swallowing-related quality of life and symptom severity were assessed using the Swallowing Quality of Life questionnaire (SWAL-QOL), Eating Assessment Tool-10 (EAT-10), and Reflux Symptom Index (RSI). All patients underwent fiberoptic endoscopic examination, and FEES findings were evaluated using the Penetration-Aspiration Scale and Reflux Finding Score (RFS).

Results

Sixty-one patients (mean age: 59 ± 13 years; mean disease duration: 10 ± 9 years) were included. Seropositivity, xerostomia, and temporomandibular joint (TMJ) tenderness rates were 67.2%, 68.9%, and 32.8%, respectively. No significant association was found between disease activity or serological markers and dysphagia or reflux parameters ($p > 0.05$). However, patients with xerostomia and TMJ tenderness had significantly worse SWAL-QOL, EAT-10, and RSI scores. Post-swallow residue was significantly higher in patients with TMJ tenderness ($p = 0.014$).

Conclusion

Dysphagia and LPR in RA appear to be independent of disease activity and serological markers but are associated with xerostomia and TMJ tenderness, suggesting a potential role of local factors in swallowing dysfunction.

Keywords: *Rheumatoid Arthritis; Deglutition Disorders; Laryngopharyngeal Reflux; Temporomandibular Joint; Xerostomia*

INTRODUCTION

Rheumatoid arthritis (RA) is a chronic systemic autoimmune inflammatory disease primarily affecting synovial joints[1]. Although articular manifestations such as symmetrical polyarthritis and morning stiffness represent its hallmark features, RA may also involve multiple extraarticular organs and systems. Extra-articular manifestations are reported in approximately 17.8– 40.9% of patients and may affect the lungs, heart, skin, eyes, and the head and neck region[2].

In the head and neck region, RA may involve the atlanto-axial joint, temporomandibular joint (TMJ), and laryngeal structures. TMJ involvement may cause pain, restricted mandibular movement, and impaired mastication[3]. Laryngeal involvement, most commonly in the form of cricoarytenoid arthritis, may present with hoarseness, globus sensation, dyspnea, or dysphagia and has been reported in up to 25–35% of patients[4]. In addition, secondary Sjögren syndrome and associated xerostomia frequently observed in RA may further compromise swallowing function[5].

Dysphagia, defined as difficulty in the passage of solids or liquids from the oral cavity to the stomach, may occur at the oropharyngeal or esophageal level. In RA, dysphagia is considered multifactorial, potentially resulting from TMJ dysfunction, cricoarytenoid joint involvement, xerostomia, cervical spine abnormalities, or medication-related esophageal irritation[5]. Despite the presence of swallowing complaints in RA, objective endoscopic assessment has not been routinely incorporated into clinical evaluation.

Laryngopharyngeal reflux (LPR), characterized by retrograde flow of gastric contents into the larynx and pharynx, may also contribute to upper aerodigestive symptoms such as hoarseness, chronic throat clearing, globus sensation, chronic cough, and dysphagia[6]. Structured symptombased and endoscopic instruments enable standardized evaluation of laryngopharyngeal reflux, yet their use in the context of rheumatoid arthritis has been limited.

Rheumatoid factor (RF) and anti-cyclic citrullinated peptide (anti-CCP) antibodies are widely used serological markers in the diagnosis and clinical evaluation of rheumatoid arthritis. Disease activity is commonly evaluated using the Disease Activity Score-28 with C-reactive protein (DAS28-CRP)[7]. Whether dysphagia and LPR are associated with serological status or disease activity in RA remains unclear.

Therefore, the present study aimed to determine the prevalence of dysphagia and LPR in patients with RA, to evaluate their impact on swallowing-related quality of life, to investigate their association with serological markers and disease activity, and to present findings from fiberoptic endoscopic evaluation of swallowing (FEES).

METHODS

Study Design and Ethical Approval

This prospective study was conducted at a tertiary referral center as a collaborative investigation between the departments of rheumatology and otolaryngology. Written informed consent was obtained from all participants prior to enrollment.

Participants

The study included consecutive patients diagnosed with rheumatoid arthritis (RA) who were followed at the Rheumatology Outpatient Clinic. Patients with a history of head and neck or esophageal surgery, prior chemotherapy or radiotherapy for malignancy, previous stroke, inability to cooperate, or inflammatory rheumatic diseases other than RA were excluded.

Clinical and Laboratory Assessment

Demographic characteristics, serological markers, laboratory findings, current treatment regimens, and disease duration were recorded. Disease activity was assessed using the Disease Activity Score-28 with C-reactive protein (DAS28-CRP), calculated based on tender joint count, swollen joint count, patient global assessment, and CRP levels. Serological status was determined based on rheumatoid factor (RF) and anti-cyclic citrullinated peptide (anti-CCP) antibody positivity.

Swallowing and Reflux Assessment

All participants completed validated self-report questionnaires including:

- Swallowing Quality of Life questionnaire (SWAL-QOL)
- Eating Assessment Tool-10 (EAT-10)
- Reflux Symptom Index (RSI)

Otolaryngologic examination was performed using flexible fiberoptic endoscopy. Laryngeal involvement related to RA (e.g., cricoarytenoid fixation, subluxation, or nodules) was documented. Endoscopic reflux findings were evaluated using the Reflux Finding Score (RFS).

All patients underwent Fiberoptic Endoscopic Evaluation of Swallowing (FEES). Swallowing function was assessed using liquid, semi-solid, and solid consistencies. Penetration-Aspiration Scale (PAS) scores were recorded separately for each consistency.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics for Windows, Version 23.0 (IBM Corp., Armonk, NY, USA). Normality of distribution was assessed using the Shapiro– Wilk test. Categorical variables were compared using the chi-square test. For continuous variables, independent samples t-test was used for normally distributed data and Mann– Whitney U test for non-normally distributed data. Associations between continuous variables were analyzed using Spearman correlation analysis. Logistic regression analysis was performed where appropriate.

Continuous variables were expressed as mean ± standard deviation or median (minimum– maximum), and categorical variables were presented as frequency (percentage). A p-value < 0.05 was considered statistically significant.

RESULTS

A total of 61 patients with rheumatoid arthritis (RA) were included in the study. Demographic and clinical characteristics are presented in Table 1. The mean age was 59 ± 13 years, and the mean disease duration was 10 ± 9 years. The mean DAS28-CRP score was 2.61 ± 0.71. Mean SWAL-QOL, EAT-10, RSI, and RFS scores were 83 ± 10, 2 ± 4, 9 ± 8, and 9 ± 3, respectively.

Xerostomia was reported in 68.9% of patients and temporomandibular joint (TMJ) tenderness in 32.8%. On fiberoptic endoscopic evaluation of swallowing (FEES), no penetration or aspiration was observed (PAS score = 1 in all patients). Post-swallow residue was detected in 52.5% of patients.

Associations between clinical parameters and swallowing- and reflux-related outcomes are summarized in Table 2. Among all evaluated variables, statistically significant associations were observed only for xerostomia and TMJ tenderness. Patients with xerostomia demonstrated significantly lower SWAL-QOL scores and higher EAT-10 and RSI scores ($p = 0.005$, $p = 0.005$, and $p < 0.001$, respectively). Similarly, TMJ tenderness was associated with lower SWAL-QOL and higher EAT-10 and RSI scores ($p = 0.046$, $p = 0.003$, and $p = 0.021$, respectively).

Post-swallow residue was significantly more frequent in patients with TMJ tenderness ($p = 0.014$). An association between residue and Sjögren syndrome was also observed ($p = 0.030$). No significant associations were found between swallowing or reflux outcomes and sex, treatment variables, serological status, comorbidities, PPI use, or disease activity (all $p > 0.05$).

Correlation analysis revealed a weak inverse association between DAS28-CRP and RSI scores ($r = -0.271$, $p = 0.035$), whereas no significant correlations were observed between disease activity and other swallowing-related parameters.

Tables

Table 1. Demographic and Clinical Characteristics of the Participants

		n	n (%)
Sex	Male	12	19.7%
	Female	49	80.3%
Steroid therapy	No	17	27.9%
	Yes	44	72.1%
NSAID therapy	No	49	80.3%
	Yes	12	19.7%
Conventional DMARD therapy	No	1	1.6%
	Yes	60	98.4%
Biologic DMARD therapy	No	51	83.6%
	Yes	10	16.4%
Proton Pump Inhibitor therapy	No	34	55.7%
	Yes	27	44.3%
Sjögren's syndrome	No	57	93.4%
	Yes	4	6.6%
Diabetes Mellitus	No	52	85.2%
	Yes	9	14.8%
Hypertension	No	48	78.7%
	Yes	13	21.3%
Rheumatoid factor (RF)	Negative	25	41.0%
	Positive	36	59.0%
Anti-CCP antibody	Negative	25	41.0%
	Positive	36	59.0%
Seropositivity	Negative	20	32.8%
	Positive	41	67.2%
Xerostomia	No	19	31.1%
	Yes	42	68.9%
Temporomandibular joint tenderness	No	41	67.2%
	Yes	20	32.8%
Penetration-Aspiration Scale	2-8	0	0.0%
	1	61	100.0%
Pharyngeal residue	No	29	47.5%
	Yes	32	52.5%

Table 2. Association between Clinical Variables and Swallowing and Reflux Outcomes

Variable	SWAL-QOL (p)	EAT-10 (p)	RSI (p)	RFS (p)	Post-swallow Residue (p)
Sex	0.084	0.074	0.081	0.373	>0.05
Steroid therapy	0.174	0.807	0.545	0.329	>0.05
Conventional DMARD	0.887	0.905	0.181	0.206	>0.05
Biological DMARD	0.424	0.358	0.625	0.851	>0.05
PPI use	0.217	0.386	0.710	0.866	>0.05
Sjögren syndrome	0.129	0.123	0.261	0.871	**0.030***
Seropositivity	0.437	0.687	0.455	0.895	>0.05
Xerostomia	**0.005***	**0.005***	**<0.001***	0.098	>0.05
TMJ tenderness	**0.046***	**0.003***	**0.021***	0.250	**0.014***

* Statistically significant at $p < 0.05$

DISCUSSION

Rheumatoid arthritis (RA) is a chronic systemic autoimmune disease in which extra-articular manifestations frequently involve the head and neck region. Temporomandibular joint (TMJ) involvement, laryngeal pathology, and salivary gland dysfunction are well-documented features of RA and may substantially affect swallowing function. Although previous studies have reported an increased prevalence of dysphagia in RA compared to the general population, the mechanisms underlying swallowing impairment and its relationship with disease activity remain incompletely understood8 .

In the present study, swallowing-related quality of life, dysphagia severity, reflux symptoms, and objective endoscopic findings were evaluated in patients with RA. The most important finding is that dysphagia- and reflux-related symptoms were significantly associated with xerostomia and TMJ tenderness, whereas systemic disease activity (DAS28-CRP), serological status (RF and anti-CCP), and most treatment variables were not.

Temporomandibular joint (TMJ) involvement represents a frequent extra-articular manifestation of rheumatoid arthritis and may significantly affect mastication and oral function. TMJ inflammation may result in pain, crepitation, restricted mandibular movement, and impaired mastication9 . Effective bolus preparation depends on coordinated mandibular mobility and adequate chewing efficiency. In our cohort, TMJ tenderness was significantly associated with lower SWAL-QOL scores, higher EAT-10 scores, increased RSI values, and a higher frequency of post-swallow residue on FEES. These findings support the hypothesis that mechanical factors related to mastication and oral-phase dysfunction play a central role in swallowing impairment in RA.

The presence of post-swallow residue in more than half of the patients further strengthens this interpretation. Residue formation, particularly in the absence of penetration or aspiration, may reflect inefficient bolus formation and propulsion rather than severe pharyngeal dyscoordination. Notably, no penetration or aspiration events were observed in this study. This finding is consistent with previous reports demonstrating that RA patients may report dysphagia symptoms despite normal instrumental swallowing assessments10. The discrepancy between subjective symptom burden and objective aspiration risk suggests that swallowing impairment in RA may often be subtle, quality-of-life–driven and primarily related to oral and mechanical factors.

Xerostomia was strongly associated with symptom severity. Because saliva is crucial for bolus formation and lubrication, impaired salivary function may contribute to inefficient swallowing and heightened symptom perception. In our study, xerostomia was significantly associated with worse SWAL-QOL and EAT-10 scores, as well as higher RSI scores. These results underscore the impact of oral dryness on eating comfort and swallowing perception in patients with RA. Interestingly, xerostomia was strongly linked to subjective symptom scales but not to objective penetration–aspiration findings, highlighting the importance of patient-reported outcome measures in clinical assessment.

In contrast to these local factors, systemic disease parameters showed limited association with swallowing dysfunction. Seropositivity, which is often linked to more aggressive disease and higher rates of extra-articular manifestations[8], was not associated with dysphagia- or refluxrelated measures in our cohort. Similarly, DAS28-CRP scores were not positively correlated with SWAL-QOL, EAT-10, or RFS. A weak inverse correlation between DAS28-CRP and RSI scores was observed, suggesting that reflux symptoms may not directly parallel systemic disease activity. However, DAS28-CRP primarily reflects peripheral joint activity and systemic inflammatory markers and does not incorporate TMJ involvement, cricoarytenoid arthritis, or salivary gland dysfunction—structures directly relevant to swallowing physiology. Therefore, patients may experience clinically meaningful head and neck involvement despite low or moderate systemic disease activity scores.

No significant associations were found between treatment type (steroids, conventional DMARDs, biological DMARDs, or PPI use) and swallowing-related scores, suggesting that swallowing dysfunction may not be solely influenced by systemic anti-inflammatory therapy. While immunosuppressive therapies effectively reduce synovial inflammation, their impact on local mechanical factors such as TMJ structural changes or chronic salivary dysfunction may be limited.

Objective laryngoscopic findings, as assessed by the Reflux Finding Score (RFS), did not differ significantly across demographic, serological, or treatment-related variables. In our cohort, laryngoscopic reflux signs appeared to occur independently of systemic disease characteristics. Moreover, endoscopic findings may not always directly parallel symptom severity or reflect real-time reflux activity. Therefore, the absence of a clear relationship between RFS and systemic disease parameters in our study is not unexpected.

Overall, our findings suggest that swallowing impairment in RA is predominantly driven by localized structural and functional factors—particularly TMJ dysfunction and xerostomia— rather than by systemic inflammatory burden. This perspective challenges the assumption that dysphagia in RA necessarily parallels global disease activity and underscores the need for targeted head and neck evaluation.

Limitations

Several limitations should be acknowledged. First, the study was conducted in a single tertiary center with a relatively modest sample size, which may limit generalizability. Second, the crosssectional design precludes causal inference between RA-related factors and swallowing dysfunction. Third, although FEES was used as an objective method, complementary techniques such as videofluoroscopic swallowing studies could have provided additional physiological detail. Fourth, subgroup analyses—particularly in patients with Sjögren syndrome—were limited by small numbers. Finally, detailed analysis of cumulative medication exposure and dosage effects was beyond the scope of this study and may have influenced symptom profiles.

Despite these limitations, the prospective design and combined use of validated symptom scales and objective endoscopic assessment strengthen the reliability of our findings.

CONCLUSION AND RECOMMENDATIONS

In patients with rheumatoid arthritis, dysphagia and laryngopharyngeal reflux symptoms appear to be largely independent of systemic disease activity and serological status. Xerostomia and temporomandibular joint tenderness emerged as the principal factors associated with impaired swallowing-related quality of life and increased symptom burden. Although no penetration or aspiration was observed, post-swallow residue was common and significantly linked to TMJ tenderness, suggesting subtle but clinically relevant mechanical alterations in swallowing.

These findings highlight the importance of comprehensive head and neck evaluation in RA patients presenting with swallowing complaints, regardless of systemic disease activity level. Future larger-scale and longitudinal studies are warranted to further elucidate the mechanisms underlying swallowing dysfunction in RA and to determine whether targeted management of TMJ dysfunction and xerostomia can improve functional outcomes.

From a clinical perspective, our findings emphasize that swallowing complaints in RA should not be attributed solely to systemic disease activity. Even patients with low DAS28-CRP scores may experience clinically meaningful dysphagia related to TMJ involvement or xerostomia. Routine assessment of jaw pain, chewing difficulty, and oral dryness may help identify individuals at risk of swallowing impairment. Early referral for otolaryngologic evaluation and instrumental assessment, when indicated, may improve symptom recognition and management. A multidisciplinary approach integrating rheumatology and head–neck expertise appears essential for comprehensive RA care.

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VIBRATOSCOPE: AN OPEN-SOURCE PYTHON TOOLKIT FOR VIBRATO ANALYSIS IN THE SINGING VOICE

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ABSTRACT

Introduction

Vocal vibrato is a key expressive feature in singing, characterized by periodic modulations of fundamental frequency (fo). Accurate quantification of its rate, extent, and regularity is essential for pedagogical, clinical, and stylistic research. However, existing tools often face limitations regarding platform dependency, proprietary licensing, or lack of automation for large-scale datasets. This paper introduces VibratoScope, an open-source, extensible Python-based toolkit designed to address these needs through both interactive and automated workflows.

Methods

VibratoScope integrates a graphical user interface (GUI) for manual inspection and a batchprocessing mode for large datasets. The software supports multiple fo extraction algorithms (Praat, YIN, HPS, and REAPER) and employs a modular pipeline: (1) fo extraction and outlier filtering; (2) vibrato isolation via a 3–9 Hz band-pass filter; (3) cycle segmentation using peak/trough detection; and (4) computation of metrics including rate, extent, jitter indices (Local, RAP, PPQ5, DDP), coefficient of variation (CoV), and Sample Entropy (SampEn). Results are exported as structured CSV files and diagnostic PNG reports.

Results

The toolkit was validated using synthetic stimuli and real operatic recordings. In synthetic vowels, vibrato rate errors remained within ±0.03 Hz. For real singing excerpts across eight vocal classifications (Soprano to Bass), fo tracking was robust with no octave errors. Vibrato rate estimates showed high agreement with semi-automated reference standards ($p > 0.05$). While a systematic overestimation of extent was noted in lower voice types (15–20 cents), the results remained consistent across all extraction methods, demonstrating the tool's reliability for comparative analysis.

Conclusions

VibratoScope provides a transparent, reproducible, and scalable framework for vibrato analysis. By combining traditional pitch metrics with dynamical measures like Sample Entropy, it offers a comprehensive tool for voice scientists and teachers. The software is freely available under the MIT license, encouraging community-driven development and integration into diverse research pipelines.

KEYWORDS *Vibrato; Singing; Signal Processing, Computer-Assisted; Acoustics*

INTRODUCTION

Vocal vibrato is typically described as a periodic modulation of fundamental frequency that contributes to expressive intent and is often discussed in relation to vocal quality and musical style[1], [2] Beyond its perceptual and aesthetic relevance, vibrato is also a measurable acoustic phenomenon that can be quantified through parameters such as rate (modulation frequency, in Hz) and extent (modulation magnitude, typically expressed in cents or semitones). Although these parameters are widely used in research and pedagogy, their accurate estimation depends on robust analysis tools and transparent workflows. A recurring methodological concern in vibrato research is the need to quantify not only mean rate and mean extent, but also how consistently these characteristics are maintained over time. One approach has been to examine local maxima and minima across successive cycles to derive instantaneous values, then summarize central tendency and variability.[3]

More recently, vibrato regularity has also been examined using measures that capture signal predictability and structure, such as sample entropy, in addition to conventional descriptors of dispersion.[4] In practice, however, researchers and clinicians often face a trade-off between detailed analysis and feasible workflow: manual procedures can be time-consuming, while automated tools may be limited by licensing, platform constraints, or insufficient batch-processing support. Another key issue is the dependence of vibrato metrics on the quality of the underlying fo contour. Pitch-extraction algorithms vary in performance depending on signal characteristics such as harmonic structure, background interference, and the magnitude of modulation. In this context, careful validation of pitch tracking and downstream vibrato extraction is essential for credible inference[5]
VibratoScope was developed to provide an open-source, cross-platform toolkit for highresolution vibrato analysis that supports both interactive inspection and automated processing. The software is implemented in Python and distributed under the MIT license. It integrates multiple pitch-extraction options (including Praat autocorrelation, YIN, and REAPER), computes standard vibrato metrics (rate and extent) together with variability descriptors (CoV, jitter indices computed on vibrato cycle durations) and sample entropy, and exports results in structured formats suitable for statistical workflows and reproducible pipelines. In addition to describing the toolkit, this paper reports validation using synthetic vibrato stimuli with known ground truth and real singing excerpts benchmarked against a semi-automated reference method.

METHODS

Software Design And Workflows VibratoScope is organized as a modular application with two complementary modes: (i) a GUI workflow for visual inspection and manual region-of-interest (ROI) selection, and (ii) a batch workflow for automated processing of multiple audio files under consistent parameter settings. In GUI mode, the user loads an uncompressed PCM .wav file, inspects the spectrogram display, and selects one or more ROIs for analysis. The software then computes the fo contour, isolates the vibrato-related modulation band, segments vibrato cycles via peak and trough detection, and outputs summary metrics alongside diagnostic visualizations. In batch mode, users select a directory of .wav files and process each file in its entirety without manual ROI selection, producing cycle-level CSV outputs, summary CSV files (region/file level), and diagnostic PNG plots.

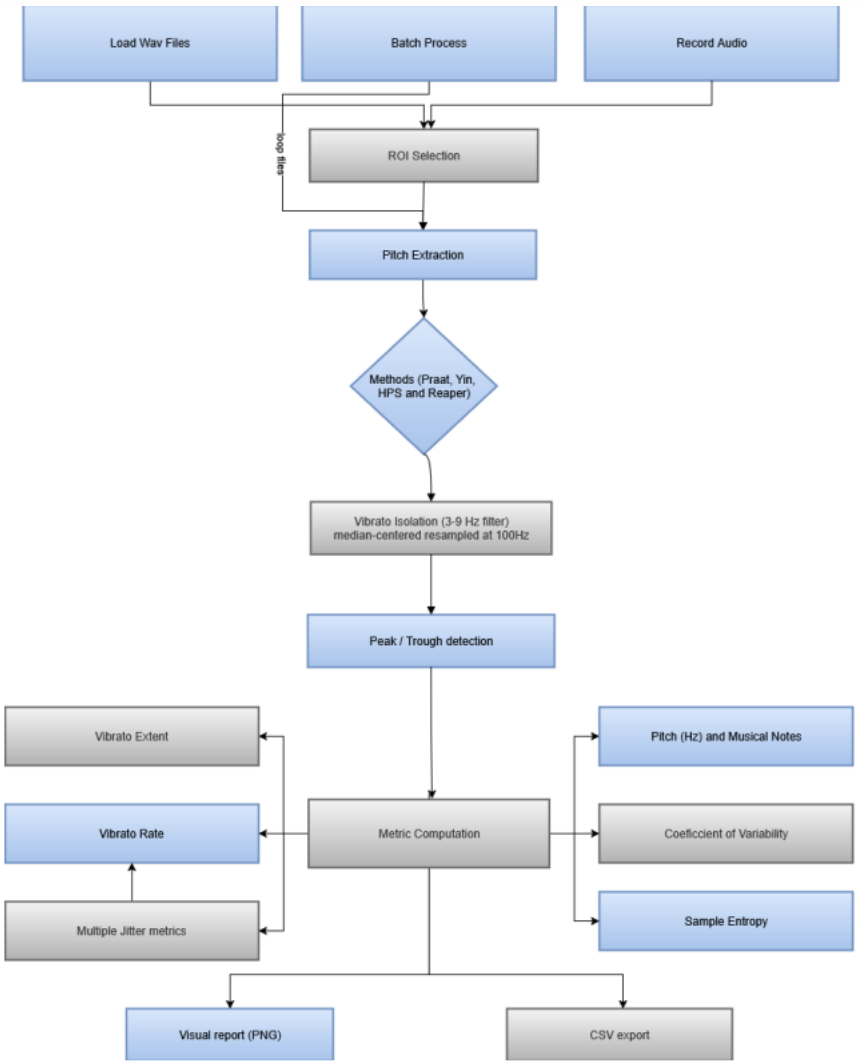

Figure 1. Processing pipeline of VibratoScope. Audio is loaded and (in GUI mode) ROIs are selected. Pitch extraction is performed using a user-selected method, vibrato-related modulation is isolated via band-pass filtering, peaks and troughs are detected to segment cycles, and metrics are computed. Outputs include CSV summaries and PNG diagnostic reports.

Analysis Pipeline

The analysis begins by extracting an fo contour using one of the supported methods. Praat extraction is implemented via Parselmouth using an autocorrelation approach,[6] YIN is implemented via librosa.pyin,[7] and REAPER is integrated as an external command-line pitch estimator.[8] Pitch outliers are filtered using a median-plus-MAD criterion with a threshold of 3 × MAD. The resulting pitch contour is converted to a cents scale relative to its median value, resampled at 100 Hz, and filtered using a zero-phase 4th-order Butterworth band-pass filter with a 3–9 Hz passband to isolate vibrato-related modulation. Peak and trough detection is then applied to the filtered contour, using a prominence threshold of 5 cents and a minimum spacing of 5 resampled points (approximately 50 ms) to define cycle boundaries.

Vibrato cycles are represented through successive extrema defining half-cycles. The instantaneous vibrato rate is computed as the reciprocal of twice the half-cycle duration, and the instantaneous half-extent is computed as half the peak-to-trough swing expressed in cents. Summary statistics are calculated as averages of instantaneous values (e.g., global mean rate and global mean extent). Additional variability descriptors include coefficient of variation (CoV = 100 × SD/mean) computed for both rate and extent.

Sample entropy is computed separately for the sequences of instantaneous vibrato rate and instantaneous vibrato extent, using embedding dimension m = 2 and tolerance r = 0.2 × σ, where σ is the standard deviation of the analyzed sequence. VibratoScope also computes jitter indices (Local, RAP, PPQ5, DDP) on vibrato cycle durations rather than glottal cycles. Outputs include: (i) a detailed cycle-level CSV file containing timestamps, instantaneous rate, half-extent, and cycle duration; (ii) summary CSV files reporting means, standard deviations, CoV, jitter indices, and SampEn; and (iii) a diagnostic multi-panel PNG report to support visual inspection and documentation.

Validation Design

Two validation datasets were used.

1. Synthetic Vibrato Stimuli

Sustained vowels /a/, /i/, and /u/ were synthesized using MADDE (Tolvan Data). Each vowel was rendered at three nominal pitches (C3, C4, C5), with fixed duration (5 seconds), 44.1 kHz sampling rate, and 16-bit resolution. Ground-truth vibrato parameters were generated by modulating the glottal source frequency using three vibrato rates (5, 6, 7 Hz) and three half-extents (0.3, 0.5, 0.8 semitones; equivalent to 30, 50, 80 cents), yielding 27 stimuli per vowel. No additional reverberation or filtering was applied.

2. Real Singing Material

A dataset of commercial recordings of the aria "Ombra mai fu" from Handel's Xerxes was analyzed. Vocal tracks were isolated using the Music.ai voice separation workflow, and vibrato-rich excerpts were selected for analysis. The same excerpts were analyzed using a semi-automated procedure based on published protocols, providing reference values for vibrato rate and extent.[9], [10] These reference annotations were compared with VibratoScope outputs obtained from manually defined ROIs and fully automated extraction.

Statistical Analysis

For synthetic stimuli, Wilcoxon signed-rank tests were used to compare extraction errors against zero. For real singing material, Wilcoxon signed-rank tests compared automatic estimates against semi-automated reference values, with effect sizes reported as r.

Method	Rate		Extent	
	p-value	Effect Size (r)	p-value	Effect Size (r)
Praat	*0.034**	0.41	*0.019**	0.45
Yin	*0.017**	0.46	*0.017**	0.46
HPS	*0.017**	0.46	*0.017**	0.46
REAPER	*0.017**	0.46	*0.017**	0.46

Table 1. Wilcoxon signed-rank test results for synthetic stimuli (error vs. zero) and real singing excerpts (automatic vs. reference).

RESULTS

Synthetic Stimuli

Across synthetic vowels and pitches, VibratoScope produced vibrato rate estimates closely aligned with nominal targets (5, 6, and 7 Hz), with typical absolute deviations below ±0.03 Hz.

Vibrato extent estimates also showed strong agreement with expected values. In the highest extent condition (80 cents), underestimation was noted (with median errors near –5 cents at C3), while other conditions showed small deviations with limited variability.

No systematic pitch-tracking errors were observed in synthetic stimuli: extracted mean fo closely matched expected values, with correct dominant-harmonic identification. In rare cases of unreliable fo tracking, the algorithm automatically selected the next most prominent harmonic to preserve accurate cycle detection.

Wilcoxon signed-rank tests indicated statistically significant deviations from zero error for rate and extent across methods ($p < 0.05$), with moderate effect sizes ($r \approx 0.41–0.46$), while the absolute magnitudes of errors remained small.

Real Singing Excerpts

In real singing excerpts spanning eight vocal classifications (Soprano, Mezzo-Soprano, Alto, Boy Soprano, Countertenor, Tenor, Baritone, Bass), vibrato rate estimates showed generally good agreement with semi-automated reference values, with errors distributed close to zero and relatively narrow interquartile ranges. A tendency toward underestimation was noted in Alto, Boy Soprano, and Bass (median errors around –0.05, –0.1, and –0.15 Hz, respectively), while Soprano showed slight overestimation with low overall error.

Consistent with these trends, statistical testing confirmed no significant differences between automatic rate estimates and reference annotations (p values reported in Table 1).

In contrast, vibrato extent estimates showed a general overestimation bias that was most pronounced in lower-pitched voices, particularly Baritone and Bass, where median extent errors exceeded 15–20 cents. Wilcoxon tests for extent comparisons yielded statistically significant differences with moderate effect sizes ($r = 0.556–0.672$, depending on method).

Despite these systematic differences in extent, no pitch-tracking failures or harmonic misassignments were observed in the real singing dataset, and octave errors were avoided.

DISCUSSION

This paper presented VibratoScope as an open-source Python toolkit intended to support reproducible vibrato analysis through both interactive (GUI-based) inspection and automated (batch) workflows. The validation strategy combined controlled synthetic stimuli with real commercial recordings benchmarked against a semi-automated reference procedure. In synthetic conditions, the observed vibrato rate deviations were small (within ±0.03 Hz), and extent deviations were similarly limited (typically within a few cents), indicating that the pipeline can recover known modulation parameters across multiple vowel and pitch conditions. In real singing excerpts, the primary finding was a strong agreement in vibrato rate across voice types and extraction methods, accompanied by a consistent, method-wide tendency to overestimate vibrato extent, especially for lower-pitched voice types. The extent bias was systematic rather than sporadic, appearing across methods and reflected in moderate effect sizes in statistical comparisons. Practically, this pattern suggests that relative comparisons (e.g., between methods, conditions, or groups) remain feasible when the same configuration and workflow are used consistently, while absolute extent values in lower voices should be interpreted with added caution.

The lack of pitch-tracking failures and the reported avoidance of octave errors across diverse voice types supports the stability of the integrated pitch-extraction and outlier-handling procedures. Because vibrato metrics depend on reliable segmentation of cycles, the combination of band-pass isolation (3–9 Hz), cycle delineation via peak/trough detection, and structured reporting (cycle-level data plus diagnostic plots) is intended to make analytical decisions more transparent and easier to audit.

From a usability perspective, VibratoScope's dual-mode design addresses common workflow needs: GUI-based ROI marking supports careful inspection and targeted analysis, while batch mode supports large-scale processing in which identical parameter settings are applied across files. The inclusion of sample entropy and cycle-based jitter indices provides additional descriptors of vibrato regularity beyond mean rate and extent, aligning with research interest in temporal consistency.

CONCLUSION AND RECOMMENDATIONS

VibratoScope is an open-source, cross-platform toolkit implemented in Python for quantitative vibrato analysis in singing recordings. It integrates multiple pitch-extraction methods, isolates vibrato-related modulation using a 3–9 Hz band-pass filter, segments vibrato cycles via peak/trough detection, and computes vibrato rate, vibrato extent, cycle-based jitter indices, coefficient of variation, and sample entropy. Outputs are exported as structured CSV files and diagnostic PNG reports to support reproducibility and downstream analysis.

Validation using synthetic vowels demonstrated close agreement with known ground-truth parameters, and analysis of real singing excerpts showed high agreement for vibrato rate against semi-automated reference values, with a consistent overestimation trend in vibrato extent for lower voice types.

For applied use, two recommendations follow directly from the findings: (1) when comparing groups or conditions, maintain the same extraction method and parameter settings across the dataset; and (2) when reporting absolute extent values in lower-pitched voices, acknowledge the observed systematic overestimation and consider interpreting extent results primarily in comparative terms within a consistent workflow. The software is distributed under the MIT license and is publicly available at: https://github.com/tiagolbc/vibratoscope.

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THE ROLE OF TEACHING VOCOLOGY IN VOCAL EDUCATION: THE EXPERIENCE OF THE SCHOOL OF ARTS OF KARABAKH UNIVERSITY

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ABSTRACT

Introduction: Vocal performers often receive intensive artistic training while having limited structured education in voice science and vocal health. This gap may contribute to inefficient technique, delayed recognition of voice problems, and preventable vocal injury—particularly in training programs that include diverse singing styles such as mugham and Western classical voice.

Goal: To describe the implementation and educational outcomes of a semester-long Vocology course delivered to second-year vocal students at the School of Arts of Karabakh University.

Methods: A Vocology course was integrated into the curriculum for one academic semester (16 weeks; 32 class sessions) and delivered to 13 second-year students (10 mugham-track, 3 classical-track). Teaching covered functional vocal anatomy and physiology, basic voice physics, acoustic characteristics of voice, mechanisms of voice production, principles of efficient voice use, foundational voice disorders and practical management strategies, and professional voice care and prevention. Baseline understanding was explored during the first session using targeted questions on laryngeal/vocal fold anatomy. Learning was evaluated throughout the semester using continuous assessment and end-of-semester performance measures (the course average score was recorded).

Results: Initial baseline knowledge was limited: in the first session, only one student provided a partially correct response regarding vocal fold anatomy, while the remaining students were unable to answer. By the end of the semester, students demonstrated competency across the planned domains, including an improved conceptual understanding of voice production and acoustics, and increased awareness of vocal hygiene, early symptoms of common voice disorders, and practical strategies for prevention and self-management. The mean course score across the semester was 81%.

Conclusion: Introducing a structured Vocology course into undergraduate vocal training was feasible and was associated with substantial gains in voice-science literacy and vocal health awareness among both mugham and classical voice students.

Keywords: *Voice; Vocology; Vocal education; Voice science; Professional voice*

INTRODUCTION

Vocal education traditionally emphasizes artistic interpretation, repertoire, style, and technical mastery, often transmitted through mentorship and studio practice. While this approach is essential for musical development, it may underrepresent explicit instruction in voice science, vocal health, and prevention of voice problems. When foundational concepts are not taught in a structured way, students may rely primarily on imitation and instinct, with limited understanding of the biomechanical and acoustic principles that underpin efficient phonation and resonance [1].

This educational gap is particularly relevant in regions where singers train simultaneously in Western classical and traditional styles. In the South Caucasus, and in Azerbaijan specifically, mugham training is widely practiced alongside classical vocal education. Mugham performance may involve extended melismatic passages, modal improvisation, emotionally intense declamation, and frequent high-tessitura singing, all of which can increase vocal load. Classical singing entails different technical goals and resonance strategies, yet it similarly demands sustained practice and performance under time pressure. Despite stylistic differences, both traditions depend on the same biological instrument and are vulnerable to maladaptive compensations when early symptoms are not recognized and when vocal load is not managed systematically.

Vocology—introduced as a term to describe the science and practice of voice habilitation— integrates anatomy, physiology, acoustics, and behavior change to support optimal and sustainable voice use[2]. In contemporary training environments, vocology concepts are increasingly operationalized through multidisciplinary teaching that connects classroom learning to real-world voice use. Large, technology-enabled interprofessional teaching events have demonstrated that students value seeing dynamic laryngeal function, learning the range of normal variation, and linking visual information to proprioceptive and auditory feedback, which can strengthen understanding of the vocal mechanism and vocal health behaviors [3-5].

Although vocology content is increasingly present in many European and North American music and performing arts programs, it has not been widely embedded in undergraduate vocal curricula in Azerbaijan and several other post-Soviet settings. To address this need, the School of Arts of Karabakh University introduced a semester-long Vocology course for second-year vocal students. The present manuscript describes the course structure, baseline observations, and end-of-semester outcomes in a mixed cohort of mugham-track and Western classicaltrack students. From a pedagogical perspective, early exposure to voice-science concepts may improve students' ability to interpret technical instructions (e.g., breath management, resonance strategies, registration) in relation to measurable physiological and acoustic mechanisms. Such literacy can support more consistent self-monitoring, improve communication between students and teachers through shared terminology, and provide a rational basis for adapting technique during periods of increased rehearsal and performance demands.

METHODS

The course design was informed by Dr. İlter Denizoğlu's Vocology course delivered to singing students in the Opera Department (Major Art Branch) of the Dokuz Eylül University State Conservatory, which served as a practical reference framework for defining the curriculum structure and learning objectives.

Setting And Participants

The Vocology course was implemented at the School of Arts of Karabakh University and delivered to second-year students enrolled in vocal education. The cohort included 13 students: 10 students in the mugham track and 3 students in the Western classical vocal track. The course was conducted over one academic semester (16 weeks) and consisted of 32 class sessions.

Course Content And Delivery

The curriculum was organized to provide a structured introduction to core vocology concepts with direct relevance to singing practice. Content domains included: (1) functional vocal anatomy and physiology; (2) basic physics relevant to voice; (3) acoustic characteristics of voice; (4) mechanisms of voice production; (5) principles of efficient and sustainable voice use; (6) foundational voice disorders and practical prevention/self-management strategies; and (7) professional voice care and vocal-load management.

Instruction progressed from basic structure–function relationships to application. Early sessions focused on anatomical orientation, vocal fold vibration, and respiratory–phonatory coordination. Mid-semester sessions emphasized acoustic source–filter concepts (harmonics, formants) and their relationship to perceived voice quality and stylistic goals. Later sessions addressed common voice problems in singers (e.g., fatigue, strain, hoarseness), preventive routines, and decision points for seeking professional assessment. Teaching methods included short lectures, guided discussion, applied demonstrations, and group activities aimed at transferring theoretical concepts into everyday practice habits.

Baseline Knowledge Assessment
Baseline understanding was explored during the first session using targeted questions on laryngeal and vocal fold anatomy and basic concepts related to voice production. Responses were summarized descriptively to characterize prior exposure to voice-science terminology and concepts.

Learning Assessment
Learning was evaluated throughout the semester using continuous assessment and a midterm quiz. End-of-semester achievement was summarized using the overall course average score. In addition, an applied group task (television-style health messaging project) was used to evaluate students' ability to translate vocology principles into clear, performance-relevant communication. The applied task required students to present short scenarios and explanations using correct terminology and prevention-oriented guidance suitable for peer audiences.

Clinical Screening And Applied Therapy Component
As part of the course, all students underwent laryngostroboscopic examination for educational screening purposes. Findings were discussed individually, and students with identified voice disorders received targeted counseling and practical instruction in the DoctorVox voice therapy method. Two class sessions were fully dedicated to teaching and practicing these techniques, with an emphasis on safe phonation, reduction of phonatory effort, and carryover into studio singing tasks. Only aggregated, non-identifiable findings are reported in this manuscript.

RESULTS

Baseline Knowledge
Baseline voice-science literacy was low across the cohort. In the initial assessment, 1 of 13 students correctly identified the vocal folds and described their basic function, whereas 12 of 13 students were unable to answer or provided unrelated responses. Core terms frequently used in voice science and vocal health education (resonance, subglottic pressure, and vocal hygiene) were unfamiliar to all participants.

End-Of-Semester Outcomes
By Week 16, all students demonstrated acquisition of core foundational competencies. All participants (13/13) could label key anatomical structures relevant to phonation (vocal folds, larynx, epiglottis) and describe their functional roles using appropriate terminology. Students also demonstrated understanding of basic acoustic concepts relevant to voice production, including harmonics and formants, and were able to relate these concepts to perceptual voice qualities and singing technique in classroom tasks (Figure 1).

Assessment Performance And Applied Task
All students passed the midterm quiz (13/13; 100% pass rate), with scores ranging from 60% to 90%. The mean course score across the semester was 81% (Figure 2). The applied group television-style project received positive evaluations from instructors and peers, indicating that students could convey accurate vocal health messaging and apply course concepts in performance-based scenarios.

Laryngostroboscopic Findings And Therapy-Related Outcomes
Laryngostroboscopic screening identified voice disorders in 6 of 13 students (46%). Four students presented with hypotonic dysphonia, and two students were found to have vocal fold nodules. Following sessions focused on the DoctorVox voice therapy method, all students reported improvement in vocal performance and/or vocal comfort during their routine vocal training.

Student Feedback

Qualitative feedback collected informally during and after the course described the content as practical and relevant. Several students indicated that the course should be mandatory within vocal training. Mugham-track students frequently reported improved self-monitoring, including earlier recognition of vocal discomfort and increased ability to make independent technical adjustments informed by course concepts.

DISCUSSION

The present findings support the educational value of integrating structured voice science and vocology content into undergraduate vocal training. The course outcomes align with prior work in vocology and vocal pedagogy suggesting that systematic instruction in anatomy, physiology, acoustics, and vocal health can strengthen students' self-regulation and contribute to long-term vocal sustainability [5,6]. In our cohort, the combination of foundational scientific concepts with applied tasks appeared to facilitate transfer from theoretical knowledge to performance-relevant behaviors.

The applied project component suggests that students were able to translate theoretical content into functional communication and performance-oriented skills. In particular, the televised group project simulated elements of real-life performance pressure and required students to integrate technical terminology with accessible, informal communication. This format reinforced confidence, spontaneity, and stage presence, while allowing students to practice vocal projection and endurance in semi-structured scenarios. From an educational perspective, these observations are consistent with technology-enabled and interprofessional approaches described in the literature, where students report that observing dynamic laryngeal function and receiving expert commentary strengthens the link between what they hear, feel, and understand about voice production [3].

Similarly, the group task on voice physics appeared to support comprehension of abstract acoustic principles by anchoring them in the familiar framework of students' own singing. This approach may reduce the perceived distance between "science content" and studio practice, thereby improving engagement and conceptual depth. Comparable curriculum initiatives in conservatory settings have reported increased student engagement and enhanced understanding when vocology is introduced early in training [5].

An additional and clinically relevant component of this course was the integration of laryngostroboscopic screening and targeted voice therapy instruction. The identification of hypotonic dysphonia and vocal fold nodules in a substantial subset of students underscores the practical need to embed vocal health literacy within vocal education. Importantly, the post-course improvement noted by students should be interpreted cautiously: improvement was self-reported and was not assessed using standardized symptom scales or objective acoustic/aerodynamic measures. Accordingly, these observations should be considered educationally meaningful signals rather than causal evidence of treatment efficacy. Future iterations should incorporate validated pre–post outcomes, objective voice measures where feasible, and follow-up to evaluate durability of change.

A further implication concerns clinical literacy and help-seeking behavior. Interprofessional teaching initiatives have reported that many performing arts students and graduates may not seek specialist assessment when experiencing voice problems, instead attributing symptoms solely to technique or relying on self-directed measures [3]. Embedding vocology and vocal health education early may normalize appropriate pathways of care, encourage timely consultation when symptoms arise, and promote safer decision-making regarding vocal load and recovery.

This work has limitations. It represents a pilot implementation with a small cohort and primarily educational outcomes. Baseline assessment was exploratory rather than a standardized pre-test, and post-course knowledge was not measured using a validated instrument. Broader studies across institutions and multiple semesters are needed. Additionally, further development of culturally specific content for mugham and other traditional genres may enhance relevance and improve translation of core concepts into genrespecific technical practice.

From a curricular perspective, sustainability and scalability are important considerations. A structured vocology course can be positioned as a foundational module that complements studio instruction rather than replacing it, with a focus on shared concepts—mechanism, load, recovery, and safe practice habits—that apply across styles. Where resources allow, future iterations could incorporate curated laryngeal imagery or short video segments to illustrate normal laryngeal function across tasks and reinforce learning through visual anchors, consistent with the rationale of technology-enabled teaching models that build reusable learning repositories 3. Finally, future work could add low-burden tracking tools (e.g., weekly self-rated vocal effort, fatigue, and recovery) and, where feasible, objective measures to test whether increased vocology literacy translates into improved vocal function and reduced symptom burden during intensive training periods.

CONCLUSION

Introducing a structured Vocology course into undergraduate vocal training at Karabakh University was feasible and was associated with measurable gains in voice-science literacy and vocal health awareness among both mugham and Western classical voice students. Based on this experience, we recommend that vocal curricula in similar settings include a dedicated vocology component early in training; incorporate applied tasks that require translation of scientific concepts into performance-relevant behaviors; and, where feasible, build collaborations with clinical voice specialists to strengthen anatomical/physiological accuracy and to reinforce appropriate help-seeking pathways.

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Figure 1. Illustration of educational outcomes following the Vocology course.

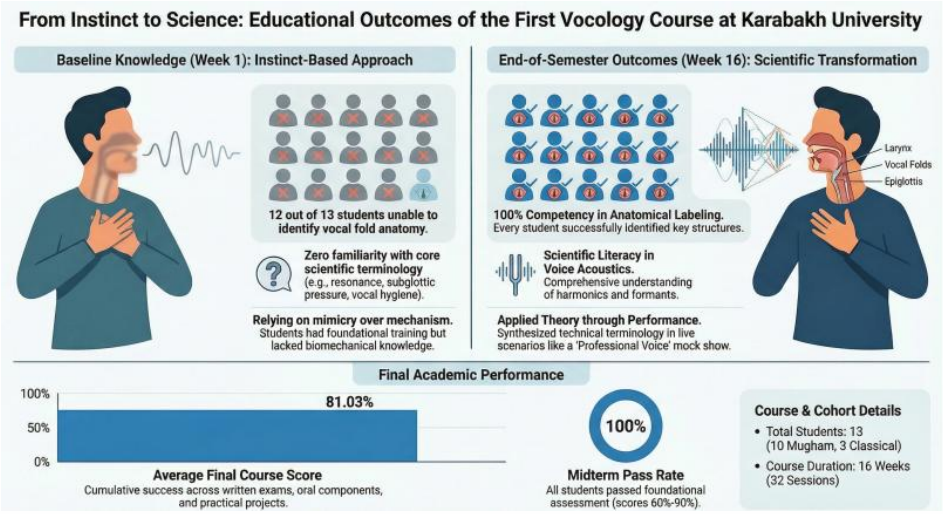
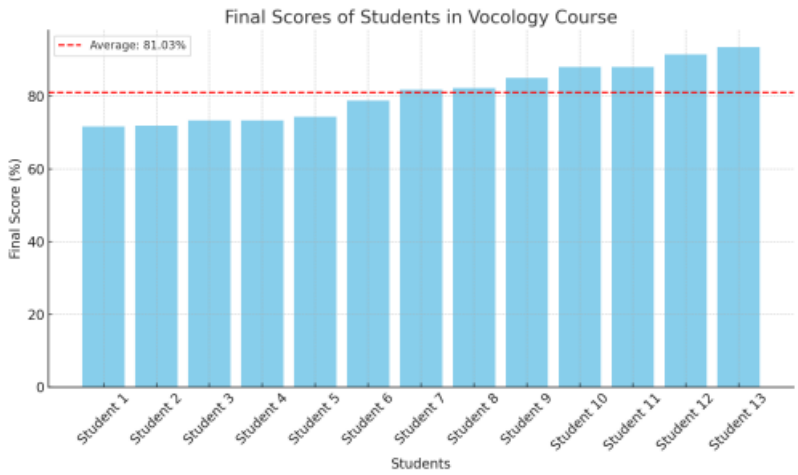


Figure 2. Final student scores in the Vocology course.



DIVERSITY IN CHOIRS – UNDERSTANDING THE VIEW OF TRANS* PEOPLE IN THE FIELD OF MUSIC EDUCA;ON TO FORM BE=ER SAFE SPACES FOR ALL

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Abstract
This study examines attitudes toward trans* people in choral contexts and investigates the extent to which group aGiliation, personality traits, and socio-demographic factors predict acceptance. Choirs constitute social micro-communities in which voice, gender, and identity are closely interconnected. Given the traditionally binary organization of vocal categories, choral settings may represent both inclusive spaces and potential sites of structural exclusion for trans* and non-binary individuals. Understanding how musically active individuals position themselves toward gender diversity is therefore of particular relevance for music education and cultural practice.
A total sample of N = 597 participants (choir directors, choir singers, and a non-choir control group) completed the Transgender Attitudes and Beliefs Scale (TABS) and the HEXACO60 personality inventory in an online survey. Linear regression and ANCOVA models were conducted controlling for age, gender, education, and income. Results showed that choir directors and choir singers reported significantly more positive attitudes toward trans* people than the control group. Among the HEXACO traits, only Honesty–Humility diGered between groups, with singers scoring higher than both choir directors and controls. Regression analyses revealed that personality traits explained a substantial proportion of variance in attitudes (R^2 = .50). Openness to Experience, Honesty–Humility, and Agreeableness emerged as the strongest positive predictors, while age negatively predicted acceptance. Moderation analyses indicated that Emotionality moderated the relationship between group membership and attitudes, though other personality traits did not show significant interaction eGects.
Overall, the findings suggest that both personality dispositions and participation in choral practice are associated with greater acceptance of trans* people. Choirs may function as social environments that foster inclusive attitudes beyond individual diGerences, highlighting their potential role in promoting diversity competence within music education and cultural practice.

1. Introduction

In recent years, the gender discourse has intensified. More people are openly living as trans*, non-binary or genderfluid and demanding social recognition. This development is evident in public debates, politics and culture. Artists such as Nemo and Conchita Wurst have recently brought the diversity of gender identities to the attention of a wide audience in the music world. At the same time, their success has also clearly shown that acceptance of gender diversity is still not a matter of course. Despite growing visibility, trans* people continue to experience discrimination and insecurity, including in cultural and (music) educational contexts. Research shows that a lack of acceptance significantly impairs both psychological well-being and social participation (Hancock, Krissinger & Owen, 2011). It is therefore important to assess attitudes towards trans* people more closely in order to understand which individual and social factors are at play in this context. This article focuses on choir practice: choirs are social micro-communities in which gender and voice are closely linked. The traditional division into female and male voices reflects binary gender norms and can be a burden for trans* or non-binary singers (Rastin, 2016; Palkki, 2020). Choir directors play a key role in this, as their attitude towards diversity influences whether a choir becomes a place of openness or exclusion. At the same time, social psychological findings show that individual diGerences such as personality, political orientation and socio-demographic characteristics have a significant influence on the acceptance of gender diversity (Rye et al., 2019; Hatch et al., 2022). Traits such as openness, empathy and moral integrity, described in the HEXACO model by the dimensions of openness to experience, agreeableness and honesty–humility, are particularly closely linked to tolerance and social sensitivity.

The aim of the present study was therefore to compare attitudes towards trans* people among choir directors, singers and the general population and to investigate the role played by personality traits and socio-demographic factors. The results should contribute to a better understanding of acceptance processes and provide impetus for more inclusive music education practice.

1.1 Theoretical considerations on the relationship between gender and voice

Gender is a complex concept. It encompasses biological, social and psychological dimensions. Biological sex refers to physical characteristics such as chromosomes, hormones and genitals. Social gender describes the socially constructed roles, expectations and behavioural norms associated with "male" or "female". Gender identity, in turn, refers to a person's deeply felt knowledge of their own gender. It describes the answer to the question of who someone is in terms of gender (Federal Anti-Discrimination Agency, 2024; Henning & Jorda, 2024).

For many people, their biological sex and their subjective gender identity match (cisgender), but for some people this is not the case. These people are referred to as trans* or transgender. The term trans* serves as an umbrella term for people whose gender identity does not correspond to the gender assigned to them at birth. It also includes non-binary, gender-fluid or agender identities that fall outside the traditional male-female scheme (Federal AntiDiscrimination Agency, 2024).

Trans* and non-binary people shape their identity in a variety of ways. Some undergo medical or social transitions, others do not. The self-definition is crucial for the gender identity that people adopt, as it is central to psychological well-being (cf. Hancock, Krissinger & Owen, 2011). Studies show that social acceptance and the opportunity to live one's identity openly correlate strongly with life satisfaction and mental health.

Despite the growing visibility of trans* people in the media, art and music, structural barriers and prejudices continue to exist. These are evident in education, healthcare and culture. And also in the context of vocal and choral education, where voice and body are closely linked to gender, questions of identity for people who deviate from the cisheteronormative population are clearly evident. The voice is not only an instrument, but also part of the self. It conveys belonging and expression. For many trans* singers, it thus becomes the central medium of their gender self-identification (cf. Constansis & Foteinou, 2017).

1.2 Trans* people in choirs and choral education contexts

Choirs are more than musical ensembles. They are social spaces where people breathe, sound and communicate together. In this collective process, ideas of community, identity and gender are constantly being renegotiated. This is precisely why choirs are insightful fields for revealing social dynamics around inclusion and diversity.

1.2.1 Structural barriers and social challenges

Traditional choir structures are often based on a binary understanding of gender. Voices are referred to as "female" or "male" voices, which seems self-evident because it is so deeply rooted in social norms. Soprano and alto voices are usually assigned to women, while tenor and bass voices are assigned to men. This practice assumes that voice type and gender match. However, this assumption does not always apply to some people, especially trans* and nonbinary singers (Rastin, 2016; Palkki, 2020).

In her study of Western choral traditions, Molly Rastin (2016) describes how these gender norms can lead to exclusion. Trans* singers often experience uncertainty or incomprehension when their voice does not fit into the expected category. They speak of "vocal invisibility," in which their voice finds no place, either tonally or socially, that corresponds to their identity. This invisibility and the conflict between their own identity and their choir voice aGects not only the choir structure, but also the self-image of the singers innen .

These tensions are particularly evident in adolescence. Palkki (2020) reports on trans* young people in American school choirs who experience their voices as "out of place". Vocal development during puberty does not always run parallel to gender identity, which can lead to emotional distress. A lack of sensitivity on the part of choir directors exacerbates these insecurities. Many choir directors feel unprepared to deal with gender diversity and unintentionally reproduce normative ideas of masculinity and femininity. In addition to these institutional structures, social dynamics also play a role. In genderspecific ensembles, such as male or female choirs, trans* people often experience tensions between belonging and exclusion. Fisher (2020) uses the example of gay male choirs to show that even in supposedly open contexts, uncertainties can exist. Trans* singers report ambivalent experiences between acceptance, irritation and the desire for visibility. These ambivalences show that even spaces of diversity are not automatically inclusive.

1.2.2 Vocal development and identity work

For many trans* people, the voice is a central component of their identity. It connects the body, self-image and social perception. Studies show that vocal changes during transition can have a profound emotional impact (Hancock, Krissinger & Owen, 2011; Constansis & Foteinou, 2017). Trans* men often experience a significant deepening of their voice due to testosterone. This change can be liberating, but also challenging, as familiar sound spaces disappear and new ones have to be developed. Trans* women, on the other hand, do not experience an automatic change in voice pitch, which requires specific voice training. In both cases, the voice becomes a place of identity negotiation.
Constansis and Foteinou (2017) impressively document this process using a case study of a trans* singer who had to relearn his voice during hormonal transition. They describe how technical and emotional aspects are inextricably intertwined: insecurity, self-doubt, but also the joy of finally having a voice that fits one's own self.

1.2.3 Inclusive approaches and educational perspectives

Current music education research emphasises the need to make choir practice more flexible and sensitive to diversity. Aguirre (2018) calls for voice categories to no longer be separated exclusively by gender, but rather by actual voice range and personal well-being. It is crucial that all singers are able to use their voices authentically, regardless of gender or transition experience.
Palkki (2020) proposes establishing gender-neutral terms and rehearsal practices. Instead of "female" and "male voices," soprano, alto, tenor and bass should be used to eliminate gender attribution. This linguistic change signals respect and creates space for belonging. In addition, several authors (Rastin, 2016; Aguirre, 2018) recommend that choir directors receive specific training on issues of gender diversity. Such training promotes understanding of vocal and social needs and helps to reduce uncertainty.

1.2.4 Choirs as social spaces of identity

Choirs can provide a space for self-aGirmation and community. Bird (2017) describes LGBTQIA+ choirs as spaces where music and identity merge. Here, singers experience acceptance, support and a form of public visibility that is often lacking in other areas of life. According to , these safe spaces fulfil a dual function, as they promote artistic development and strengthen self-esteem at the same time.

1.3 Attitudes towards trans* people

1.3.1 Concept

Attitudes towards trans* people comprise cognitive, aGective and behavioural components (Eagly & Chaiken, 1993). They reflect how people think about trans* identities and how they feel and act based on these thoughts. Cognitively, they refer to beliefs and stereotypes; aGectively, to emotional reactions such as empathy or rejection; and behaviourally, to actions or social distance. Taken together, they determine whether gender diversity is perceived as legitimate, normal or threatening.

1.3.2 Determinants of trans-related attitudes

Empirical research shows that attitudes towards trans* people are influenced by a number of individual and ideological factors. A comprehensive meta-analysis by Hatch, Warner, Broussard and Harton (2022) identified several consistent predictors of trans*negative attitudes. Negative attitudes correlate most strongly with high religiosity or religious fundamentalism, right-wing authoritarianism (RWA), social dominance orientation (SDO) and gender essentialism[1]. It was also found that less personal contact with trans* or other LGBTQAI+ individuals is associated with increased rejection. These correlations were robust across diGerent cultures.

In-depth analyses by Rye, Merritt and Straatsma (2019) show that two types of conservatism can be distinguished: general, ideological conservatism and gender-specific conservatism. The latter in particular, which is characterised by both hostile and benevolent sexism and rigid gender roles, proved to be a strong predictor of negative attitudes towards trans* people. People who emphasise traditional gender norms tend to perceive gender diversity as a deviation from the "natural order".

A study by Moloto (2019) in South Africa confirmed these findings in a diGerent cultural context. Here, too, there were clear correlations between RWA, SDO and transphobic attitudes. In addition, men had higher average prejudice scores than women. These gender diGerences point to the close link between gender roles, power orientation and acceptance of gender diversity.

In summary, these findings suggest that trans*negative attitudes are based on an interplay of ideological beliefs, social hierarchy thinking and a lack of personal experience. Conversely, openness, education and contact promote the acceptance of gender diversity, which points to a connection that is also of central importance in the context of music education.

1.4 Cognitive and psychological mechanisms of anti-transgender attitudes

Recent social cognitive research shows that prejudice against trans* people does not only arise from ideological beliefs, but is also deeply embedded in perception processes. People usually automatically assign their counterparts to a gender category. This quick, intuitive judgement provides orientation in social interactions. However, when external characteristics such as voice, clothing or facial features cannot be clearly assigned, perceptual uncertainty arises, also known as disfluency.

Liebenow and Cassidy (2025) describe transphobic prejudices as a consequence of such person perception processes. Gender-ambiguous stimuli disrupt the familiar pattern with which people categorise others. This irritation can lead to cognitive dissonance, which some people unconsciously resolve through devaluation or distancing. The result is subtle forms of misgendering[2] or degendering[3] – processes in which trans* people are linguistically or socially deprived of their gender identity.

It is noteworthy that such mechanisms can also occur in people who are fundamentally inclusive. Anti-trans* bias is therefore not exclusively an expression of conscious rejection, but can arise from automated perception routines. This perspective broadens our understanding of prejudice. It is not only the product of ideology, but also the result of limited cognitive flexibility. This has important implications for intervention and education. If prejudices result in part from perception processes, they can be mitigated through targeted training in social categorisation and the conscious use of gender-neutral language. Such approaches aim to reduce cognitive uncertainty and to perceive the diversity of gender expressions as a matter of course.

In the context of music-related practice, this means that inclusion is promoted not only through positive attitudes, but also through conscious perception and language . Choir directors who actively name gender diversity and make it visible through language can thus change not only structures, but also patterns of perception.

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[1]Gender essentialism describes the belief that gender is determined solely by biological sex and is immutable.

[2]Misgendering describes the use of incorrect gender designations (e.g. pronouns) when referring to a person.

[3]Degendering describes the deliberate use of incorrect gender designations, which often stems from prejudice or aversion.

1.5 Personality and acceptance

Personality traits significantly determine how people react to social diversity. They influence empathy, moral judgements and cognitive openness, which are characteristics closely linked to the acceptance of gender diversity.

The HEXACO model by Ashton and Lee (2009) oGers a diGerentiated framework for this. It describes six basic personality dimensions: honesty–humility, emotionality, extraversion, agreeableness, conscientiousness and openness to experience. Each dimension reflects characteristic patterns of thinking, feeling and acting. Honesty–Humility, Agreeableness and Openness to Experience are particularly relevant for research into prejudice and acceptance.

People with high honesty–humility are characterised by sincerity, fairness and modesty. They reject manipulative or power-oriented strategies and treat others with respect. Previous studies show that these characteristics are associated with lower discriminatory and hierarchical tendencies (Ashton & Lee, 2007; Lee et al., 2013). Agreeableness stands for forbearance, empathy and a willingness to resolve conflicts peacefully. People with high scores in this dimension react less hostile to diGerence and show less prejudice. Openness to experience describes curiosity, intellectual flexibility and the desire to learn about new perspectives. This is a disposition that is particularly strongly linked to acceptance of and interest in diversity.

Empirical findings confirm these theoretical assumptions. Rye, Merritt, and Straatsma (2019) found that openness and low gender stereotypes correlate significantly positively with acceptance of trans* people. Hatch et al. (2022) showed in their meta-analysis that personality traits such as empathy and openness are among the most reliable predictors of positive attitudes towards trans* people. These traits do not act in isolation, but in conjunction with ideological factors such as political orientation or religious fundamentalism.

This results in a theoretical model in which personality traits have both a direct and indirect eGect on acceptance. Directly, by shaping basic attitudes towards diversity, and indirectly, by weakening or strengthening the eGect of ideological beliefs. For example, a high level of openness can mitigate the negative eGects of conservative attitudes on the acceptance of trans* people.

1.6 Hypotheses

The theoretical considerations presented so far illustrate that attitudes towards trans* people arise from a complex interplay of social, cognitive and individual factors. Social structures, perception processes and personality traits interact at diGerent levels and determine how gender diversity is perceived and evaluated.

In a musical context, especially in choirs, these levels intersect directly. Choirs form social microsystems in which gender, voice and identity are closely intertwined. The way choir directors and singers respond to gender diversity can thus be exemplary of broader social attitudes. Previous research suggests that pedagogical experience, openness and sensitivity to diversity in musical contexts promote acceptance, while traditional gender images or authoritarian values reinforce negative tendencies (Rastin, 2016; Palkki, 2020; Hatch et al., 2022).

Furthermore, the social psychological findings of Rye et al. (2019) and Moloto (2019) indicate that ideological attitudes such as right-wing authoritarianism (RWA), social dominance orientation (SDO) or religious fundamentalism are closely linked to transphobic beliefs. At the same time, work on cognitive mechanisms (Liebenow & Cassidy, 2025) shows that subtle perception processes can also contribute to the stabilisation of such prejudices. Finally, findings from personality research (Ashton & Lee, 2007, 2009; Lee et al., 2013) suggest that the dimensions of honesty–humility, agreeableness, and openness to experience play a central role by promoting empathy and openness and mitigating the eGect of ideological factors. These theoretical and empirical foundations give rise to the following research questions and hypotheses:

H1 There is a group diGerence in attitudes towards trans* people between the three groups under investigation (choir directors, choir singers, non-choir singers).
H2 There are group diGerences between the study groups in the personality traits of the HEXACO scales.
H3 Higher scores in Honesty–Humility, Agreeableness and Openness to Experience are associated with more positive attitudes towards trans* people.
H4 The personality traits of the participants moderate the relationship between the groups and attitudes towards trans* people.
Sub-hypotheses:
N1 Age, gender, level of education, country of origin, current country of residence, annual net income, and the choir's singing style have an influence on attitudes towards trans* people.
N2 Age, gender, level of education, country of origin, current country of residence, annual net income, political views and the choir's singing style have a small moderating influence on attitudes towards trans* people.

Control analyses:
K1 Conservative political orientation, higher religiosity and stronger agreement with traditional gender roles are negatively correlated with the acceptance of trans* people.

2. Methods

2.1 Sample

The power analysis for the present study was performed using GPower (version 3.1) (Faul et al., 2009). In order to achieve a power of at least 80% at a significance level of α = 5% and a presumed small eGect size of f = .15 in a two-tailed group comparison, N_{prior}= 576 individuals were required for the model of H_2. Fewer subjects were required for the same power for all other models used to test the hypotheses. The required sample size was achieved with N = 597 subjects. The sample was recruited through music colleges, networks of choir directors and the snowball principle, whereby choir directors forwarded the study to their choir singers. Furthermore, the control group was recruited online on social media platforms (Reddit, Facebook, Instagram, X). To divide the participants into study groups, they were asked whether they conduct choirs or sing in choirs, as well as specific questions about the type of choirs, which queried their singing and choir conducting experience, the genre, type and professionalism of the respective choir.

2.2 Measuring instruments

In the present study, the participants were asked about their attitudes towards trans* people, their political views, their life satisfaction and demographic data, as well as their choir experience and membership of the respective study group (choir conductor/choir singer/control group).

2.2.1 TABS

The Transgender Attitudes and Beliefs Scale (TABS; Kanamori et al., 2017) was used to assess attitudes towards trans* people. The questionnaire measures explicit attitudes, beliefs and potential prejudices towards trans* people. It comprises 29 items that are answered on a seven-point Likert scale (1 = strongly disagree to 7 = strongly agree).
The TABS maps three dimensions. Interpersonal Comfort describes individual comfort in direct contact with trans* people, Sex/Gender Beliefs captures normative beliefs about sex and gender identity, and Human Value reflects the recognition of the equal dignity and value of trans* people. Higher scores represent more positive and inclusive attitudes.
In the original validation, the scale showed high internal consistency (Cronbach's α = .88 – .94) and good construct validity and has been used successfully in various population groups. In the present study, both the English and German versions of the TABS were used. The sum score of all items was used as a total measure of trans-affirmative attitudes for the evaluation.

2.2.2 Hexaco

The short version of the HEXACO Personality Inventory (HEXACO-60; Ashton & Lee, 2009) was used to assess basic personality traits. The questionnaire assesses six central personality dimensions: Honesty–Humility (honesty, modesty, fairness), Emotionality (emotional sensitivity and anxiety), Extraversion (sociability and self-confidence), Agreeableness (yieldingness and patience), Conscientiousness (orderliness and conscientiousness) and Openness to Experience (curiosity and creativity).
The scale comprises 60 items, which are answered on a five-point Likert scale from 1 = strongly disagree to 5 = strongly agree. A mean value is calculated for each dimension, with higher values indicating a stronger expression of the respective personality trait.
The HEXACO-60 has good internal reliability (Cronbach's α = .70 – .80). It is an economical and reliable shortened version of the complete HEXACO-PI-R and is an established instrument for assessing higher-order personality structures without placing too much of a time burden on participants. The German and English versions of the questionnaire were used in the present study.

2.3 Experimental design

The study was conducted entirely online via the SoSci-Survey platform (Leiner et al. 2024). The data was collected between 29 October 2024 and 18 March 2025. At the beginning of the study, all participants received a consent form informing them about the anonymous nature of the data collection, its exclusive use for scientific purposes, and their rights (voluntary participation, option to withdraw at any time). A study by Geisen et al. (2022) showed that an attention question at the beginning of the questionnaire improves the quality of the data compared to an interruption during the questionnaire and increases the honesty of the participants (Geisen et al., 2022). Therefore, a conscientiousness question was asked at the beginning of the questionnaire, in which participants were asked to indicate whether they intended to answer the questions honestly and conscientiously in order to ensure high data quality.
The order of the two psychological questionnaires (TABS, HEXACO) was randomly varied for each person to control for potential order eGects. After the main scales, demographic information (age, gender, country of origin, occupation, political aGiliation, and annual net income) was collected, as well as information on choral experience and classification (see Chapter 2.1). To divide the participants into diGerent groups, the type of art the participants practise professionally was determined.
The survey was available in German and English. The established and validated translation of the questionnaire was used for the German version (see section 3.2). Participants could select their preferred language at the start. The average completion time was t = 19 minutes, with a maximum completion time of t_{max}= 35 minutes. The study was approved by the Ethics Committee of the Mozarteum University Salzburg .

2.4 Data analysis

The data was evaluated using statistical analyses with R (version 4.5.1) (R Core Team, 2025). The R packages used are described in Appendix C. The significance level was set at α = .05. To investigate H1, the group diGerences between the study groups in terms of attitude, a linear regression was calculated in which the control variables of the secondary hypothesis were integrated to rule out possible spurious eGects. Compliance with the requirements for this was checked using inferential statistics and visual inspection. For H2, an ANCOVA was performed for each of the personality traits in which secondary variables were integrated. Post hoc analyses were performed for significant group diGerences in order to describe them in more detail. A linear regression was also performed to examine H3, for which the secondary variables were also controlled and the prerequisites were checked as in H1. The examination of H4, the moderation analysis, was also performed using a linear model in which the interactions between the study groups and the personality traits were integrated.

3. Results

The results of the study are presented below. Beginning with the descriptive findings, the correlations found are then presented.

3.1 Descriptive statistics

A total of Ntotal= 847 participants took part in the study, most of whom were choir directors and singers, thus representing a specific sample. Nunv.= 133 participants were excluded because they did not complete the study. Furthermore, n = 117 participants had to be excluded due to the conscientiousness question . Therefore, data from N = 597 participants could be evaluated.
The study included 233 men, 336 women and 24 diverse individuals, while four other individuals did not wish to disclose their gender (see Table 1). The sample included people from 21 diGerent countries around the world. The three most common countries of origin were Germany (n = 281), Austria (n = 198) and the USA (n = 23).

Table 1

Sample description (N = 597)

Demographic data	*n*	Percentage or Mean (*SD*)
Gender		
Male	233	39.03
Female	336	56.28
Various	24	4.02
k. A .	4	0.67
Research groups		
Choir directors	155	25.96
Choir singers	292	48.91
Control group	150	25.1
Age		44.41 (13.18)

Note: n.a. = not available, SD = standard deviation

Table 2 shows attitudes towards trans* people, represented by the TABS score, as well as the personality traits of the HEXACO scales, broken down into three groups. The most positive attitude towards trans* people.

Table 2a

Descriptive statistics of the dependent variables by group

Group	Attitude score	
	MW	SD
C	119.14	19.82
S	117.41	23.22
K	108.86	25.24

Note: MW = mean value; SD = standard deviation, C = choir directors, S = singers and K = control group.

Table 2b

Descriptive statistics of the dependent variables by group (continued)

Group	Honesty-Humility		Emotionality		Extraversion	
	MW	SD	*MW*	SD	MW	SD
C	31.53	7.9	30.99	6.74	32	7.14
S	33.84	7.65	32.23	6.98	32.7	6.84
K	31.57	7.92	31.91	6.99	31.77	6.58

Note: MW = mean value; SD = standard deviation, C = choir directors, S = singers and K = control group.

Table 2c

Descriptive statistics of the dependent variables by group (continued)

Group	Agreeableness		Conscientiousness		Openness	
	MW	SD	MW	SD	MW	SD
C	31	6.74	32.24	8	33.74	7.15
S	30.65	6.51	33.07	6.96	34.36	6.87
K	29.85	6.48	32.04	6.91	32.74	7.27

Note: MW = mean value; SD = standard deviation, C = choir directors, S = singers and K = control group.

3.2 Attitudes towards trans* people

To examine group diGerences in attitudes towards trans* individuals, controlling for income, gender, age and level of education, a linear regression was performed, which is shown in Table 3. The statistical requirements for linear regression were tested and were met in the data. The linear regression showed a significant diGerence between the choir directors and the control group (β = 0.10; p = .036) as well as between the singing participants and the control group (β = 0.10; p = .037) with F(588) = 16.80, p < .001. With the exception of income, all control variables had a significant influence on a person's attitude. People who identified as female (β = 0.21; p < .001), diverse (β = 0.24; p < .001) or no gender (β = 0.09; p = .015) had a more positive attitude towards trans* people. In addition, level of education had a significantly positive influence (β = 0.26; p < .001), while age had a significantly negative influence on attitudes (β = - 0.09; p = .018). Overall, the model explains R^2 = .17 variance with a power of 1.00.

Table 3

Linear regression: Attitudes towards trans persons depending on the groups*

Predictor	*b*	*β*	*t*	$CI_{2.5\%}$	$CI_{97.5\%}$
Intercept	97.88		25.69	90.39	105.36
Choir directors [a]	5.44	0.10	2.11	0.37	10.52
Singers [a]	4.56	0.10	2.10	0.27	8.84
Income (centred)	-0.81	-0.05	0.18	-1.99	0.38
Female gender [b]	9.8	0.21	5.39	6.23	13.38
Miscellaneous gender [b]	28.42	0.24	6.21	19.43	37.40
No gender specified [b]	26.23	0.09	2.43	5.05	47.40
Age	-0.16	-0.09	-2.38*	-0.30	-0.03
Level of education	2.45	0.26	6.55	1.72	3.19
Statistical parameters	R^2 = 0.18		$R^2_{adj.}$ = 0.17		
	F(588) = 16.80***				

Note: *p < .05, **p < .01, ***p < .001, CI = confidence interval.
[a] compared to the control group
[b] compared to males.

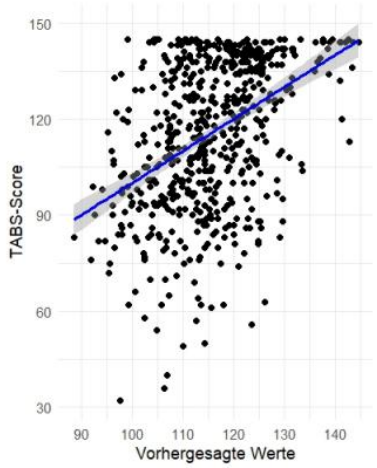

***Fig. 1**: Graphical representation [Adsız] ble 3*

3.3 Personality traits

The analysis of variance (ANCOVA) performed in Table 4 to determine group diGerences in personality traits between choir directors, singers and the control group revealed a significant eGect of group membership only for the personality trait honest-humility, F(2) = 6.65, p = .001 and an eGect size of η^2_p = .02. The prerequisites for the ANCOVA were met for the data. Gender also showed significant group diGerences . The post hoc pairwise comparisons with Bonferroni correction of the ANCOVA are shown in Table 5. It shows, that singers show significantly higher honest-humility.

Table 4

ANCOVA: Honest humility depending on the groups

Predictor	*df*	*S Sq*	*M Sq*	*F*	η^2_p
Group comparison (C, S, K)	2	784	391.8	6.65**	.02
Gender	3	1261	420.4	7.14***	.04
Age	1	5	4.8	0.08	$1.38*10^{-4}$
Residuals	590	34750	58.9		

*Note: *p < .05, **p < .01, ***p < .001.* C = choir directors, S = singers and C = control group.

Table 5

Group comparisons (ANCOVA) regarding age at death with pairwise post hoc comparisons

Age		Differences	
Groups	*MW (SD)*	*ΔGroups*	*ΔMW*
C	31.53 (7.9)	S-C	2.31
S	33.84 (7.65)	K-C	0.04
K	31.57 (7.92)	K-S	2.27
Statistical parameters		*F(2)* = 6.65**	

*Note: *p < .05, **p < .01, ***p < .001,* CI = confidence interval. C = choir directors, S = singers, and C = control group.

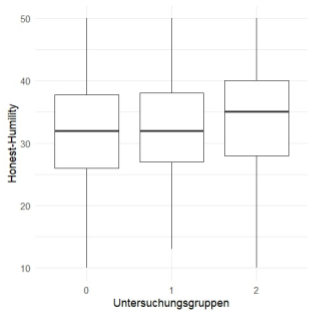

***Fig. 4**: Graphical representation of Table x. 0 = control group, 1 = choir conductors, 2 = singers*

The ANCOVA in Tables 6-10 showed that there were no significant diGerences between the groups in the personality traits of emotionality, extraversion, agreeableness, conscientiousness and openness. Therefor, the results confirm hypothesis H2 only for honest humility; no other personality traits are particularly pronounced among choir conductors and choir singers.

Table 6

ANCOVA: Emotionality depending on the groups

Predictor	*df*	*S Sq*	*M Sq*	*F*	η^2_p
Group comparison (C, S, K)	2	159	79.28	1.71	$5.75*10^{-3}$
Gender	3	883	294.37	6.34***	0.03
Age	1	151	151.24	3.26	$5.49*10^{-3}$
Residues	590	27412	46.46		

*Note: *p < .05, **p < .01, ***p < .001.* C = choir directors, S = singers and C = control group.

Table 7

ANCOVA: Extraversion depending on the groups

Predictor	*df*	*S Sq*	*M Sq*	*F*	η^2_p
Group comparison (C, S, K)	2	102	50.91	1.10	$3.70**10^{-3}$
Gender	3	297	99.10	2.14	0.01
Age	1	241	240.70	5.19	$8.71*10^{-3}$
Residuals	590	27388	46.42		

*Note: *p < .05, **p < .01, ***p < .001.* C = choir directors, S = singers and C = control group.

Table 8

ANCOVA: Agreeableness depending on the groups

Predictor	*df*	*S Sq*	*M Sq*	*F*	η^2_p
Group comparison (C, S, K)	2	107	53.66	1.24	$4.20*10^{-3}$
Gender	3	19	6.43	0.15	$7.57*10^{-4}$
Age	1	65	64.71	1.50	$2.53*10^{-3}$
Residues	590	25475	43.18		

Note: *$p < .05$, **$p < .01$, ***$p < .001$. C = choir directors, S = singers and C = control group.

Table 9

ANCOVA: Conscientiousness depending on the groups

Predictor	*df*	*S Sq*	*M Sq*	*F*	η^2_p
Group comparison (C, S, K)	2	130	65.20	1.26	$4.26*10^{-3}$
Gender	3	618	205.85	3.99	0.02
Age	1	0	0.09	0.002	$2.79*10^{-6}$
Residuals	590	30454	51.62		

Note: *$p < .05$, **$p < .01$, ***$p < .001$. C = choir directors, S = singers and C = control group.

Table 10

ANCOVA: Openness depending on the groups

Predictor	*df*	*S Sq*	*M Sq*	*F*	η^2_p
Group comparison (C, S, K)	2	259	129.7	2.70	$9.06*10^{-3}$
Gender	3	1817	605.5	12.59	0.06
Age	1	36	36.4	0.76	$1.28*10^{-3}$
Residuals	590	28381	48.1		

Note: *$p < .05$, **$p < .01$, ***$p < .001$. C = choir directors, S = singers, and K = control group.

3.4 Personality traits and attitudes towards trans* people

Table 11 shows the linear model that expresses attitudes towards trans* persons through the personality traits of the test subjects. The statistical requirements for the model were met. With an F(584) = 50.95 and p < .001, the model significantly explains R2 = .50 of the variance with a post hoc power of 1.00. The personality traits honest humility (β = 0.29; p < .001), extraversion (β = 0.09; p = .003), agreeableness (β = 0.13; p < .001), conscientiousness (β = 0.08; p = .013) and openness (β = 0.32; p < .001) predicted a positive attitude. In addition, corrections were made for the secondary variables of , whereby belonging to various genders (β = 0.17; p < .001) and level of education (β = 0.15; p < .001) positively predicted the attitude, while age negatively predicted the attitude (β = -0.07; p = .030).

Table 11

Linear regression: moderation analysis of personality traits on the dependence of attitudes towards trans persons on the groups*

Predictor	*b*	β	*t*	$CI_{2.5\%}$	$CI_{97.5\%}$
Intercept	11.90		1.84	-0.81	24.6
Honest Humility	0.85	0.29	8.53	0.65	1.04
Emotionality	0.11	0.03	1.06	-0.09	0.31
Extraversion	0.32	0.09	2.99	0.11	0.53
Agreeableness	0.45	0.13	4.17	0.24	0.67
Conscientiousness	0.25	0.08	2.49	0.05	0.45
Openness	1.03	0.32	9.41	0.81	1.24
Income (centred)	-0.32	-0.02	-0.69	-1.25	0.60
Female gender [b]	2.44	0.05	1.65	-0.45	5.33
Miscellaneous gender [b]	20.35	0.17	5.68	13.31	27.39
No gender specified [b]	15.60	0.05	1.86	-0.87	32.06
Age	-0.12	-0.07	-2.18	-0.22	-0.01
Level of education	1.38	0.15	4.90	0.83	1.94
Statistical parameters	R^2 = .51		$R^2_{adj.}$ = .50		
	F(584) = 50.95***				

Note: *$p < .05$, **$p < .01$, ***$p < .001$, CI = confidence interval, C = choir directors, S = singers, C = control group

3.5 Moderation analysis

For the moderation analysis, linear regression revealed a significant eGect of F (576) = 28.68 with p < .001, whereby only the predictors themselves, as described in the previous model, and the moderation between emotionality and the choir directors (β = -0.52; p = .004) and the singing subjects (β = -0.40; p < .001) were significant. The remaining personality traits do not moderate the group diGerence in terms of attitude. The explained variance of the model was R^2 = .49 with a power of 1.00. Thus, H4 can only be partially accepted (for emotionality).

Table 12

Linear regression: moderation analysis of personality traits on the dependence of attitudes towards trans persons on the groups*

Predictor	*b*	β	*t*	$CI_{2.5\%}$	$CI_{97.5\%}$
Intercept	-34.10		-2.62	-59.65	-8.55
Choir directors [a]	88.02	1.66	5.15	54.45	121.61
Choir singers [a]	29.10	0.63	1.85	-1.80	60
Honest Humility	1.01	0.34	5.12	0.62	1.40
Emotionality	0.71	0.21	3.47	0.31	1.11
Extraversion	0.67	0.19	3.04	0.24	1.11
Agreeableness	0.62	0.17	2.72	0.17	1.07
Conscientiousness	0.35	0.11	1.72	-0.05	0.76
Openness	1.14	0.35	5.5	0.73	1.55
Moderation C – H-H	-0.39	-0.24	-1.37	-0.94	0.17
Moderation S – H-H	-0.04	-0.03	-0.16	-0.52	0.44
Moderation C – Em	-0.86	-0.52	-2.86	-1.46	-0.27
Moderation S – Em	-0.55	-0.40	-2.20	-1.05	-0.06
Moderation C – Ex	-0.40	-0.25	-1.27	-1.03	0.22
Moderation S – Ex	-0.31	-0.22	-1.14	-0.83	0.22
Moderation C – Ag	-0.36	-0.22	-1.16	-0.98	0.25
Moderation S – Ag	-0.16	-0.11	-0.57	-0.70	0.39
Moderation C – Co	-0.16	-0.10	-0.56	-0.72	0.40
Moderation S – Co	0.004	0.003	0.02	-0.49	0.5
Moderation C – Op	-0.32	-0.21	-1.01	-0.95	0.30
Moderation S – Op	0.22	0.17	0.85	-0.28	0.72
Statistical parameters	R^2 = 0.51		$R^2_{adj.}$ = 0.49		
	F(576) = 29.68***				

Note: **p* < .05, ***p* < .01, ****p* < .001, CI = confidence interval, C = choir directors, S = singers, C = control group, H-H = honest humility, Em = emotionality, Ex = extraversion, Ag = agreeableness, Co = conscientiousness, and Op = openness.
[a] Compared to the control group

4. Discussion

In the following, the results of the study presented above will be placed in relation to the current state of knowledge and the most important findings of the study will be explained.

4.1 Interpretation

The results of this study show that attitudes towards trans* people are significantly influenced by a combination of group aGiliation, personality and socio-demographic factors. It is particularly clear that choir directors and choir singers have significantly more positive attitudes than the control group. This finding supports theoretical approaches that understand choirs as social spaces in which communal practices promote empathy, perspective-taking and openness . Music education studies (Rastin, 2016; Palkki, 2020) describe choirs as places where gender identity becomes more negotiable, as vocal and physical forms of expression are closely intertwined. The present data provide quantitative evidence for this for the first time. Musically active groups diGer significantly in their acceptance of trans* people. This acceptance is still present even when key influencing variables such as age, gender, income and education are statistically controlled for.

Furthermore, the results confirm the socio-demographic eGects frequently documented in attitude research. Women and diverse individuals showed significantly higher acceptance scores than men, which is consistent with findings from meta-analyses (Hatch et al., 2022). Similarly, a positive influence of educational attainment and a negative influence of age were found. These results are consistent with international comparisons and indicate that attitudes toward gender diversity are strongly influenced by social norms, educational processes, and cohort-related value patterns.

With regard to personality traits, honesty–humility was the only HEXACO dimension that showed significant group diGerences. Singers scored higher on this dimension than choir directors and the control group. This trait encompasses fairness, modesty and social integrity integrity . These are traits that have already been associated with low discrimination and prosocial behaviour in previous studies (Ashton & Lee, 2007). The fact that this diGerence occurs exclusively in this dimension suggests that choral practice is not associated with a specific overall personality, but rather with individual socially relevant dispositions that may be reinforced by long-term, cooperative group work.

The regression analyses also show that personality traits as a whole explain a large part of the attitudes, accounting for approximately 50% of the variance. Openness, e , honesty– humility, and agreeableness in particular proved to be strong predictors of positive attitudes towards trans* people. This finding is consistent with social psychological models in which openness and empathy are considered fundamental determinants of tolerance (Rye et al., 2019). Smaller but significant eGects of extraversion and conscientiousness can also be explained theoretically. Individuals who are socially engaged or structured may be more likely to exhibit inclusive behaviour in communal contexts, especially when inclusion is experienced as a social norm.

Particular attention should be paid to the finding that emotionality only moderates the relationship between personality and attitude in the control group. While higher emotionality was associated with greater acceptance in the control group, this relationship lost significance among choir directors and choir singers. One possible explanation is a ceiling eGect , as the musically active groups already have higher acceptance scores overall. Another interpretation comes from social-psychological group research: In choirs, collective social norms may be at work that promote inclusive behaviour and are independent of individual emotional dispositions. This would mean that choral structures not only reflect personality, but also actively contribute to social adaptation processes that strengthen diversity acceptance.

Overall, the findings confirm both the theoretical approaches from attitude research and socio-cultural models of the choir as an inclusive space. They expand the field by showing that musical communities can have an independent, positive eGect on attitudes towards trans* people that goes beyond personality, ideology and demographics.

4.2 Limitations

Despite the robust and theoretically well-connectable results, the study has several limitations that must be taken into account in its interpretation. First, the study is based exclusively on self-reported data, which may be susceptible to biases such as social desirability or conscious response tendencies. Particularly in the sensitive area of gender diversity, some of the participants may have deliberately communicated positive attitudes in order to appear tolerant. Although anonymity reduces this risk, complete control is not possible.

Secondly, this is a specific sample that is highly selective, particularly in the field of music. Choir directors and choir singers are significantly overrepresented. The recruitment of the control group via social media also leads to a bias in the sample. The results are therefore only partially transferable to the general population.

Thirdly, the cross-sectional study design does not allow causal statements to be made about whether choral practice leads to more positive attitudes or whether people with higher scores in openness, empathy and more liberal value orientations are more likely to be active in choirs. Longitudinal and experimental study designs would be necessary to clarify this causal direction unequivocally.

Finally, the study is based on online data collection, and despite attention controls, it cannot be ruled out that participants answered questions hastily or that diGerent interpretations of the items arose across diGerent language versions. This, too, could aGect the accuracy of individual findings.

4.3 Outlook

The results open up several perspectives for future research. First, it would be useful to conduct longitudinal studies to clarify whether and how choir participation changes attitudes towards gender diversity in the long term. Second, intervention studies could investigate whether even short music education measures, such as workshops on gender-inclusive choir work, have a measurable influence on attitudes.

Furthermore, although qualitative studies on the topic already exist, it is important to expand on them, as they can not only provide valuable insights through interviews with trans* singers or choir directors, but it is also highly important to conduct research on this topic with a focus on the minority rather than about them. Finally, there are practical implications for music education: choir directors could be specifically trained in diversity-sensitive work, and music education curricula should address gender diversity more strongly. The present results suggest that the choir is a promising social space for promoting diversity competence in artistic and (music) educational contexts.

4.4 Summary

In summary, the results of the study suggest that attitudes towards trans* people are influenced by personality and sociodemographic factors as well as by participation in choral practices. Choir directors and choir singers have significantly more positive attitudes than the general population. Openness, empathy and moral integrity proved to be key predictors of acceptance. This shows that although many choirs already oGer safe spaces and open communities for trans* people, these need to be expanded in the future. The findings also make it clear that choirs, as social spaces, have the potential to promote inclusive attitudes and thus contribute to social diversity and equality.

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ARTISTIC VOICE: THE IMPORTANCE OF SELF-AWARENESS IN THE USE OF THE SINGING VOICE

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ABSTRACT
Recent scientific literature highlights a higher incidence of vocal disorders in contemporary commercial music (CCM) singers compared to classically trained singers, likely due to variability in vocal styles, increased performance demands, and often non-structured training pathways. Based on these findings, the present study aimed to investigate levels of vocal selfawareness in CCM singers and to explore their relationship with type of training and selfreported vocal difficulties. Ninety-three singers completed a questionnaire structured into six thematic areas: subjective perception of vocal control; anatomical and physiological knowledge; ability to control phonatory structures; knowledge and management of vocal qualities (e.g., speech, falsetto, twang, belt, mix, sob, legit); awareness and adherence to warm-up, cool-down, and vocal hygiene practices; and self-reported vocal difficulties. Although 67% of participants reported perceiving good control over their voice, this perception did not fully align with the technical competencies that emerged from the questionnaire. Only 44% demonstrated adequate anatomical and physiological awareness, while 55% reported partial or absent knowledge. Greater confidence was observed in controlling easily visible or proprioceptively accessible structures (e.g., tongue and jaw), whereas substantial uncertainty emerged regarding less accessible structures such as the larynx and vocal folds. Only a minority consistently applied preventive strategies, and approximately 50% reported episodes of vocal fatigue or difficulties. Inferential analysis using Chi-square tests and post-hoc analyses revealed significant associations between type of vocal training and levels of vocal awareness. Formal or combined training was associated with higher competencies compared to informal or absent training. These findings highlight the need for integrated pedagogical approaches combining artistic expression with scientific knowledge to promote a more conscious, effective, and sustainable use of the voice in CCM singers.

KEYWORDS: *Voice; Singing; Voice Disorders; Health Behavior; Voice Training*

INTRODUCTION
Scientific literature has highlighted a higher incidence of vocal disorders and phono-traumatic injuries in singers belonging to contemporary genres compared to classically trained singers. [1–3]
This difference has been attributed to the stylistic variability of modern singing, high performance demands and lower technical standardisation of training pathways. In the context of the artistic voice, vocal awareness can be defined as the integration of anatomical and physiological knowledge, technical control of the phonatory gesture, and the adoption of preventive behaviours. It represents a metacognitive skill that allows singers to monitor and regulate vocal emission in an effective and sustainable manner. A discrepancy between subjective perception of control and actual technical-functional competence can lead to less economical use of the vocal instrument, increasing the risk of fatigue and dysphonia.

This study aims to:
1. Assess the level of vocal awareness in modern music singers.
2. Analyse the relationship between subjective perception of control and actual awareness.
3. Verify the association between type of vocal training and level of awareness.
4. Explore the presence of self-reported vocal problems.

METHODS

Study Design

Cross-sectional observational study conducted using an anonymous online questionnaire.

Sample

The initial sample included 103 adult singers. Opera singers were excluded due to their distinct technical–phonatory principles, as the investigation focused on contemporary commercial music. The final analysed sample consisted of 93 participants. The sample was heterogeneous and included singers active in various contemporary styles (pop, rock, jazz, blues, musical theatre, gospel, rap, folk, choral, neo soul, and others). Gender distribution showed a prevalence of female participants (72.8%), followed by males (26.2%) and 1% identifying as non-binary or preferring not to specify. Regarding age, the most represented group was 18–25 years (47.6%), followed by 26–35 years (34%), 36–45 years (11.7%), 46–60 years (5.8%), and one participant over 60 years. Vocal training was categorised based on self-reported educational background: 35% formal training, 36.9% informal training, 23.3% combined training, and 4.9% no training. Participation was voluntary, anonymous and unpaid. The sample was non-probabilistic and convenience-based. Training categories were defined as follows: formal training included conservatory or certified academic programmes; informal training included private lessons and workshops without institutional certification; combined training referred to the presence of both pathways; no training indicated absence of structured vocal education.

Tool

A semi-structured questionnaire was used, divided into six thematic areas:

1. Subjective perception of vocal control, investigated through the question: ‘’Do you feel you have control over your vocal instrument?’’
2. Anatomical and physiological awareness, explored through five domains:

1) knowledge of the vocal apparatus;
2) understanding of the mechanism of voice production and management;
3) importance of postural alignment;
4) role of breathing in singing;
5) knowledge of resonance cavities.

3. Control of the anatomical structures involved in phonation.
4. Awareness of vocal qualities.
5. Vocal warm-up and cool-down practices.
6. Vocal hygiene and recognition of early signs of fatigue. The question “Have you ever had vocal problems?” was also included. The terminology adopted for vocal qualities and anatomical structures was partially informed by contemporary pedagogical models of voice training, including Estill Voice Training (EVT)[4] , while also incorporating terms commonly used in contemporary commercial music practice.

Data Analysis

A descriptive analysis was performed using frequencies and percentages. To assess the association between type of vocal training and questionnaire variables, the Chisquare (χ^2) test of independence was applied, with a significance level set at $p < 0.05$. The strength of the association was estimated using Cramer's V. When statistically significant associations were identified, post-hoc analyses were conducted by examining adjusted standardized residuals in order to determine which categories contributed most to the observed differences.

RESULTS

Descriptive Analysis

Perceived Control Of The Vocal Instrument

66.7% of participants report perceiving good control of their vocal instrument, while 33.3% report not having full mastery. Although a positive perception prevails, these findings must be interpreted in light of the subsequent domains, as subjective perception of control does not necessarily coincide with structured technical–physiological knowledge.

Anatomical-physiological Awareness

The overall analysis of the five dimensions was calculated as the mean score of the five items composing the anatomical–physiological awareness domain. The overall analysis of the five dimensions shows that: 44.2% of singers have in-depth knowledge; 46.5% show partial awareness; 9.3% show no awareness. Overall, more than half of the sample does not have a fully consolidated understanding of the physiological mechanisms that regulate phonation. Critical gaps were observed across all investigated dimensions, indicating that anatomical and physiological knowledge is often partial and not fully integrated into a coherent functional representation of vocal production.

Control Of Anatomical Structures Involved In Phonation

The area relating to the control of anatomical structures investigated singers' ability to consciously perceive and modulate the components involved in vocal production. The analysis reveals a heterogeneous picture. The highest percentages of perceived control concern the structures that are most accessible on a proprioceptive or functional level: true vocal folds (58.1%), larynx (57%), tongue (55.9%), jaw (48.4%), as well as the head-neck and trunk regions (both 58.1%). Conversely, control is significantly lower for more specific and less directly perceptible anatomical structures: false vocal folds (23.7%), thyroid cartilage (14%), cricoid cartilage (11.8%) and aryepiglottic sphincter (15.1%). Only 20.4% of participants reported awareness of control over the soft palate, while 17.2% stated that they had no perception of control over any specific structure. Overall, the data show an uneven distribution of motor awareness, with higher percentages for the more intuitive and functionally perceptible structures and lower levels for the internal anatomical components and fine regulation of the phonatory gesture.

Awareness Of Vocal Qualities

The area dedicated to vocal qualities investigated both knowledge of the main modes of vocal production and the perceived difficulty in executing them. The most recognised qualities in the sample were Falsetto (92.5%), Belt (73.1%), Mix (69.9%), Twang (61.3%) and Speech (59.1%). These were followed by Sob (32.3%) and Legit (20.4%), while only 3.2% of participants stated that they were unfamiliar with any of the qualities proposed. In terms of perceived difficulty, the highest percentages were recorded for Belt (34.4%), Mix (29%) and Twang (26.9%). The remaining vocal qualities (Falsetto, Sob and Legit) have difficulty levels ranging from approximately 11% to 21%. Overall, the results show a relatively widespread knowledge of the terminology of the main vocal qualities, with variability in the perception of difficulty in execution.

Vocal Warm-up And Cool-down Practices

With regard to vocal warm-up: 43% practise it regularly; 43% are familiar with it but do not apply it consistently; 10.8% are familiar with it but never use it; less than 3% say they are not familiar with it. Despite widespread theoretical knowledge, less than half of the participants consistently integrate warm-up into their vocal routine. The picture regarding vocal cool-down is even more critical: only 11.8% practise it regularly; 37.6% know about it but do not apply it consistently; 12.9% know about it but never use it; 37.6% say they are unaware of its existence. Cool-down therefore emerges as the least internalised preventive practice, indicating a culture of prevention that is more oriented towards immediate performance preparation than postactivity recovery management.

Vocal Hygiene And Recognition Of Early Signs

79.6% of participants say they are aware of practices to preserve vocal health. The most common strategies are: hydration (74.2%); protection of the respiratory mucosa (62.4%); avoidance of alcohol and caffeine (54.8%). Less common are: allergy management (30.1%); respecting individual vocal range (36.6%); anti-reflux measures (30.1%); stress management (12.9%). 10.8% do not apply any preventive measures. With regard to recognising the early signs of fatigue: 74.2% say they are able to recognise them; 19.4% are unsure; 6.4% are unaware of their existence. Overall, there is a relatively widespread theoretical awareness, but preventive strategies are not always applied systematically.

Presence Of Vocal Problems

49.5% of participants report having had vocal problems during their singing experience. Considering the frequent partial awareness and limited systematic application of cool-down, this percentage is of particular clinical relevance. The overlap between these data suggests a possible relationship that warrants further investigation through specific analyses in future studies.

Inferential Analysis

Statistically significant associations emerged between type of vocal training and multiple domains of awareness. Significant relationships were found for control of the vocal instrument ($\chi^2 = 18.64$; $p < 0.001$; Cramer's V = 0.44), anatomical–physiological awareness ($\chi^2 = 22.17$; $p < 0.001$; Cramer's V = 0.46), knowledge and management of vocal qualities ($\chi^2 = 15.82$; $p = 0.004$; Cramer's V = 0.39), warm-up and cool-down practices ($\chi^2 = 26.91$; $p < 0.001$; Cramer's V = 0.50), and vocal hygiene and recognition of early signs of fatigue ($\chi^2 = 21.34$; $p < 0.001$; Cramer's V = 0.44).

The strongest association concerns warm-up and cool-down practices (Cramer's V = 0.50), suggesting that structured training has a particularly significant impact on the adoption of concrete preventive behaviours. Post-hoc analyses indicated that singers with formal or combined training were overrepresented in higher awareness categories, whereas informal or untrained singers were more frequently associated with lower levels of vocal awareness. The percentage distribution of awareness domains according to type of vocal training is illustrated in Figure 1.

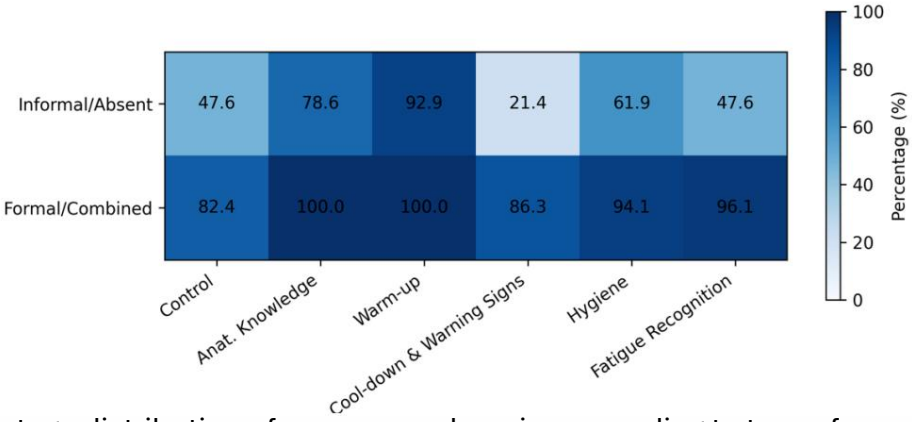

Figure 1. Percentage distribution of awareness domains according to type of vocal training.

DISCUSSION

The results of this study highlight a level of vocal awareness that appears only partially consolidated in contemporary commercial music singers. Although two-thirds of participants reported good perceived vocal control, the descriptive findings suggest that this confidence is not consistently supported by consolidated anatomical, technical, and preventive knowledge. In particular, the area relating to anatomical and physiological awareness showed that only 44.2% of participants demonstrated in-depth knowledge of voice production mechanisms, while over half of the sample (55.8%) reported partial or absent awareness. Considering that this domain included knowledge of the vocal apparatus, mechanisms of voice production and management, postural alignment, breathing in singing, and resonance cavities, these findings suggest that many modern singers develop their skills primarily through experiential learning rather than structured anatomical and functional training.

The data relating to preventive practices are particularly relevant. Although a large proportion of the sample reported awareness of the importance of vocal warm-up, only 43% stated that they practised it regularly, while a substantial percentage applied it inconsistently. Even more critical is the issue of vocal cool-down: only 11.8% reported consistent use, while over one third of participants were unaware of its existence. From a clinical perspective, this finding is noteworthy, as cool-down procedures are considered important strategies for promoting physiological recovery after vocal exertion and reducing the risk of fatigue. A similar discrepancy emerges in the area of vocal hygiene. While 79.6% of participants declared awareness of preventive practices, the systematic adoption of protective behaviours varied considerably. Hydration and avoidance of irritants were the most frequently reported strategies, whereas measures related to reflux management, respiratory allergies, and stress (all factors known to affect vocal function) were less commonly implemented. Approximately 49.5% of participants reported having experienced vocal problems during their singing activity. Although no direct causal inference can be drawn from the present data, the coexistence of limited preventive behaviours and self-reported vocal difficulties suggests a potential association that warrants further investigation. Inferential statistical analysis revealed significant associations between type of vocal training and levels of awareness across multiple domains. In particular, singers with formal or combined training demonstrated higher anatomical and physiological competence, broader knowledge of vocal qualities, and greater adherence to warm-up and cool-down practices compared to participants with exclusively informal or no training. The strongest association was observed for warm-up and cool-down practices (Cramer's V = 0.50), indicating that structured training has a substantial impact on the adoption of preventive behaviours. The study presents some limitations. The use of a convenience sample and self-reported measures may limit the generalisability of the findings. Furthermore, the cross-sectional design does not allow causal interpretations regarding the relationship between vocal awareness and the occurrence of vocal problems. Overall, the findings suggest that vocal training plays a significant role not only in artistic development but also in the promotion of vocal health and sustainability.

CONCLUSION AND RECOMMENDATIONS

This study indicates that vocal awareness among contemporary singers is frequently uneven, with a notable discrepancy between perceived control and objective knowledge of anatomical, technical, and preventive aspects of voice use. The most critical areas concern in-depth understanding of phonatory physiology and the systematic application of preventive practices, particularly vocal cool-down. Structured vocal training emerged as a significant protective factor, associated with higher levels of awareness and greater adoption of health-oriented behaviours. These findings support the integration of anatomical knowledge, self-monitoring strategies, and systematic warm-up and cool-down protocols within contemporary vocal pedagogy. Future research with larger samples and longitudinal designs will be necessary to clarify the relationship between vocal awareness, training pathways, and the long-term incidence of voice disorders.

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DECODING VIBRATO REGULARITY IN A CENTURY OF WESTERN CLASSICAL SINGING

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ABSTRACT

Introduction

Vibrato regularity—the cycle-to-cycle predictability of modulation—is essential for technique and pedagogy, yet large-scale quantification in commercial recordings has been hindered by vocal separation and quality control challenges.

Methods

A corpus of 150 recordings of Händel's "Ombra mai fù," covering various voice types and career tiers, was processed via MusicAI and iZotope RX11 Advanced. Six sustained notes per recording were analyzed in VibratoScope software. Evaluation included: (1) computing Coefficient of Variation (CV) and Sample Entropy (SampEn); and (2) dynamical assessment via recurrence analysis on reconstructed f_0 trajectories to extract Determinism (DET) and mean diagonal length (L). A PCA over (DET, L, SampEn) created a composite regularity index (PC1), where higher values indicate longer, more deterministic recurrences and lower entropy. Data integrity was managed by a "HasVibrato" screening script to ensure cycle consistency. Statistical analyses utilized Kruskal–Wallis, pairwise Wilcoxon (Holm), linear models, and balanced resampling to handle unequal group sizes.

Results

Recurrence plots showed moderate-to-high DET and stable L. By voice type, Boy Sopranos were the least regular, while Sopranos and Tenors ranked highest, particularly in CV of extent and DET/L composites. The voice-type effect for CV of extent persisted after sample-size balancing. Singerlevel rankings showed strong concordance with the PCA regularity index.

Conclusion and Recommendations

Combining dispersion (CV), complexity (SampEn), and temporal structure (DET, L) creates a scalable, meaningful representation of vibrato regularity. Systematic differences across voice types provide data-driven insights for pedagogy and for clinical assessment using professional reference models.

Keywords: *singing voice; vibrato regularity; voice type; acoustic analysis*

INTRODUCTION

Artificial intelligence (AI) has reshaped modern research through tools that automate tasks previously performed manually, while also requiring careful methodological safeguards.[1–3] In singing voice research, one particularly consequential application is music source separation, which enables the isolation of vocal stems from commercial recordings and supports systematic analysis of historically significant and otherwise inaccessible performers.[4,5] This development is especially relevant for the study of elite artists ("superstars"), whose voices cannot be captured under laboratory conditions and whose careers span recording eras that predate contemporary clinical instrumentation.

Once reliable fundamental frequency (fo) trajectories can be extracted from separated vocal tracks, commercial recordings become a practical substrate for large-scale investigation of vibrato, commonly defined as a periodic modulation of fo that is continuously and intentionally used in Western classical singing.[6] Traditional vibrato research has focused primarily on rate (modulation frequency) and extent (modulation magnitude), but recent work has emphasized that regularity— the stability and predictability of cycle structure over time—is an additional dimension with pedagogical and scientific importance.[7],[8] Regularity can be described using dispersion-based measures (e.g., coefficient of variation of cycle time or extent), complexity measures (e.g., sample entropy), and dynamical structure measures (e.g., determinism and diagonal line statistics in recurrence plots).[7] These approaches are attractive because they characterize vibrato beyond mean values and offer interpretable markers of technical stabilization and control.

Despite growing interest, large-scale regularity analysis remains constrained by two practical barriers. First, commercial recordings require robust separation and denoising to minimize interference from accompaniment and historical artifacts. Second, even when fo can be extracted, cycle-level analyses are sensitive to tracking errors, onset/offset transients, and segments lacking stable vibrato. For regularity metrics and recurrence analysis in particular, inconsistent cycle detection or sparse trajectories can inflate entropy and depress recurrence structure, producing misleading "irregularity" unrelated to technique.

The present study addresses these limitations by combining (i) dual separation pipelines for crosschecking (MusicAI and iZotope RX11 Advanced), (ii) standardized selection of six sustained notes per recording from a single aria, and (iii) a dedicated "HasVibrato" screening procedure that retains only segments with contiguous, consistent cycles and a reliably reconstructable dense fo trajectory. Using this quality-controlled dataset, vibrato regularity is quantified across classical voice types. The goal is to provide a scalable, data-driven characterization of vibrato regularity in Western classical singing and to identify systematic differences associated with developmental constraints and vocal category.

METHODS

Corpus and Grouping

A corpus of 150 commercial recordings of Händel's aria "Ombra mai fù" (from Xerxes) was assembled. Recordings were grouped by classical voice type (Soprano, Mezzo-Soprano, Alto, Countertenor, Tenor, Baritone, Bass, Boy Soprano).

Audio Processing and Note Selection

Vocal stems were produced using MusicAI and iZotope RX11 Advanced; both pipelines were retained for cross-checking. Within each track, six sustained notes were extracted, normalized, and analyzed in VibratoScope9 (batch mode). This repeated-note design provides within-singer sampling while keeping musical context constant across the dataset.

Quality Control: "HasVibrato" Screening

Because regularity metrics depend on consistent cycle structure and trajectory reconstruction, each note was labeled HasVibrato = True only when all of the following criteria were met:

1. a minimum number of contiguous vibrato cycles was present;
2. cycle period and amplitude were consistent (no erratic spikes or long gaps);
3. the dense f_0 trajectory could be reconstructed reliably for recurrence computation. Notes failing any criterion were excluded prior to statistics.

The overall workflow of the analysis is summarized in Figure 1.

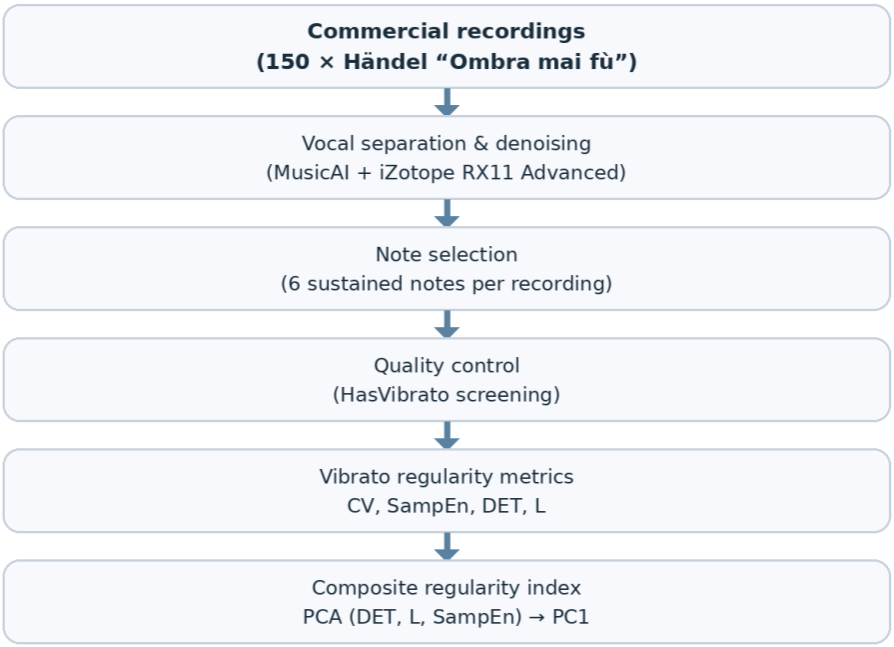

Figure 1. Methods workflow for vibrato regularity analysis. Commercial recordings (n = 150) of Händel's "Ombra mai fù" were processed with vocal separation and denoising (MusicAI and iZotope RX11 Advanced). Six sustained notes per recording were selected and submitted to quality control via HasVibrato screening. Regularity features were computed (CV, SampEn, DET, and mean diagonal length L), and a PCA over (DET, L, SampEn_neg) yielded a composite regularity index (PC1).

Regularity Metrics

Two complementary families of measures were computed:

1. **Dispersion and complexity (cycle-to-cycle):**
   - o Coefficient of Variation (CV) for vibrato rate and extent; 4
   - o Sample Entropy (SampEn) computed on cycle-wise sequences (rate/extent, or cycle-time/value where available).
2. **Dynamical structure (recurrence):**
   - o Recurrence analysis was applied to densely reconstructed f_0 trajectories, yielding Determinism (DET) and mean diagonal length (L). This approach follows recurrence/entropy framing described for vibrato complexity in opera and jazz recordings.[7]

Composite Regularity Index (PCA)

A principal component analysis (PCA) was performed on three features: DET, L, and negative SampEn (SampEn_neg). The first principal component (PC1) served as a composite regularity index: higher PC1 values correspond to longer and more deterministic recurrences together with lower entropy.

Aggregation and Statistical Analysis

Per-note outputs were aggregated to per-singer medians to reduce dependence on note count and to stabilize estimates for group comparisons. Summaries were then computed by voice type. Inferential testing used Kruskal–Wallis for omnibus effects, pairwise Wilcoxon tests with Holm correction, linear models, and balanced resampling (equal-N) as a robustness check for unequal group sizes.

RESULTS

Overall Regularity Distributions

Across all retained notes, recurrence structure was consistently moderate-to-high and diagonal lengths were stable. In the pooled summary, the median DET was 0.592 and the median L was 3.60, indicating that a substantial portion of the reconstructed trajectories formed deterministic recurrence structure rather than purely stochastic fluctuations. The median SampEn was 0.400, consistent with moderate complexity across commercial recordings rather than extreme irregularity.

PCA Regularity Index

PC1 captured the intended composite construct, with positive loadings on DET and L and a positive loading on SampEn_neg (so lower entropy increases PC1). This confirms that the index aligns with the conceptual definition of "regularity" as greater deterministic structure and longer diagonals combined with reduced unpredictability.

Voice Type Effects

Voice type differences were also apparent. Boy Sopranos were the least regular (PC1 median = −0.654), while Sopranos and Tenors ranked highest (PC1 medians 0.257 and 0.246, respectively). Mezzo-sopranos and countertenors showed intermediate-to-lower values(PC1 medians −0.019 and −0.113). Importantly, the voice-type effect observed for CV of vibrato extent persisted after balanced resampling, supporting robustness to unequal group sizes (Figure 2).

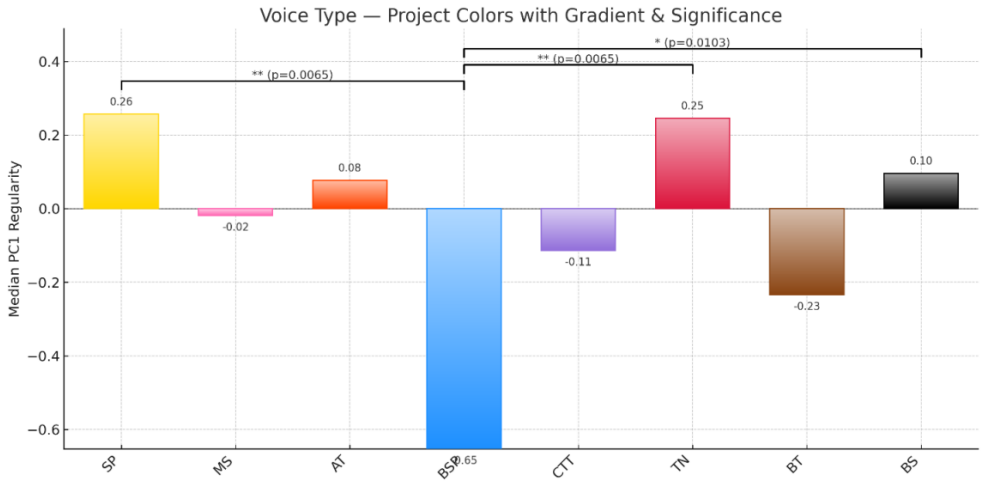

Figure 2. PC1 vibrato regularity by voice type. Bars show singer-level median PC1 regularity for each voice type. Brackets indicate statistically significant pairwise comparisons (Holm-corrected). Higher PC1 values indicate greater vibrato regularity.

Singer-Level Rankings and Concordance

Ranking singers by the PCA regularity index yielded strong concordance with an index based on DET and L. These rankings suggest that the composite index provides a stable ordering of regularity across performers rather than reflecting idiosyncratic behavior of a single metric.

DISCUSSION

This study demonstrates that vibrato regularity can be quantified at scale in commercial recordings when separation, denoising, and quality control are treated as first-order methodological constraints. Regularity was measurable and structured in commercial classical singing once stable vibrato segments were retained. The overall DET and L values indicate that vibrato trajectories commonly exhibit deterministic recurrence structure, consistent with the expectation that classical vibrato is not random modulation but an intentionally stabilized technique. This aligns with the broader view that vibrato is a controlled, style-sensitive phenomenon in Western classical traditions.[6], [8]

Voice type differences highlight developmental and physiological constraints. Boy Sopranos were consistently least regular, and this pattern remained robust in the balanced analyses for CV of extent. This aligns with the premise that vibrato control depends on vocal maturity and stable neuromuscular coordination, which can be limited in child voices. By contrast, Sopranos and Tenors ranked highest in the composite and in dispersion-based measures, suggesting that in this repertoire and note-selection context, these groups exhibit relatively stable cycle-to-cycle control. Methodologically, the study extends recent vibrato work emphasizing complexity and recurrence analysis.[7] Rather than relying solely on variability measures or single statistics, the composite index integrates dispersion (CV), complexity (SampEn), and temporal structure (DET, L), producing an interpretable regularity axis.

CONCLUSION AND RECOMMENDATIONS

Vibrato regularity can be characterized at scale in commercial Western classical recordings using a pipeline that integrates separation/denoising, rigorous vibrato screening, and complementary regularity metrics. A composite regularity index based on recurrence structure (DET, L) and complexity (SampEn) provides a scalable representation in which higher values correspond to more deterministic, longer recurrences and lower entropy. Systematic differences across voice types provide data-driven support for pedagogical models emphasizing technical stabilization and can inform clinical or teaching contexts where “professional reference models” are used to motivate targets for vibrato consistency.

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ACOUSTIC STRATEGIES IN THE AZERBAIJANI GHAZAL-ROMANCE SEVGILI CANAN: PERFORMANCES BY SINGERS REPRESENTING OPERATIC, CHAMBER, AND MUGHAM TRADITIONS

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While vibrato, resonance, and formant-related parameters are central to acoustic descriptions of professional singing, they are most often examined within Western vocal paradigms, leaving stylistic diversity in culturally hybrid repertoires underexplored. Within this broader context, the Azerbaijani ghazal-romance (qəzəl-romans) constitutes a stylistically autonomous vocal genre governed by a stable and culturally specific performance norm. Uzeyir Hajibeyli's ghazal-romance Sevgili Canan, which integrates mugham-based intonation with European art-song form, provides a unique test case for examining how divergent vocal lineages realise the same musical material through distinct physiological and acoustic strategies. This study analyses the climactic sustained vowel /i/ in the word çünki from the ghazal-romance Sevgili Canan as produced by six elite Azerbaijani singers representing operatic, chamber, and mugham traditions (Murtuza Mammadov, Muslim Magomayev, Alim Qasimov, Yusif Eyvazov, Ramil Qasimov, Anar Shushaly). Using Praat and VoceVista software, fundamental frequency, formant distribution, long-term average spectrum (LTAS), and vibrato parameters were compared. All singers demonstrate stable phonation and well-defined formant structures, confirming high levels of vocal motor control. However, systematic differences emerge in resonance tuning and vibrato behaviour. Operatic voices exhibit a pronounced singer's formant cluster and broader vibrato depth, supporting projection and orchestral balance, whereas mugham-based singing shows a higher pitch centre, more flexible formant tuning, and narrower vibrato, aligning with speech-derived intonation and modal expressivity. Vibrato rates across all performers fall within physiologically normative limits (approximately 5–6 Hz), yet vibrato depth varies widely (approximately 40–80 cents), reflecting divergent aesthetic and pedagogical priorities rather than vocal health or technical competence. These findings demonstrate that acoustic parameters of professional singing cannot be interpreted in isolation from genre, pedagogy, and cultural context. The study therefore supports a culturally responsive, evidence-based approach to vocal training and singing voice assessment, directly relevant to contemporary debates in professional voice pedagogy and acoustic applications in singing education.

Keywords: *vocal acoustics, vibrato analysis, formant tuning, Azerbaijani ghazal-romance, vocal pedagogy*

Introduction

Late 19th- and early 20th-century European art-song genres (German Lied, French mélodie, Russian romance, etc.) developed as culturally specific systems shaped by language, poetic meter, and national vocal traditions. In these chamber-vocal genres, textual intimacy and nuanced expression are paramount, in contrast to the projection-focused demands of grand opera. Vocal acoustics studies have shown that singing technique adapts to style: parameters like vibrato rate, resonance tuning, and timbre balance are intentionally shaped by aesthetic conventions[1,2]. Thus, acoustic features observed in professional singing must be interpreted within cultural context rather than assumed universal. From a voice science perspective, this implies that physiologically healthy phonation may manifest through different acoustic targets depending on stylistic and cultural constraints. Within this broader landscape, the Azerbaijani ghazal-romance occupies a distinctive hybrid niche. Pioneered by composer Uzeyir Hajibeyli in the early 20th century, the ghazal-romance fuses Western art-song form (tonal harmony, piano-accompaniment, formal structure) with modal melodic elements and poetic principles derived from the traditional mugham vocal style[3] . Sevgili Canan (1943), a setting of a ghazal (poetry) by medieval poet Nizami Ganjavi, is a canonical example. This genre requires the singer to honor the declamatory narrative of the text while also navigating the flexible, improvisatory ornamentation of mugham. As Safarova notes, the melody in such romances is tightly interwoven with the poetic meter, so that even minor deviations in timing or articulation can alter the piece's character[3] .

These demands place competing constraints on phonatory stability, vibrato deployment, and resonance tuning, making the genre particularly suitable for comparative acoustic investigation. Despite extensive research on operatic and Western artsong singing, hybrid repertoires such as the Azerbaijani ghazal-romance remain largely absent from empirical acoustic literature. Comparing vibrato behavior and spectral features among operatically trained singers and those rooted in mugham can isolate stylistic variables while holding the composition constant. This approach avoids conflating genre with repertoire: rather than comparing different pieces, the author examines one ghazal-romance across interpreters. Based on vocal acoustics research, the author hypothesizes that operatic performers will emphasize stable resonance and a prominent singer's formant[1] , whereas mugham specialists may allow more pitch flexibility and use vibrato more sparingly. The author aims to determine how these stylistic orientations manifest acoustically, thereby informing both voice science and style-sensitive vocal pedagogy. By analyzing the same ghazal-romance across singers from operatic, chamber, and mugham traditions, this study demonstrates that multiple genre-specific acoustic strategies can support professional-level singing, challenging the assumption of a single universal acoustic standard.

Methods

This study employed a comparative, non-clinical acoustic analysis within a genre-sensitive framework. The focus was on measurable acoustic parameters associated with professional singing practice across different vocal traditions, examined within a single musical work. All analyses were conducted on publicly available commercial recordings and broadcast performances. The study involved acoustic examination of existing sound material only and did not include interaction with participants, clinical assessment, or collection of personal data. All references to individual performers are made solely for analytical purposes and do not involve clinical, diagnostic, or evaluative assessment.

The analyzed material consisted of performances of the climactic sustained vowel /i/ in the word çünki from the ghazal-romance Sevgili Canan by Uzeyir Hajibeyli, presented in solo recital contexts. Six professional Azerbaijani singers representing distinct vocal traditions and training backgrounds were included in the analysis in order to enable stylistic comparison within a shared musical context. The corpus comprised performers associated with Western classical operatic training, national mugham-based vocal practice, and hybrid or transitional vocal profiles. Specifically, Murtuza Mammadov (nicknamed Bulbul, meaning "nightingale" in Azerbaijani), the first performer of the romance Sevgili Canan, is represented as an operatically trained tenor whose early vocal formation originated in the traditional khanende (mugham singer) practice; Muslim Magomayev is included as an operatic baritone who later developed a prominent crossover career into popular music; Alim Qasimov represents the traditional mugham singing with exclusive grounding in mugham performance practice; Yusif Eyvazov is classified as a Western-trained operatic tenor; Ramil Qasimov and Anar Shushaly represent classically trained tenors whose vocal profiles integrate elements of both Western operatic technique and national Azerbaijani vocal aesthetics. This classification was adopted to reflect not only formal vocal training but also historically and stylistically embedded performance identities, which form the basis for the subsequent acoustic and interpretative analysis.

Prior to acoustic measurement, the vocal component of each audio file was attenuated from the commercial recordings using computer-based signal processing techniques in order to reduce the influence of accompanying instrumentation and to improve the reliability of voice-specific acoustic measurements. For analytical consistency, the vocal samples were resampled to a sampling rate of 16,000 Hz using the Sopran4 acoustic software. Subsequent computer-based voice analysis of the singing voice was carried out using acoustic computer software Praat5 for fundamental frequency (F0) and spectral parameters and VoceVista6 - for vibrato characteristics. Vibrato rate (the frequency of periodic pitch oscillations), vibrato extent (peakto-peak frequency deviation), and mean F0 were obtained across the selected phrase. Formant structure (F1–F4) was examined to assess resonance strategies, and long-term average spectrum (LTAS) analysis was applied to evaluate overall spectral energy distribution and the presence of a singer's formant cluster in the 2.5–3.5 kHz region.

Results

Vibrato Rate and Vibrato Extent

Across all six performances, acoustic analysis revealed stable phonation with regular vibrato modulation and clearly defined harmonic structures. Vibrato rate fell within physiologically typical limits for trained male voices, ranging from 4.9 to 6.1 Hz (Figure 1). Rates were tightly distributed across singers and showed no systematic separation between operatic tenors, the operatic baritone, and mugham-oriented performers. This convergence indicates that, within this professional corpus, vibrato rate is less stylistically differentiating. In contrast, vibrato extent emerged as a highly differentiating acoustic parameter across performers. Peak-to-peak pitch excursion ranged from 39 to 78 cents (approximately 2.2–4.5% of the fundamental frequency), revealing clear stratification aligned with vocal training and stylistic orientation (Figure 1).

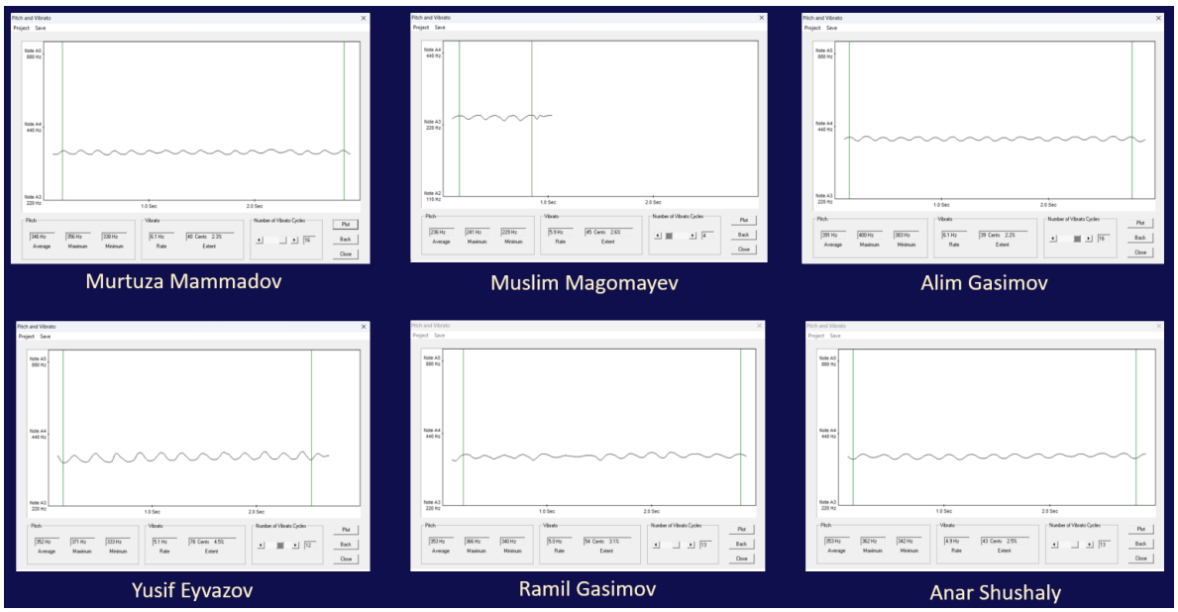

Figure 1. Vibrato waveforms and parameters obtained from the VoceVista acoustic software for the vowel /i/ (in the word çünki) in the ghazal-romance Sevgili Canan, performed by six singers.

The classically-trained operatic tenor Yusif Eyvazov (≈78 cents; 4.5%), who exhibited the widest vibrato excursion in the corpus, as well as Ramil Qasimov (≈54 cents; 3.1%), Anar Shushaly (≈43 cents; 2.5%), and the operatic baritone Muslim Magomayev (≈45 cents; 2.6%) demonstrated broader vibrato extents above 2.5%. Narrower vibrato extents were observed in khanende Alim Qasimov (≈39 cents; 2.2%) and Murtuza Mammadov (Bulbul) (≈40 cents; 2.3%), whose vocal profile embodies a synthesis of classical operatic training and early formation within the mugham singing tradition.

Fundamental Frequency (F0)

Four singers with predominantly tenor vocal profiles—Murtuza Mammadov, Yusif Eyvazov, Ramil Qasimov, and Anar Shushaly—exhibited mean F0 values centered around approximately 350 Hz. By contrast, the operatic baritone Muslim Magomayev demonstrated a substantially lower mean F0 of 236 Hz, consistent with baritone register placement. At the upper extreme, Alim Qasimov, representing the mugham singing tradition, exhibited the highest mean F0 of 391 Hz.

Formant Tuning Strategies

Formant–harmonic relationships revealed distinct resonance strategies across performers (see Figure 2). Four singers with predominantly operatic vocal profiles—Murtuza Mammadov, Yusif Eyvazov, Ramil Qasimov, and Anar Shushaly—demonstrated a highly consistent resonance strategy. In these voices, the first formant (F1) aligned closely with the first harmonic (H1), while the second formant (F2) coincided with the fifth harmonic (H5). This configuration facilitates efficient acoustic coupling between the vocal tract resonances and the harmonic spectrum, supporting vocal projection, tonal clarity, and spectral reinforcement typical of Western operatic technique.

In contrast, Alim Qasimov and Muslim Magomayev exhibited fundamentally different resonance strategies. Alim Qasimov's formant positioning showed alignment of F1 mainly with H2 and F2 with H4. In Muslim Magomayev's performance, the first formant appears tuned close to the second harmonic, while the second formant appears to fall within the H6–H7 region.

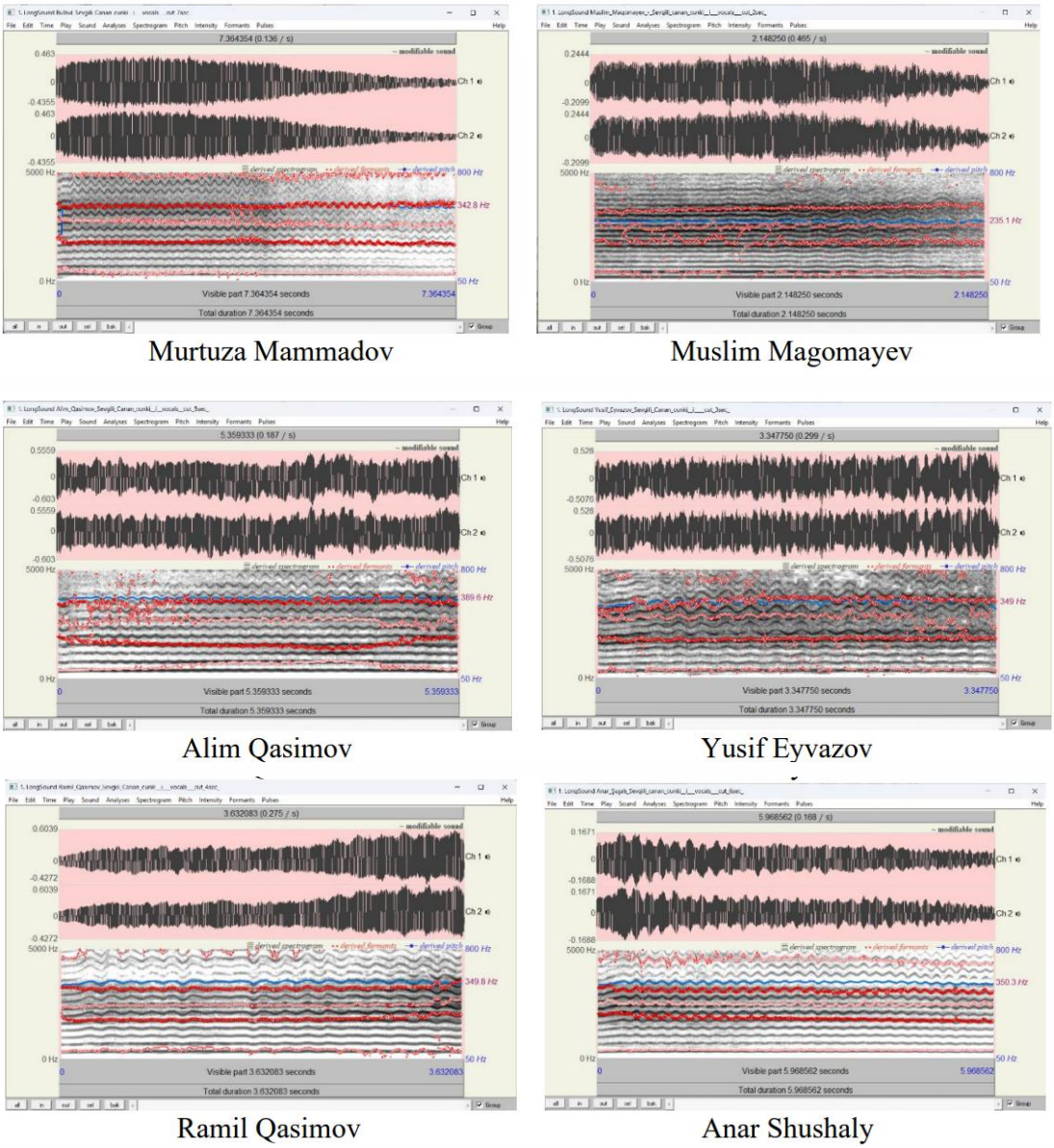

Figure 2. Visualization of fundamental frequency (F0), formants, and overtones using Praat acoustic software for the vowel /i/ (in the word çünki) in the ghazal-romance Sevgili Canan, performed by six singers.

Long-Term Average Spectrum (LTAS)

Long-term average spectrum (LTAS) analysis revealed systematic differences in the distribution of spectral energy across performers associated with different vocal traditions. In singers with predominantly operatic or operatically informed vocal profiles—including Murtuza Mammadov, Muslim Magomayev, Yusif Eyvazov, Ramil Qasimov, and Anar Shushaly—LTAS profiles showed a more pronounced singer's formant – a relative concentration of energy in the upper mid-frequency region (approximately 2.5–3.0 kHz). The LTAS profile of khanende Alim Qasimov was characterized by a different resonance tuning approach, with primary emphasis on low-mid frequency range. Differences in spectral energy distribution reflect stylistically conditioned resonance strategies rather than differences in vocal efficiency or technical control[7] .

Discussion

The comparative analysis indicates that acoustic differences in Sevgili Canan arise largely from stylistic orientation rather than from simple physiological or technical disparity among singers. All performers demonstrated professional-level control (stable pitch, healthy vibrato, clear resonance), but they activated different vocal schemas based on their training. Operatically trained singers approached the ghazal-romance with projection-oriented strategies: they maintained a rich, evenly spaced harmonic spectrum and stable vibrato, enhancing tonal continuity. This aligns with well-documented operatic technique, where a clear singer's formant and consistent vibrato support carrying power and perceptual richness[1]. In contrast, the mugham-rooted singers allowed greater pitch flexibility and treated vibrato as a local expressive device. For example, their vibrato often appeared only on longer notes or climactic peaks, and they used micro-glissandi and ornamental inflections between notes. This reflects mugham aesthetics, which favor speech-like declamation and modal coloring over uniform vibrato. The performance of virtuoso mugham singer Alim Qasimov exemplifies this approach: his recordings of ghazal-romances are characterized by variable vibrato deployment and a lighter, more modal tone. Importantly, these differences should not be interpreted as technical inferiority or reduced vocal efficiency within professional voice assessment frameworks. Rather, they illustrate distinct expressive intentions. In a classical paradigm, vibrato uniformity and formant strength signal vocal "richness"[2,8] , whereas in mugham tradition, vocal color derives from rhythmic freedom and intonation nuance. The stable vibrato rates (5–7 Hz) observed across all singers confirm that each voice operated within healthy norms, regardless of style. Under conditions of identical musical material, systematic differences in mean fundamental frequency point distinct modes of vocal anchoring and tessitural organization: the operatic tenor voices converge around a shared F0 domain near 350 Hz, the operatic baritone is situated in a markedly lower register-centered region (≈236 Hz), while the khanende occupies an elevated pitch domain approaching 391 Hz, consistent with the modal and tessitural logic of mugham performance practice. These findings challenge the notion of a single "ideal" acoustic target for singing. Contemporary voice science increasingly recognizes that multiple acoustical configurations can support efficient, beautiful tone[2,9]. Our data support this by showing that professional singers achieve complete performances through different resonance and vibrato strategies. In practice, this means that rigidly applying Western operatic criteria to evaluate a mugham-influenced performance can be misleading. For instance, a teacher expecting a strong singer's formant or wide, continuous vibrato might wrongly perceive a stylistically appropriate mugham rendition as weak. Similarly, a clinician assessing voice health should not confuse the naturally narrower vibrato of certain genres with a pathology. Howes et al. reported that listener judgments of vibrato quality do not always correlate with objective metrics; our results reinforce that the perceptual norms are culturally framed[10] .

From a musicological and vocal-pedagogical perspective, it is essential to acknowledge that Uzeyir Hajibeyli conceived the ghazal-romance not as an operatic or purely traditional vocal form, but as an inherently chamber, intimate genre situated between Western art song and mugham declamation. Its aesthetic core relies on refined intonation, textual intimacy, and controlled expressive restraint rather than on operatic projection or fully traditional mugham improvisation. Consequently, while performances rooted in operatic, mugham, or hybrid vocal traditions can each achieve compelling artistic results and contribute to the wider dissemination of the genre, the interpretative balance most closely aligned with the composer's stylistic intent lies in a chamber-oriented vocal approach. Such an approach preserves the delicate equilibrium between classical vocal discipline and modal-intentional flexibility, which constitutes the defining expressive identity of the ghazal-romance as a distinct vocal genre.

A critical implication is for vocal pedagogy and assessment: training and evaluation must be style-sensitive. A "one-size-fits-all" model risks suppressing valid expressive differences[2]. Instead, instructors should incorporate knowledge of genre conventions. For example, students learning ghazal-romance should be encouraged to maintain text clarity and flexible phrasing, even if this slightly reduces the prominence of operatic resonances. Conversely, students of Western art song should build the sustained vibrato and formant focus valued in that idiom.

Such culturally responsive pedagogy aligns with recent calls in voice research to prioritize functional efficiency and vocal health across traditions rather than enforce a single ideal[8,9]. Limitations of this study include the small sample size and focus on a single work. While Sevgili Canan is representative, analysis of additional ghazal-romances and singers would strengthen generality. Our acoustic measures provide objective data but cannot fully capture subjective qualities like timbre or emotional impact; future work should include listener perception studies. Nonetheless, the results contribute to a growing body of evidence that stylistic context is essential for interpreting singing acoustics. Conclusion and Recommendations In sum, the Azerbaijani ghazal-romance Sevgili Canan demonstrates that professional singing can accommodate multiple acoustic solutions. Operatic, chamber, and mugham singers all produce healthy, efficient tone, yet they manifest different vibrato and spectral patterns in line with their training. Rather than ranking one approach above another, the author advocates a culturally responsive model of voice analysis. While stylistically diverse interpretations may enrich the performance history and international visibility of Sevgili Canan, the ghazal-romance as conceived by Hajibeyli remains fundamentally rooted in a chamber-oriented aesthetic that prioritizes intimacy, intonational nuance, and balanced vocal restraint. Recognition of this distinction is essential for both pedagogical guidance and culturally sensitive voice assessment. For researchers and educators, this implies assessing ghazal-romance and comparable repertoires on their own terms rather than against default Western operatic benchmarks. Expanding voice science to include diverse singing traditions—and training voice teachers to recognize the legitimacy of multiple vocal aesthetics—is therefore a methodological necessity if vocal analysis and pedagogy are to remain culturally accurate and scientifically responsible.

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EXAMINATION OF VOICE AND SWALLOWING CHARACTERISTICS IN INDIVIDUALS WITH AND WITHOUT CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD): A PRELIMINARY STUDY

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Abstract

Objective: The aim of this study is to examine the presence of swallowing symptoms in individuals diagnosed with Chronic Obstructive Pulmonary Disease (COPD), together with the acoustic and aerodynamic characteristics of the voice, and to compare the findings with those of a healthy control group. Additionally, the study seeks to identify the potential effects of swallowing symptoms on voice parameters.

Method: The study included individuals aged 45–65 years diagnosed with COPD and age- and sex-matched healthy controls. Data were collected using the Informed Consent Form, Demographic Information Form, mMRC Dyspnea Scale, Pulmonary Function Test results, MMSE, EAT-10, MDVP, aerodynamic measurements, SHI-10, GRBAS, and the Vocal Tract Discomfort Scale. Aerodynamic assessment was complemented by a timed water swallow test, from which total swallowing duration, number of swallows, volume per swallow, and swallowing speed were calculated.

Results:
The study included 8 healthy controls and 6 individuals with COPD. No statistically significant differences were found between the COPD and healthy groups in terms of mean s/z ratio or maximum phonation time ($p>0.05$). Similarly, no significant differences were observed between groups regarding total scores on the Vocal Tract Discomfort Scale and the SHI-10 ($p>0.05$). Although the volume per swallow was lower in the COPD group during the timed water swallow test, the difference was not statistically significant ($p>0.05$). Correlation analysis revealed strong positive correlations between volume per swallow and total swallowing speed, and strong negative correlations between total swallowing duration and both volume per swallow and total swallowing speed ($p<0.001$). Acoustic parameters tended to be less favorable in the COPD group. Conclusion: In individuals with COPD, voice- and swallowing-related measures showed a less favorable trend compared to healthy individuals; however, statistically significant differences couldn't be demonstrated due to the limited sample size. The strong relationships among timed water swallow parameters support the intrinsic connections within swallowing physiology.

Keywords: *aerodynamic measurements, COPD, EAT-10, swallowing disorders, voice acoustic analysis*

Introduction

Swallowing and breathing are tightly coordinated physiological processes, and disruptions in this coordination are well-documented in COPD. Prior work has shown that individuals with COPD frequently exhibit swallow–breathing discoordination, increasing vulnerability to penetration–aspiration and compromising airway safety[1] . Similarly, large-scale cohort findings indicate that swallowing symptoms are common in stable COPD; for example, Gonzalez Lindh et al. (2019)[2] reported that 33% of patients experience at least some degree of swallowing difficulty, which is significantly associated with greater dyspnea severity and reduced physical capacity, even when lung function remains within expected clinical ranges.

In addition to swallowing-related impairments, COPD has been shown to influence phonatory function. Shastry et al. (2014)[3] demonstrated that individuals with COPD present with reduced fundamental frequency, increased acoustic perturbation measures, and greater noise components in the speech signal, suggesting that compromised respiratory physiology can negatively affect voice acoustics. Further supporting the interconnected nature of respiration, phonation, and swallowing, Węglarz et al. (2025)[4] found that individuals with COPD exhibit altered breathing patterns, lower voice frequency, and stronger correlations between respiratory and acoustic parameters compared with healthy controls.
This study aims to examine the presence of swallowing symptoms in individuals diagnosed with COPD, along with the acoustic and aerodynamic characteristics of their voice, and to compare these findings with those of a healthy control group. Additionally, it seeks to identify the potential effects of swallowing symptoms on voice parameters.

Methods

The study cohort consisted of individuals aged 45–65 years with a confirmed diagnosis of COPD and healthy control participants matched for age and sex. Data were obtained using the Informed Consent Form, Demographic Information Form, mMRC Dyspnea Scale, Pulmonary Function Test outcomes, MMSE, EAT-10, MDVP, aerodynamic assessments, SHI-10, GRBAS, and the Vocal Tract Discomfort Scale. The aerodynamic evaluation was additionally supported by a timed water swallow test, from which total swallowing time, number of swallows, volume per swallow, and swallowing velocity were calculated. The assessment tools applied in this study are supported by robust psychometric evidence across the literature. The Eating Assessment Tool-10 (EAT-10) demonstrates excellent internal consistency (Cronbach's $\alpha = 0.96$) and strong test–retest reliability, along with well-established criterion validity for identifying dysphagia severity[5] . Similarly, the modified Medical Research Council (mMRC) Dyspnea Scale shows acceptable validity and reliability in clinical populations, with studies reporting moderate correlations with dyspnea-related measures and adequate test–retest agreement[6]. The Multi-Dimensional Voice Program (MDVP) provides reliable acoustic measurements, with research showing high robustness and strong parameter reliability in both typical and disordered voices[7]. The GRBAS perceptual rating scale also demonstrates high intra- and interrater reliability, with intraclass correlation coefficients ranging from 0.923 to 0.985 and strong consistency with other perceptual protocols[8]. The Vocal Tract Discomfort Scale (VTDS) likewise exhibits strong psychometric properties, including excellent internal consistency (Cronbach's $\alpha \approx 0.92$–0.96), strong test–retest reliability, and solid criterion and discriminative validity[9]. Lastly, although the SHI-10 has been studied less extensively, available research shows that it retains an interpretable factor structure with acceptable reliability and modest nomological validity, supporting its cautious use in behavioral health assessment[10].

Results

The study included a total of 14 participants, comprising 8 healthy controls and 6 individuals diagnosed with COPD. Across the acoustic and aerodynamic measures examined, no statistically significant differences emerged between the COPD and healthy groups in terms of the mean s/z ratio or maximum phonation time ($p>0.05$). These findings suggest that basic phonatory efficiency, as captured through these commonly utilized clinical metrics, did not demonstrate measurable group-level disparities within the constraints of the present sample. Similarly, no significant differences were observed in total scores on the Vocal Tract Discomfort Scale or the SHI-10 ($p>0.05$), indicating that self-reported symptoms related to vocal tract discomfort and sleep hygiene behaviors did not differ appreciably between groups.
Although the COPD group demonstrated a lower volume per swallow during the timed water swallow test, this reduction did not reach statistical significance ($p>0.05$). Nevertheless, the correlation analysis provided important insight into swallowing physiology. Strong positive correlations were identified between volume per swallow and total swallowing speed, whereas strong negative correlations were observed between total swallowing duration and both volume per swallow and total swallowing speed ($p<0.001$). These robust associations underscore the internal coherence of the timed swallow parameters and reflect the tightly integrated nature of temporal and volumetric aspects of swallowing performance.

In addition, acoustic parameter performance tended to be less optimal in the COPD group, suggesting a possible trend toward reduced voice quality or stability. While these tendencies did not rise to the level of statistical significance, likely due to the limited sample size, they align with existing evidence indicating that respiratory compromise in COPD may subtly influence vocal acoustic characteristics even in the absence of overt functional impairment.

Conclusion and Recommendations

In individuals with COPD, voice- and swallowing-related measures showed a less favorable trend compared to healthy individuals; however, statistically significant differences could not be demonstrated due to the limited sample size. The strong relationships among timed water swallow parameters support the intrinsic connections within swallowing physiology. n individuals diagnosed with COPD, the overall pattern of voice- and swallowing-related outcomes revealed a generally less favorable profile compared to healthy participants, suggesting a subtle but clinically meaningful vulnerability across both physiological domains. Despite these observable tendencies, statistical significance could not be established, largely due to the restricted sample size, which limited the power to detect group differences with sufficient precision. Nonetheless, the directionality of the findings aligns with established literature indicating that COPD-related respiratory impairment can influence multiple aerodigestive functions simultaneously, often in ways that are measurable yet modest in magnitude when cohorts are small. Within this context, the strong associations identified among the parameters derived from the timed water swallow test provide particularly compelling evidence regarding the inherent coordination required for effective swallowing. Specifically, the consistent and robust relationships between swallowing duration, volume per swallow, and swallowing speed highlight the interdependent nature of biomechanical components that govern safe and efficient deglutition. These correlations reinforce the view that swallowing is not an isolated motor task but rather a tightly integrated physiological process in which temporal sequencing, respiratory control, and neuromuscular efficiency operate as a unified system. For individuals with COPD, even mild disruptions in respiratory capacity may subtly interfere with this integration, contributing to altered swallowing performance despite the absence of overt clinical symptoms or statistically significant group-level impairments. Consequently, the present findings underscore the importance of evaluating not only absolute performance metrics but also the internal consistency and relational patterns among swallowing measures when investigating populations with compromised respiratory function. Such relational analyses may offer earlier or more sensitive indicators of functional vulnerability than single-parameter comparisons alone, thereby providing valuable insight into the underlying physiology of swallowing in chronic respiratory disease.

Keywords: *aerodynamic measurements, COPD, EAT-10, swallowing disorders, voice acoustic analysis*

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VOXAPP: A SMARTPHONE TOOL FOR MULTİLİNGUAL CLİNİCAL AVQI AND ABI MEASUREMENT

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ABSTRACT

Introduction

Smartphones are within reach, creating an opportunity to bring laboratory-grade acoustic voice assessment into everyday clinical and research contexts. Evidence suggests that key acoustic measures such as the Acoustic Voice Quality Index (AVQI) can be estimated reliably from smartphone recordings when appropriate protocols are followed, narrowing the gap between telephone and laboratory recordings for clinical use. VoxApp was conceived to harness this potential in a multilingual, user-friendly application for iOS and Android.

Methods

VoxApp records sustained vowels and connected speech through the built-in microphone, following standardized recording instructions embedded in the interface to support protocol adherence. Audio is transferred to a secure Linux server that runs Praat scripts for preprocessing, segmentation and extraction of AVQI, Acoustic Breathiness Index (ABI) and fundamental frequency (fo). The app provides a localized interface in Brazilian Portuguese, English, German, Spanish, and Italian, including language-specific AVQI and ABI cut-off values derived from published data, and results exportable as PNG or PDF reports for clinical records. Planned expansion includes additional languages.

Results

The current implementation demonstrates robust end-to-end performance across iOS and Android, with seamless communication between the mobile client and the Praat backend. Users receive immediate visual feedback of AVQI, ABI and f_o, can review previous recordings in an organized history view, and can generate shareable graphical and PDF summaries suitable for clinical documentation and longitudinal monitoring during in-person therapy. Although clinical validation is ongoing, the analytical pipeline adheres closely to protocols and computational approaches previously validated for smartphone-based AVQI estimation.

Conclusion

VoxApp showcases how standardized acoustic voice assessment can be delivered on widely available smartphones through a multilingual, protocol-driven interface underpinned by a Praatbased Linux backend. By combining language-specific cut-off values, detailed parameter displays and flexible export options, the app is positioned as a foundation for future multicenter validation studies and the addition of further languages and acoustic indices.

Keywords: *Smartphones; Voice Quality; Voice Disorders; Speech Acoustics; Praat; AVQI; ABI*

INTRODUCTION

Objective acoustic assessment is an important complement to perceptual judgment and patientreported outcomes in clinical voice evaluation. A key practical barrier is that laboratory-grade acquisition (calibrated microphones, controlled environments, standardized workflows) is often unavailable in community clinics, outreach services, and telehealth-adjacent contexts. Smartphones have become ubiquitous and technically capable of high-quality local audio capture, motivating efforts to translate validated acoustic indices from laboratories into mobile workflows. This opportunity must be approached cautiously. Telepractice studies show that videoconferencing transmission can significantly degrade acoustic signals and, by consequence, distort many voice measures.

In a comparative study across videoconferencing platforms, all investigated platforms significantly affected the speech signal, and nearly all acoustic measures were significantly impacted by platform transmission, with mean f_o being among the most robust measures.[1]
This evidence supports workflows that avoid platform-transmitted audio for acoustic computation and instead rely on local recording followed by controlled, reproducible analysis.
Two multiparametric indices are particularly relevant for standardized mobile assessment. The Acoustic Voice Quality Index (AVQI) was developed as an objective index of dysphonia severity that combines sustained vowel and connected speech to improve ecological validity for outcome tracking.[2] Subsequent research supports AVQI as a robust global measure when task materials and editing rules are standardized. The Acoustic Breathiness Index (ABI) extends the multiparametric approach to breathiness and was developed as a multivariate acoustic correlate of perceived breathiness severity.[3] Together, AVQI and ABI offer clinically interpretable composite measures that align with common clinical constructs (global severity and breathiness) while leveraging multiple acoustic features to reduce reliance on any single descriptor.
Evidence directly addressing smartphone capture is encouraging but not definitive. A study comparing AVQI obtained using smartphones to AVQI obtained using an oral microphone reported that smartphone-derived AVQI can be accurate, and that AVQI estimates remained acceptable under added ambient noise conditions (under the study's protocol and analysis approach).[4] In parallel, "voice screening" mobile applications have been evaluated as feasible tools for AVQIbased measurement and clinical monitoring in patient cohorts, highlighting both the potential and the need for careful standardization. [5,6]
A major remaining issue is validation in the exact conditions of use. Smartphone models differ in microphone response, built-in processing, and OS-level audio pipelines. Ambient noise, mouth-tomicrophone distance, and recording instructions can materially influence features that feed composite indices. Moreover, normative thresholds and cut-off values for AVQI and ABI are language- and protocol-specific, with Brazilian Portuguese validation work demonstrating that AVQI performance depends on the connected-speech material and methodological choices.[7] For English speakers, recent validation studies report specific thresholds for AVQI and ABI that optimize discrimination within their cohorts.[8] These considerations motivate multilingual, protocol-driven implementations that can enforce tasks, compute indices consistently, and support large-scale validation.
VoxApp was conceived to implement a standardized, multilingual smartphone workflow for AVQI, ABI, and f_o measurement using local recording paired with centralized server-side computation via Praat. Clinical validation is ongoing; therefore, the purpose of this full text is to describe VoxApp's architecture and computational workflow and to situate the tool within peer-reviewed evidence on composite indices and mobile voice assessment, while outlining a validation roadmap consistent with current literature.

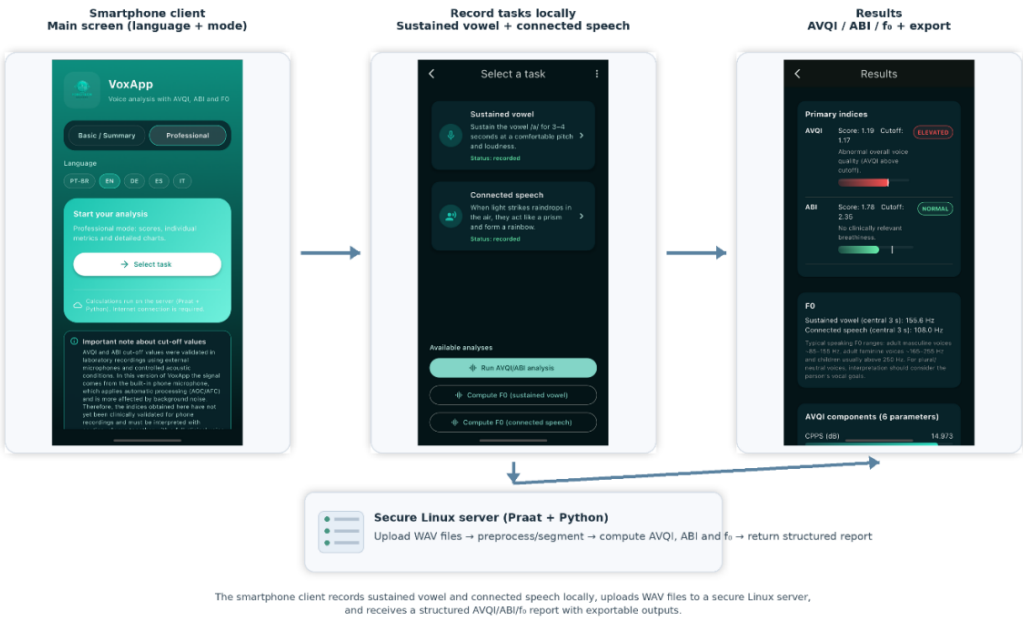

Figure 1. VoxApp workflow. The smartphone client records sustained vowel and connected speech locally, uploads WAV files to a secure Linux server, and receives a structured AVQI/ABI/fo report with exportable outputs.

METHODS

System Overview

VoxApp is a smartphone application for iOS and Android that captures (i) sustained vowel phonation and (ii) connected speech using the built-in microphone. Recording instructions are embedded in the interface to support protocol adherence (task completion, stable distance, and consistent effort). Audio is transferred to a secure Linux server that executes Praat scripts for preprocessing, segmentation, and metric extraction.

Backend Service and Endpoints

Server-side processing is implemented via a FastAPI backend exposing endpoints for AVQI/ABI analysis and for optional fo-only extraction. The main endpoint accepts a connected speech WAV and sustained vowel WAV plus a language code, stores inputs, runs the AVQI/ABI pipeline, and returns a structured report. This behavior is implemented in the /analyze_avqi_abi.py route, which calls the analysis function and returns the report object.

Robust WAV Handling for Praat Compatibility

Because smartphone recordings may vary in encoding and channel layout, the backend rewrites incoming WAV files into a Praat-friendly canonical format. Specifically, it forces mono, writes PCM_16 WAV, preserves sample rate, and removes NaN/Inf values defensively. This step reduces failure risk and improves reproducibility when calling Praat in batch mode.

Job Isolation and Praat Batch Execution

To avoid collisions during concurrent usage, each run is isolated into a unique job directory. Praat is called using --run with explicit arguments that include the connected speech WAV, sustained vowel WAV, and an output path for results. Output is parsed from a tabulated file into a metrics dictionary, and pitch contours are loaded (when present) from CSV files into the returned structure.

Computed Outputs and Report Structure

The backend structures outputs into (i) primary indices (AVQI, ABI) with score, cut-off, status, and interpretive message; (ii) AVQI component parameters; (iii) ABI component parameters; and (iv) fo metrics and associated contours for sustained vowel and connected speech when available.

AVQI component parameters currently include CPPS, HNR, shimmer measures, and LTAS slope/tilt features. ABI component parameters include CPPS, jitter local, GNE, HF noise, HNR (variant), H1–H2, shimmer measures, and period SD. fo metrics are retained separately for sustained vowel and connected speech and may include time series contours.

VoxApp offers two operational modes: Basic Mode, which displays final AVQI/ABI scores with color-coded interpretation suitable for screening workflows, and Professional Mode, which exposes all 15 component parameters, interactive fo contour graphs, patient metadata fields, and exportable advanced reports for research and clinical documentation.

Language Support and Cut-Off Handling

VoxApp is multilingual by design. The backend contains language-coded AVQI and ABI cut-offs for multiple languages (pt-BR, en, de, es, it) and uses these values for status classification and messaging. Classification returns language-appropriate status strings and messages for AVQI and ABI.

Language (code)	AVQI Cut-off	ABI Cut-off
Brazilian Portuguese (pt-BR)	1.33	2.94
English (en)	1.17	2.35
German (de)	1.85	3.42
Spanish (es)	2.28	3.40
Italian (it)	2.35	3.34

Table 1. AVQI and ABI cut-offs currently implemented in VoxApp backend by language code.

RESULTS

Because clinical validation is ongoing, results are reported as implementation-level outputs and workflow capabilities rather than diagnostic performance in patient cohorts.

End-to-End Pipeline Functionality

The current implementation supports a complete pipeline: the app records sustained vowel and connected speech, uploads both WAV files, and receives computed AVQI, ABI, and fo outputs from the backend. The backend includes file canonicalization for Praat compatibility, per-run job isolation, Praat batch execution, and standardized parsing into a structured report.

Structured Reporting for Clinical Documentation

The backend returns a structured report object containing primary indices with cut-offs and classification status, plus component parameters and fo measures. This format is designed to support immediate viewing in-app and exportable summaries (PNG/PDF) as described in the abstract.

Multilingual Classification Support

Language-coded cut-offs and localized messages are applied and returned within the report for supported language codes. This supports future multicenter studies where consistent computation is required while presenting results in a language-appropriate clinical interface.

DISCUSSION

VoxApp is intended to reduce practical barriers to standardized acoustic voice assessment by combining local smartphone recording with centralized Praat-based computation. This design is aligned with telepractice evidence showing that platform transmission can significantly distort voice acoustics and therefore should not be used as the primary signal source for quantitative analysis.[1] Instead, VoxApp emphasizes local recording and controlled computation to improve reproducibility.

Composite Indices for Mobile Workflows

AVQI was specifically motivated by the need for an objective, ecologically valid dysphonia index that incorporates both sustained vowel and continuous speech, and it has been framed as useful for treatment outcomes assessment.[2] ABI was developed as a multivariate acoustic model for breathiness, offering a targeted acoustic correlate of an important perceptual dimension. [3] These indices are well suited to protocol-driven mobile capture because they are task-defined (sustained vowel + connected speech) and produce clinically interpretable outputs that can support monitoring across time, provided that acquisition and analysis are standardized.

Smartphone Feasibility and Remaining Gaps

Peer-reviewed evidence supports the feasibility of smartphone-based AVQI estimation under controlled protocols, including conditions with added ambient noise, with findings suggesting that smartphone-derived AVQI can be comparable to oral microphone-derived AVQI in those settings.[4] However, feasibility does not equate to full clinical interchangeability. Device heterogeneity, uncontrolled noise, and OS-level signal processing can affect acoustic features, and therefore any smartphone deployment requires explicit validation of agreement and diagnostic accuracy under real-world conditions.

Mobile “voice screening” applications that incorporate AVQI have shown promising results in feasibility and reliability studies, reinforcing that smartphone-based workflows can be clinically meaningful when protocols and computation are controlled[5,6] The existence of such apps also highlights a key methodological point: results depend not only on the index (AVQI/ABI) but on capture constraints, speech tasks, editing, and computational implementation. VoxApp addresses this by centralizing computation on a server and by providing a structured report that includes component parameters to support auditing.

Normative Values and Language-Specific Thresholds

The interpretability of AVQI and ABI depends on language- and protocol-specific validations and cut-offs. Brazilian Portuguese research demonstrates that AVQI outcomes depend on the chosen connected-speech material and methodological choices.[7] English validation work reports thresholds for AVQI and ABI tailored to English-speaking cohorts and their protocols.[8] VoxApp implements language-coded cut-offs in the backend (Table 1) and returns classification messages accordingly. A key recommendation is that VoxApp's forthcoming validation studies explicitly document the provenance of each implemented cut-off and confirm that those thresholds remain appropriate under VoxApp's smartphone acquisition conditions.

Validation Roadmap

Consistent with the smartphone AVQI literature and telepractice findings, a strong validation program for VoxApp should include: (i) simultaneous recording comparisons between VoxApp (smartphone microphone) and a reference recording system; (ii) device-stratified testing across multiple smartphone models and OS versions; (iii) controlled and real-world noise-condition testing; and (iv) clinical cohorts with external criteria (perceptual ratings and diagnostic categorization) to establish diagnostic accuracy and clinically meaningful change thresholds.[1,4,8] These steps are necessary before VoxApp can be framed as equivalent to laboratory acquisition for clinical decision-making.

CONCLUSION AND RECOMMENDATIONS

VoxApp is a multilingual smartphone tool designed to deliver standardized AVQI, ABI, and fo measurement using local recording combined with reproducible, server-side Praat computation. The implementation emphasizes protocol guidance, robust file handling, and structured reporting intended for chairside clinical documentation and in-clinic longitudinal monitoring of therapy outcomes.

Peer-reviewed literature supports the feasibility of smartphone-based AVQI estimation under controlled and noise-added conditions, while also demonstrating that telepractice transmission platforms can substantially distort many acoustic measures, motivating VoxApp's local-recording approach. AVQI and ABI are well-established composite indices with cross-linguistic validation and clinically interpretable thresholds, but device- and context-specific validation remains essential.

Accordingly, VoxApp should be considered a protocol-driven platform ready for multicenter validation rather than a fully validated diagnostic replacement for laboratory systems. Future work will focus on quantifying agreement with reference recording systems, defining acceptable recording conditions, and extending language support and acoustic indices as validation evidence accumulates.

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INVESTIGATION OF THE EFFECTIVENESS OF HIGH-PRESSURE SEMI-OCCLUDED VOCAL TRACT EXERCISES IN THE TREATMENT OF OBSTRUCTIVE SLEEP APNEA SYNDROME

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Keywords:
Obstructive Sleep Apnea, Upper Airway Muscles, DoctorVOX Voice Therapy, SemiOccluded Vocal Tract Exercises

Abstract:
Obstructive Sleep Apnea Syndrome (OSAS) is a disorder characterized by recurrent partial or complete obstruction of the upper airway during sleep, leading to snoring, apnea, oxygen desaturation and nocturnal awakenings. A reduction in ***upper airway muscle*** tone, particularly during deep sleep (N3) and rapid eye movement (REM) sleep, contributes to pharyngeal narrowing and soft-tissue collapse, facilitating the development of OSAS. The aim of this study is to evaluate the effectiveness of high-pressure ***semi-occluded vocal tract exercises*** based on the ***DoctorVOX Voice Therapy*** Technique(DVT) in strengthening upper airway muscles in individuals with OSAS and to investigate their potential to reduce soft-tissue collapse during sleep.

Materials and Methods:
Fifteen patients diagnosed with OSAS were included in the study. Participants completed an exercise program based on the DVT for an average duration of 8 weeks. During the first week, primal sound exercises were performed using abdomino-diaphragmatic breathing at normal pressure. In subsequent sessions, glissando–sostenuto exercises in the chest register were introduced with progressively increasing back pressure. Finally, plyometric exercises using the vowel /ə/ were applied, aiming to stretch and load the relevant muscles as pitch increased within the chest register. Polysomnography was performed before and after the exercise program. Subjective outcomes were assessed using the Epworth Sleepiness Scale, which evaluates bed partner–reported complaints

Conclusion:
The study is ongoing, and preliminary objective and subjective data from eight participants are currently under analysis. Preliminary findings suggest that high-pressure semi-occluded vocal tract exercises may strengthen the upper airway muscles, increase soft-tissue resistance, and reduce the risk of tissue fluttering and airway obstruction during sleep. This technique may represent a non-invasive and feasible complementary treatment option for OSAS. Upon completion of the study, a multicenter trial is planned to provide more objective evidence regarding its effectiveness.

SUBJECTIVE						OBJECTIVE									
						TIME IN THE BED				REM					
EPWORTH		ELBOW SIGN				SATURATION MIN.(%)		SNORİNG COUNT		AHI		TIME		BMI	
PRE-TX	POST-TX	PRE-TX	POST-TX		AGE	PRE-TX	POST-TX	PRE-TX	POST-TX	PRE-TX	POST-TX	PRE-TX	POST-TX	PRE-TX	POST-TX
5	1	1	1	E.K (F)	45	70	66	720	312	71,6	65,9	33,5	35,5	52,5	52,8
3	3	1	1	R.K (M	50	86	87	49	377	14,2	2,7	72	43,9	27,5	27,4
8	2	0	0	Ş.K (M)	52	76	87	427	217	48,3	7,7	74,5	78	26,8	26,8
16	10	1	0	F.Ç (F)	42	79	84	279	49	40,5	5	40	12	30	30,5
9	8	2	1	H.U (M)	44	81	89	627	90	16,4	11,8	80,5	30,5	26,8	26,9
16	15	1	1	A.G (F)	51	76	82	326	356	74	28,6	30	41,5	29,7	29,6
1	1	1	0	F.Ç (F)	60	76	81	142	155	33	37	32,7	40,5	38,3	38,5
8	4	1	1	İ.K (F)	53	84	84	169	231	27	34,9	93,5	58,5	33,3	33,8
7	4	___	___	S.K (F)	38	82	84	95	9	35,1	5,6	35,1	54	26,4	26,6
11	10	___	___	A.D (F)	27	89	89	138	67	23	7,7	23,4	46,5	21,4	21,6
				S.K (M)	55	80	80	145	198	67,8	50,3	11,5	37	29,4	30
				AVG(≈)		80	83	283	187	41	23,4	47,8	43,4	___	___

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THE ACUTE EFFECT OF SUBMAXİMAL EXERCİSE ON VOCAL PERFORMANCE İN HEALTHY YOUNG ADULTS

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ABSTRACT

Aim: The aim of this study is to examine the acute effect of submaximal exercise testing on vocal performance in healthy young adults.

Method: A total of 68 university students (47 females, 21 males) were included in the study. Measurements of voice intensity, fundamental frequency (F0), vocal fatigue, jitter, shimmer, and noise-to-harmonic ratio (NHR) were obtained in an isolated sound booth. Perceived vocal fatigue of the participants was measured using a 100 mm Visual Analog Scale (VAS). Subsequently, the 6-Minute Walk Test (6MWT) was administered to the participants as a submaximal exercise test in accordance with clinical standards. Heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), walking distance (WD), and perceived exertion levels of the participants were measured. The Borg scale was utilized to assess the level of perceived exertion. All measurements were taken immediately before and immediately after the 6MWT.

Results: Following the 6MWT, a statistically significant increase was observed in HR, SBP, and DBP values ($p < 0.001$). Similarly, perceived exertion levels of the participants increased significantly after the 6MWT ($p < 0.001$). Also, voice intensity, F0, and perceived vocal fatigue showed a statistically significant increase following the 6MWT ($p < 0.001$). In contrast, no statistically significant difference was observed between pre- and post-test values for jitter, shimmer, and NHR. Additionally, a negative correlation was found between WD and the magnitude of change in F0 ($p < 0.05$).

Conclusion: This study demonstrates that the 6MWT can affect voice parameters in addition to vital signs. According to the results of our study, submaximal exercise testing via the 6MWT may lead to acute changes in vocal performance; however, it does not appear to have a significant effect on acoustic voice quality. Furthermore, it was determined that F0 values remained more stable after the 6MWT in individuals with high exercise capacity.

INTRODUCTION

Vocal fatigue is one of the most prevalent complaints reported by individuals, particularly occupational voice users. It often manifests alongside symptoms such as laryngeal discomfort and hoarseness, significantly hindering professional performance. Phonotraumatic behaviors, including prolonged and loud speaking in crowded environments, lack of vocal rest, shouting, screaming, and frequent throat clearing due to laryngeal irritation not only contribute to fatigue but can also lead to benign vocal fold lesions like nodules or polyps in the long term[1,2]. This place occupational voice users at a substantial risk. Furthermore, individuals in professions such as athletes, coaches, singers, and actors are often required to maintain high physical performance while simultaneously speaking, shouting, or singing. Consequently, it is very important to examine the relationship between physical exertion and vocal fatigue.

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The impact of physical fatigue on the voice has been addressed in a limited number of studies[3-7] . Due to the complex interaction between the respiratory and phonatory systems, physical exercise leads to distinct changes in both the acoustic and physiological characteristics of the voice. Research indicates that as exercise intensity increases, there is a statistically significant elevation in fundamental frequency (F0)[4,6]. This increase is attributed to several factors: one explanation is the heightened tension in the vocal folds associated with increased physical effort. This is supported by observed decreases in vocal stability during high-intensity activities, evidenced by a gradual increase in acoustic parameters such as jitter and shimmer. Another explanation involves the increased subglottal pressure resulting from deeper and more frequent breathing during exercise; subglottal pressure is directly correlated with increases in both vocal intensity and fundamental frequency[4,6]. Elevated F0 and deterioration in measures such as jitter, shimmer, and the harmonics-to-noise ratio have been observed both during and immediately after physical activity[6,7]. Similarly, an increase in perceived phonatory effort following exercise has been documented[3] . These findings suggest that intense physical exertion can impair voice quality and potentially lead to chronic voice disorders.
Submaximal tests like the Six-Minute Walk Test (6MWT), Two-Minute Walk Test or the Sit-toStand Test are widely utilized globally to assess exercise capacity. These tests provide valuable data for exercise prescription and allow for the calculation of exercise intensity through specific equations or algorithms. Submaximal tests are also employed in the literature to measure vocal changes following moderate-level exercise and found to be related to vocal function. These studies showed that there is considerable change in vocal performance after submaximal tests[7,8]. Research has demonstrated that speaking during and after exercise, as well as monitoring individuals during physical activity, has measurable effects on respiration and voice production. Specifically, fundamental frequency tends to increase, and vocal fold vibrations become more irregular[4,6,7]. However, it is noteworthy that the specific relationship between perceived vocal fatigue, physical fatigue, and acoustic voice parameters remains an under-researched area in the current literature. Therefore, the aim of this study is to examine the acute effect of submaximal exercise testing on vocal performance in healthy young adults. The second aim of this study is to determine the relationship between walking distance and magnitude of change in vocal parameters.

METHODS

Participants

This prospective study had a pre-test post-test experimental design. A total of 68 university students (47 females, 21 males) voluntarily participated in the study. The mean age of the participants was 20,01± 2,24 (range 18-29) years. Informed consent was taken from all the participants before the study. Inclusion criteria were (1) being enrolled in undergraduate education, (2) not having a history of voice disorder or voice-related complaints on the day of data collection, (3) perceived as having a normal voice quality as assessed by a speech and language therapist specialized in assessment and therapy of voice disorders. Exclusion criteria were (1) having a diagnosis of hearing impairment, neurological disorder or a speech and language disorder, (2) having an upper respiratory tract infection or allergy symptoms on the test day, (3) having a score greater than 7 on the Voice Handicap Index-10-TR.

Procedure

The acoustic parameters, perceived vocal fatigue, perceived physical effort, hemodynamic and functional physical capacity markers were obtained immediately before and immediately after the submaximal exercise test, which was the 6-Minute Walk Test (6MWT). The objective of the 6MWT is to reach the longest possible walking distance at the end of six minutes. To easily determine the distance reached, a 30-meter-long test track was established and divided into 30 equal sections at 1-meter intervals. Within the scope of this test, participants were required to walk at their own pace for six minutes, without running, to achieve the maximum possible distance. The total walking distance was recorded in meters[9] . The 6MWT has been used not only to assess physical capacity, but also in studies testing the effects of moderate physical exercise[7] .

The acoustic parameters that were measured in this study were voice intensity (SPL), fundamental frequency (F0), jitter, shimmer, and noise-to-harmonic ratio (NHR). Perceived vocal fatigue of the participants was measured using a 100 mm Visual Analog Scale (VAS), and to assess the level of perceived exertion, the modified Borg scale, which measures the perceived exertion between 0- 10, was utilized. The hemodynamic parameters were the heart rate (HR), systolic blood pressure (SBP), and diastolic blood pressure (DBP). Also, the walking distance (WD) was used to assess functional physical capacity. Magnitude of change of acoustic and vocal fatigue parameters were calculated after the pre- and post-test results obtained. The audio recordings used for the acoustic analyses in the research were obtained using an AKG C417 PP microphone and a Presonus Studio24c audio interface on an HP laptop inside a soundproof booth. The Praat software was used for the analysis of acoustic parameters[10].

Statistics

Jamovi v2.4 (https://www.jamovi.org) was used for the statistical analyses. Shapiro-Wilks test was utilized to test whether the data normally distributed. Only SBP and DBP values before the 6MWT, and HR measurement before and after the 6MWT were found to be normally distributed ($p < .05$). Pre and post measurements were analyzed with paired samples t-test for HR, and Wilcoxon signedrank test was used for rest of the variables that failed to show normal distribution. Spearman correlation analysis performed to test relationship between WD and magnitude of F0, jitter, shimmer, NHR and vocal fatigue change. The significance level was set at $p < 0.05$.

RESULTS

As presented in the Table 1, there were statistically significant increase in HR ($t(65) = -15.67$, $p < .001$), SBP ($W = 34.50$, $p < .001$), and DBP ($W = 230$, $p < .001$) values following the 6MWT. Similarly, perceived exertion levels of the participants increased significantly after the 6MWT ($W = 0$, $p < 0.001$). Also, voice intensity ($W = 407$, $p < .001$), F0 ($W = 606$, $p < .001$), and perceived vocal fatigue ($W = 304$, $p < .001$) showed a statistically significant increase following the 6MWT. In contrast, no statistically significant difference was observed between pre- and post-test values for jitter ($W = 1161$, $p = 0.893$), shimmer ($W = 1251$, $p = 0.488$), and NHR ($W = 924$, $p = 0.307$).

Table 1. Comparison of Physiological and Acoustical Parameters Before and After 6MWT

	Pre-test		Post-test			
Variables	**Mean (SD)**	**Median**	**Mean (SD)**	**Median**	**Test statistic**	**p**
Physiological Parameters						
Heart Rate (bpm)	89.7 (12.4)	88	120 (20.1)	119	t = -15.67	**< 0.001**
Systolic Blood Pressure (mmHg)	115 (12.9)	115	129 (17.5)	126	W = 34.50	**< 0.001**
Diastolic Blood Pressure (mmHg)	72.7 (9.68)	74	79.1 (9.04)	80	W = 230	**< 0.001**
Perceptual Parameters						
Perceived Exertion	1.77 (1.68)	1.5	4.22 (1.93)	4	W = 0.00	**< 0.001**
Perceived Vocal Fatigue	3.49 (1.77)	3	4.25 (2.11)	4	W = 304	**< 0.001**
Acoustical Parameters						
Voice Intensity (dB)	60.9 (5.16)	60.3	62.9 (5.69)	62.8	W = 407	**< 0.001**
Fundamental Frequency (Hz)	202 (54.4)	226	209 (55.7)	233	W = 606	**< 0.001**
Jitter (%)	0.323 (0.135)	0.293	0.329 (0.184)	0.28	W = 1161	0.893
Shimmer (%)	2.6 (1.41)	2.32	2.52 (1.27)	2.14	W = 1251	0.488
Noise-to-Harmonics Ratio	0.007 (0.005)	0.006	0.006 (0.005)	0.007	W = 924	0.307

Additionally, a negative correlation was found between WD and the magnitude of change in F0 ($r = -0.244$, $p < 0.05$). There was no significant correlation between WD and magnitude of change in jitter, shimmer, NHR or perceived vocal fatigue ($p > .05$).

DISCUSSION

The results of this study showed that a submaximal exercise test has an acute effect on both vital signs and vocal parameters. F0, voice intensity and perceived vocal fatigue elevated significantly as the HR, SBP, DBP and perceived exertion increased.

In literature, the increase observed in the HR and blood pressure (SBP and DBP) values of the participants confirms that 6MWT creates metabolic demand on the cardiovascular system, which is mirrored in the elevated perceived exertion values of the participants[9] . Our results indicated that this physiological load parallels the significant increases detected in voice intensity and F0. Consistent with the literature, it is thought that increased subglottal pressure and respiratory support needs during physical activity raise both the pitch and intensity of the voice[6] . In particular, the increase in F0 can be explained by increased laryngeal muscle tension and sympathetic nervous system activation during exertion. However, no significant difference is observed in the vocal stability although the perceived vocal fatigue and perceived exertion increased after the test. This result indicates that young adults can tolerate the effect of moderate level of physical effort on the respiratory and phonatory systems. Also, it can be assumed that the physical effort caused by 6MWT does not lead to a pathological instability in biomechanics of vocal system.

Additionally, the results of the present study showed that there is a significant negative correlation between walking distance and the amount of change in F0. This result indicates that individuals with higher physical performance capacity are better able to compensate for fluctuations in F0. This suggests a potential protective role of physical fitness in vocal stability. Specifically, participants who walked greater distances demonstrated more stable vocal pitch following 6MWT. This can be explained by the superior physiological efficiency of individuals who have better exercise capacity. These individuals might require less compensatory laryngeal effort to manage the increased subglottal pressure during exercise due to their more robust cardiovascular and respiratory system. This finding suggests there is a link between vocal stability and individual's overall physical conditioning.

The literature shows that even light to moderate level physical activity results in increased F0 levels[6]. Also, high intensity physical exercise, such as running on a treadmill until exhaustion, leads to deteriorated acoustic values when the measurement taken after the test[5] . Our findings demonstrate that F0 levels do not return to baseline immediately after physical activity ends in young adults. While vocal outcomes were not monitored during exercise, it could be hypothesized that transient fluctuations in jitter, shimmer, or NHR may have normalized rapidly upon cessation of the task. However, clinical populations appear more susceptible to persistent vocal instability. For instance, Reinders et al. reported that the vocal stability is significantly deteriorated postexercise in patients with chronic obstructive pulmonary disease[7]. Integrating our results with existing literature, it can be inferred that while young and healthy individuals possess the physiological resilience to stabilize vocal pitch following moderate exertion, patients may lack the compensatory mechanisms required to mitigate the effects of physical load. This is further supported by our finding of a negative correlation between walking distance and F0 change, suggesting that higher baseline physical exercise capacity enhances vocal post-exercise stability.

CONCLUSION AND RECOMMENDATIONS

This study shows that submaximal exercise testing influences vocal outcomes except the acoustic parameters regarding vocal quality (jitter, shimmer and NHR). Also, this study highlighted the relationship between physical exercise capacity and vocal pitch change. The F0 values remained more stable among the young, healthy adults who has better physical exercise capacity. The present results underscore the critical role of physical fitness in maintaining vocal health, particularly for occupational voice users who face high vocal and physical demands. Health providers should consider a patient’s cardiovascular conditioning as a potential factor in vocal resilience.

While this study focused on the acute effects of submaximal exercise, future research should investigate how varying exercise intensities, recovery durations and measurement time (during, pre- and post-exercise) influence vocal outcomes. Also, the mediating effects of gender, age and vocal health status remain to be elucidated to provide a more comprehensive understanding of the relationship between physical activity and the vocal system.

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EXAMINATION OF VOICE HYGIENE AWARENESS, PERCEIVED VOICE HANDICAP AND ACOUSTIC VOICE PARAMETERS ACCORDING TO ACADEMIC YEAR IN PRESERVICE MUSIC TEACHERS

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ABSTRACT

Objective:

The aim of this study was to compare acoustic voice parameters, levels of voice hygiene awareness, and perceived voice handicap between the first- and fourth-year preservice music teachers, and to investigate the relationships between voice hygiene awareness with acoustic voice measures and perceived voice handicap.

Method:

Participants were 48 preservice music teachers (first year: 5 males/23 females; fourth year: 6 males/14 females) enrolled in the Department of Music Education at Gazi University. Data were collected using a Demographic Information Form, the Voice Handicap Index-10 (VHI-10) and a 15-item Voice Hygiene Awareness Questionnaire. Voice samples were obtained during sustained /a/ phonation and connected speech (CAPE-V sentence: “Arda onca yılın ardından aradı”) using Audacity. Acoustic analyses were conducted with PRAAT (v6.4.23). Mean F0, jitter, shimmer, mean intensity, HNR, and CPP were extracted from sustained phonation; mean F0, mean intensity, and CPP were obtained from connected speech. Statistical analyses were performed using IBM SPSS Statistics 26. Independent samples t-tests and Mann– Whitney U tests were used for group comparisons, and Spearman correlation analysis was applied for relationship analyses.

Results:

First-year students showed significantly higher voice hygiene awareness scores ($p = 0.040$) and VHI-10 rank means ($p = 0.002$) than fourth-year students. No significant group differences were found in acoustic parameters ($p > 0.05$). A significant negative correlation was observed between voice hygiene awareness and connected speech CPP ($p = 0.004$).

Conclusion

First-year preservice music teachers demonstrated higher voice hygiene awareness and perceived voice handicap than fourth-year students. This may indicate limited reflection of theoretical knowledge into practice or emerging professional desensitization. Moreover, the negative relation between awareness and vocal quality (CPP) suggests that awareness may become more reactive than preventive. Therefore, integrating practical and preventive voice hygiene training early into undergraduate music teacher education programs is recommended.

Keywords: *acoustic analysis, preservice music teachers, voice handicap index, voice hygiene awareness, voice hygiene education*

INTRODUCTION

Teachers often give long verbal lessons in classrooms that are not acoustically suitable and are unable to take sufficient time for vocal rest. Excessive voice use may lead to vocal fatigue, difficulty in phonation, changes in voice quality and physical pain. These problems may manifest as symptoms such as hoarseness, coughing, speaking with effort and reduced vocal range[1]. Therefore, teachers are considered a high-risk group for voice disorders. It is known that risks related to voice use appear not only during professional work but also during the preservice period.

Studies have shown that voice handicap and vocal symptoms are common among preservice teachers and conservatory students[2]- [4].
Voice disorders are an important issue for preservice music teachers, who use their voices excessively and professionally. Students in music departments use their voices more than students in other departments. Therefore, when they start their profession, their vocal load increases, and the risk of voice disorders also increases during this transition period[5].
Although voice disorders are common, awareness and preventive approaches may not be sufficiently understood. Among preservice music teachers, the knowledge and skills learned in voice training courses may not always be applied effectively in classroom environment. In addition to that, there may be limitations in correct voice production, proper use of resonance and producing a clear voice. This shows the importance of high quality voice health practices and increasing voice hygiene awareness during preservice period.
There are limited studies that examine the relationship between voice hygiene awareness and self-perceived voice handicap and acoustic voice quality in preservice music teachers. Therefore, the aim of this study is to compare acoustic voice parameters, voice hygiene awareness and perceived voice handicap between first- and fourth-year preservice music teachers. In addition, the study aims to examine the relationships between voice hygiene awareness with acoustic voice parameters and perceived voice handicap, and to identify needs related to protecting vocal health in preservice music teachers.

METHODS

Study Design

This study is an observational, analytical and cross-sectional study.

Ethical Aspects

Ethical approval was obtained from the Ethics Committee of Ankara Medipol University (17.06.2025, Decision No: 114).
First- and fourth-year preservice music teachers studying at the Department of Music Education at Gazi University were invited to participate in the study. Written informed consent was obtained from all participants.
As inclusion and exclusion criteria, the information was verified through questions asked to the participants and was considered:
Inclusion Criteria: Being a first- and fourth-year undergraduate student in the Department of Music Education, having Turkish as a native language, and having no health condition or acute symptoms that could affect voice production.
Exclusion Criteria: History of head and neck surgery, neurological problems affecting voice and communication and diagnosis of laryngeal or vocal disorders.

Procedures

The data collection tools used in this study along with the voice recording process and the data analysis methods are presented below.

Data Collection Tools

Participants were asked to complete Demographic Information Form, Voice Handicap Index10 (VHI-10) and Voice Hygiene Awareness Questionnaire.

Demographic Information Form

This form was prepared by the researchers to collect information about the participants' sociodemographic and health-related characteristics.

Voice Handicap Index-10 (VHI-10)
VHI-10 is a self-report measure that evaluates the functional, physical and emotional effects of voice problems. It consists of 10 items and is scored on a 5-point Likert scale (0-4). Higher total scores indicate a higher level of voice-related problems[6].

Voice Hygiene Awareness Questionnaire
Voice Hygiene Awareness Questionnaire is a 15-item closed-ended measure developed by the researchers. It evaluates individuals' risk factors related to vocal health, their level of awareness and their voice-related habits. Items were scored as 1 = "yes" and 0 = "no". A total score was calculated and higher scores indicate higher voice hygiene awareness.

Voice Recording Procedure
Participants' voices were recorded during sustained /a/ phonation and connected speech samples using Audacity software. Recordings were made in a quiet room, with a microphone distance of approximately 30 cm. A condenser microphone with a cardioid polar pattern and a USB audio interface were used. Recordings were obtained at a sampling rate of 44,100 Hz in wav format. For sustained /a/ phonation, participants sat comfortably, took a deep breath, and produced the /a/ sound for about 5 seconds within three repetitions. For connected speech, participants read the Turkish CAPE-V sentences[7].

Data Analysis
Acoustic analysis of the voice recordings was performed using PRAAT software (version 6.4.23). For sustained /a/ phonation, the middle three seconds of each recording were analyzed. From each recording, mean fundamental frequency (mean F0), jitter, shimmer, mean intensity (dB SPL), harmonic-to-noise ratio (HNR) and cepstral peak prominence (CPP) were calculated. The average of the three repetitions was used for each participant in the analyses. For connected speech analysis, the sentence "Arda onca yılın ardından aradı." was selected from the CAPE-V sentences to calculate mean F0, mean intensity and CPP.

Statistical Analysis
Statistical analyses were performed using SPSS 26. Independent samples t-test and MannWhitney U test were used for group comparisons. Spearman correlation analysis was used to examine relationships between variables. Since F0 is sensitive to gender differences, analyses were conducted separately by gender.

RESULTS
A total of 48 preservice music teachers participated in the study. 58.3% (n=28) and 41.7% (n=20) of participants were first- and fourth-year students, respectively.
Among the participants, 77.1% (n=37) were female and 22.9% (n=11) were male. The mean age of the participants was 19.56 ± 2.14 years. In addition, 91.7% (n=44) of the participants had previous voice training, while 8.3% (n=4) did not.
Comparative analysis results of voice hygiene awareness, Voice Handicap Index (VHI-10) scores and acoustic voice parameters according to year of study are presented in Table 1.

Table 1. Comparison of Variables Between First- and Fourth-Year Students

Variables	First-Year (n=28)	Fourth-Year (n=20)	Test Statistic	p
VHA Score (Mean ± SD)	8,71 ± 2,67	7,00 ± 2,88	t = 2,118	**0,040***
VHI-10 (Mean Rank)	29,70	17,23	U = 134,50	**0,002****
Shimmer % (Mean ± SD)	2,86 ± 0,90	2,61 ± 0,85	t = 0,992	0,326

HNR (Mean ± SD)	23,92 ± 2,52	23,52 ± 2,53	t = 0,540	0,592
Mean Intensity_Sus /a/ (Mean ± SD)	57,03 ± 4,47	57,04 ± 4,21	t = -0,006	0,995
Mean Intensity_CS (Mean ± SD)	56,86 ± 2,61	57,15 ± 3,45	t = -0,333	0,741
Jitter % (Mean Rank)	27,07	20,90	U = 208,00	0,132
CPP_ Sus /a/ (Mean Rank)	23,32	26,15	U = 247,00	0,490
CPP_ CS (Mean Rank)	23,89	25,35	U = 263,00	0,722
Mean F0_ Sus /a/ (F) (Mean Rank)	19,48 (n=23)	18,21 (n=14)	U = 150,00	0,730
Mean F0_ Sus /a/ (M) (Mean Rank)	5,20 (n=5)	6,67 (n=6)	U = 11,00	0,465
Mean F0_ CS (F) (Mean Rank)	19,43 (n=23)	18,29 (n=14)	U = 151,00	0,754
Mean F0_ CS (M) (Mean Rank)	5,40 (n=5)	6,50 (n=6)	U = 12,00	0,584

Note: **p<0.01. *p<0.05. Spearman's correlation coefficient (r) was used for related analyses. VHA score: Voice Hygiene Awareness score; SD: Standard Deviation; VHI-10: Voice Handicap Index-10; HNR: Harmonics-to-Noise Ratio; Sus /a/: sustained /a/ phonation; CS: connected speech; CPP: Cepstral Peak Prominence; F0: fundamental frequency; F: female; M: male.

Table 1 shows that the first-year students had significantly higher levels of voice hygiene awareness (p0.05). The findings related to the relationships between voice hygiene awareness with self-perceived voice handicap (VHI-10) and acoustic voice parameters are presented in Table 2.

Table 2. Relationship Between Voice Hygiene Awareness Score and Acoustic Voice Parameters

Variables	r	p
VHI-10	-0,022	0,882
Jitter %	-0,166	0,259
Shimmer %	-0.173	0.240
HNR	0,167	0,257
CPP_ Sus /a/	-0,250	0,087
CPP_CS	-0,407**	**0,004**
Mean Intensity_ Sus /a/	0,080	0,588
Mean F0_ Sus /a/ (F)	0,239	0,155
Mean F0_ Sus /a/ (M)	0,475	0,140

Note: **p < 0.01 indicates statistical significance. Spearman's correlation coefficient (r) was used for the related analyses. VHI-10: Voice Handicap Index-10; HNR: Harmonic-to-Noise Ratio; CPP: Cepstral Peak Prominence; Sus /a/: sustained /a/ phonation; CS: connected speech; F0: fundamental frequency; F: female; M: male.

DISCUSSION

In this study, voice hygiene awareness, perceived voice handicap and acoustic voice parameters were compared between first- and fourth-year preservice music teachers. In addition, the relationships between voice hygiene awareness with perceived voice handicap and acoustic voice parameters were examined. The findings showed that first-year students had significantly higher voice hygiene awareness than fourth-year students ($p<0.05$). This result is consistent with Jayakumar and Yasin[4], who reported that although students who are future professional voice users may have sufficient awareness of voice anatomy and physiology, limitations in knowledge about voice care and preventive strategies may still continue. However, our findings differ from studies reporting that voice health and voice hygiene knowledge increase with higher year of study and age[3]. In the present study, the higher voice hygiene awareness among the first-year students may be related to the fact that they have not yet been exposed to excessive voice use and their approach towards voice hygiene remains more at a theoretical level. This may suggest that voice awareness is higher in the early years of undergraduate education, but as academic workload and rehearsal time increase in later years, maintaining ideal voice hygiene behaviors becomes more difficult and awareness does not increase as expected. Similarly, Achey et al.[2] reported that performance pressure and excessive voice use may limit voice hygiene behaviors in conservatory students.

In addition, the first-year students had significantly higher VHI-10 scores compared to the fourth-year students ($p<0.05$). This result confirms the findings of Rosa et al.[3], who reported that vocal symptoms are more common in the early years of undergraduate education. The higher self-perceived voice handicap for the students at the beginning of their education may be explained by not having fully adapted to professional voice use and perceiving changes in their voices more clearly. However, no statistically significant differences were found between the two groups in acoustic voice parameters measured during sustained phonation and connected speech ($p>0.05$). These findings suggest that four years of undergraduate music education and increased vocal load do not lead to structural or statistically significant changes in acoustic voice parameters. The absence of significant changes may indicate that the increased voice use during undergraduate education has not yet been reflected in the measured acoustic indicators. According to the correlation analysis, no significant relationship was found between voice hygiene awareness and perceived voice handicap (VHI-10) or acoustic voice parameters except CPP in connected speech. This finding suggests that the relationship between self-perceived and acoustic voice parameters may be limited and is consistent with Achey et al.[2], who stated that voice hygiene awareness may not directly reflect acoustic voice parameters.

Finally, a negative and moderate significant correlation was found only between voice hygiene awareness and CPP in connected speech ($r=-0.407$; $p<0.01$). This result indicates that as voice hygiene awareness increases, CPP in connected speech decrease. Also, it is noteworthy that this relationship was observed only in connected speech and not in sustained phonation. In the literature, the connected speech reflects daily voice use and voice disorders more sensitively than sustained phonation[8]. Therefore, it may be expected that voice hygiene awareness in preservice music teachers would be reflected more in connected speech quality, which is closer to daily and professional voice use. However, the negative direction of this relationship, that is lower CPP values associated with higher awareness, may be explained by the fact that high theoretical awareness does not always translate into optimal voice use in practice. The study of Jayakumar and Yasin[4] also confirms this finding.

CONCLUSION AND RECOMMENDATIONS

The findings of the study showed that the first-year students had higher voice hygiene awareness, assessed by the voice hygiene awareness and higher perceived voice handicap, assessed by the VHI-10, compared to fourth-year students. In contrast, no statistically significant differences were found between the groups in terms of acoustic voice parameters. This may suggest that theoretical knowledge is not sufficiently reflected in practice among students approaching graduation, or professional desensitization may develop over time.

In addition, the negative relationship between voice hygiene awareness and CPP in connected speech suggests that awareness does not always have a protective effect. Instead, awareness may increase due to existing or perceived voice problems. Therefore, it is recommended that practical and preventive voice hygiene training programs for preservice teachers should be included early in undergraduate education and continue throughout the curriculum.

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INVESTIGATION OF THE RELATIONSHIP BETWEEN PHYSICAL, MENTAL AND VOCAL FATIGUE IN MEDICAL SECRETARIES: PRELIMINARY FINDINGS

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ABSTRACT

Aim: The aim of this study is to examine the relationship between mental, physical and vocal fatigue levels in medical secretaries. Methods: 61 medical secretaries (27F, 34M) who voluntarily participated were included in the study. Data were collected using a Demographic Information Form, the Chalder Fatigue ScaleTR (CFS-TR), the Vocal Fatigue Index-TR (VFI-TR), and a Voice Health Impact on Occupational Functioning Information Form. Results: The mean total score on the CFS-TR was 16.6 (SD= 6.64), the Mental Fatigue Subscale was 5.18 (SD= 2.65), and the Physical Fatigue Subscale was 11.4 (SD=4.66). The Tiredness and Avoidance Subscale of VFI-TR was found to be 25.8 (SD=11.5), the Physical Discomfort Subscale of VFI-TR was 11.1 (SD=6.20), and the Improvements of Symptoms with Rest Subscale of VFI TR was 7.74 (SD=3.46). When the impact of voice problems on professional life was examined, it was found that 37.7% (n=23) of the participants stated that voice problems "frequently" affected their professional performance. Similarly, when the impact on professional motivation was questioned, 34.4% (n=21) of the participants stated that their motivation "frequently" decreased, while 36.1% (n=22) stated that it "sometimes" decreased. When the relationship between mental and physical fatigue levels and voice fatigue was examined, a significant positive correlation was found between the total general fatigue score and the sub-dimensions of VFI-TR (p0.05). Conclusion: It was determined that as the levels of mental and physical fatigue increase in medical secretaries, the levels of vocal fatigue also increase. Furthermore, voice-related problems negatively affect the professional performance and motivation of employees.

Keywords: *Vocal Fatigue, Mental Fatigue, Physical Fatigue, Medical Secretary, Chalder Fatigue Scale*

INTRODUCTION

Professional voice users use their voices as a primary tool in their professions. [1]Studies indicate that professional voice users encompass various occupational groups such as teachers, academics, call center employees, actors, singers, speech and language therapists, and healthcare professionals. [1]Individuals in this group engage in activities that require prolonged speaking, loud speaking, or the use of specific vocal techniques while performing their professional duties. Furthermore, because they are required to use their voices intensively and continuously for functional performance beyond normal speech requirements, they are at high risk for voice fatigue and other voice problems. [1]Voice fatigue is defined as a condition characterized by tiredness in the voice, sore throat, dryness, and increased effort during speech, resulting from prolonged or intensive voice use.[2]

Generalized fatigue is a multidimensional concept with physical and mental aspects that affects an individual's overall performance. [3]Both types of fatigue are associated with factors such as stress, working conditions, sleep deprivation, and environmental noise, and are frequently reported, especially in individuals who use their voice professionally. [4]Today, healthcare workers, who are among the professional voice users, are experiencing increasing workloads and communication needs, leading to various negative effects on occupational fatigue levels and voice health. [5]Medical secretaries constitute a high-risk group for voice fatigue due to prolonged voice use during continuous telephone calls, patient briefings, and administrative procedures in hospitals. Furthermore, the intense work pace, constant need for focus, and high stress levels inherent of medical secretarial work can lead to heightened generalized fatigue. [6]The literature indicates that variables such as voice disorders, voice fatigue, and burnout are interrelated in healthcare workers.

[6]However, studies specifically examining the relationship between voice fatigue and general fatigue in medical secretaries are limited. Yet, it is thought that these two concepts can influence each other, and that physical and mental fatigue can negatively affect voice performance and therefore work efficiency. [4]

The aim of this research is to examine the relationship between mental and physical fatigue levels and voice fatigue levels in medical secretaries. Furthermore, it aims to reveal the effects of voice problems experienced by medical secretaries on their occupational motivation and professional lives.

METHODS

This study was designed using descriptive and correlational quantitative research methods to examine the relationship between general fatigue levels and vocal fatigue levels among medical secretaries. Ethical approval was obtained from the İzmir Bakırçay University NonInterventional Clinical Research Ethics Committee. Written informed consent were taken from all participants. Sixty-one medical secretaries (27 women and 34 men) actively working in healthcare institutions in Türkiye recruited through announcements made online. Chalder Fatigue Scale-TR (CFS) was administered to measure physical and mental fatigue levels, and the Voice Fatigue Scale-TR (VFI) was administered to measure vocal fatigue levels. Additionally, a demographic information form and the Voice Health's Impact on Occupational Functioning Information Form" prepared by the researchers specifically for this study were used to collect data.

IBM SPSS Statistics for Windows, version 20 (IBM Corp., Armonk, N.Y., USA) was used for data analysis. Mean, standard deviation, median, and range values were reported. The data failed to show a normal distribution; therefore, Spearman correlation analysis was used to examine relationship between variables. After categorization based on cutoff scores were done, the comparative analyses were performed using the Fisher Exact test. A p-value of <0.05 was accepted as the significance level.

RESULTS

A total of 61 medical secretaries, 27 of whom were women and 34 of whom were men, participated in the study. When the participants' institutions were examined, it was found that 47.5% (n=29) worked in the State Hospital, 19.7% (n=12) in the Education and Research Hospital, 13.1% (n=8) in the Children's Hospital, and 8.2% (n=5) in Private Hospitals. The remaining participants worked in the Provincial Health Directorate (n=3), University Hospital (n=2), Private Clinic (n=1), and City Hospital (n=1), respectively.

When the units in which the participants served evaluated; it was determined that the largest group worked in outpatient clinics with a rate of 45.9% (n=28). This is followed by, in order of frequency; the inpatient service (n=11), radiology (n=10), administrative units (n=5), emergency department (n=2), pathology (n=1) and intensive care (n=1).

The descriptive results of the total and subscale scores of The CFS and VFI-TR are presented in Table 1. It was found that the average Mental Fatigue subscale score was 5.18 (SD = 2.65) and the Physical Fatigue subscale score 11.40 (SD= 4.66). Also, the total fatigue severity score was found as 16.60 (SD = 6.64). VFI-TR Tiredness and Avoidance subscale score was found as 25.80 (SD= 11.50), Physical Discomfort subscale was found as 11.10 (SD= 6.20) and Improvement of Symptoms with Rest Subscale was found to be 7.74 (SD = 3.46).

Table 1. Descriptive statistic results for Chalder Fatigue Scale and Voice Fatigue Index

Variable	Mean	Median	Standart Deviation (SD)	Range (Min-Max)
Chalder Fatigue Scale				
Total	16.60	16	6.64	4-33
Physical fatigue	11.40	11	4.66	3-21
Mental fatigue	5.18	5	2.65	0-12
Voice Fatigue Index				
Tiredness and avoidance	25.80	23	11.50	1-44
Physical discomfort	11.10	10	6.20	0-20
Improvement of symptoms with rest	7.74	8	3.46	0-12

The relationship between voice fatigue and general fatigue in medical secretaries participating in the study was examined using Spearman correlation analysis, and the findings are presented in Table 2. The relationship between voice fatigue and general fatigue in medical secretaries was examined using Spearman correlation analysis. A statistically significant and positive correlation was found between the CFS total score and the VFI- Tiredness and Avoidance Subscale (r = 0.532, p < 0.001). Similarly, a significant positive correlation was found between the CFS total score and the VFI-Improvement of Symptoms with Rest Subscale (r = 0.278, p = 0.030). As the mental fatigue scores increased, the levels of the VFI-Fatigue and Avoidance Subscale (r = 0.438, p < 0.001) and the VFI-Physical Discomfort Subscale (r = 0.455, p < 0.001), the VFIPhysical Discomfort Subscale (r = 0.549, p < 0.001), and the VFI-Improvement of Symptoms with Rest Subscale (r = 0.304, p = 0.017).

Table 2. Spearman correlation analyses results for the relationship between mental, physical and vocal fatigue

	CFS-T	CFS-MF	CFS-PF	VFI-TA	VFI-PD	VFI-IR
CFS-T						
CFS-MF	0.772**					
CFS-PF	0.954**	0.569**.				
VFI-TA	0.532**	0.438**	0.508**			
VFI-PD	0.581**	0.455**	0.549**	0.827**		
VFI-IR	0.278*	0.161	0.304*	0.654**	0.579**	

*CFS-T: Chalder Fatigue Scale-Total Score, CFS-MF: Chalder Fatigue Scale- Mental Fatigue, CFS-PF:Chalder Fatigue Scale-Physical Fatigue, VFI-TA:Vocal Fatigue Index- Tiredness and Avoidance Subscale, VFI-PD: Physical Discomfort Subscale, VFI-IR: Improvement of Symptoms with Rest Subscale, * p < 0.05, ** p < 0.01, *** p < 0.001*

The relationships between participants' professional experience duration and fatigue levels were examined with Spearman correlation analysis. There were no significant correlation between professional experience duration, CFS- Mental Fatigue Subscale (r = 0.071, p = 0.589), CFSPhysical Fatigue Subscale (r = 0.030, p = 0.821) and CFS- total scores (r = 0.018, p = 0.888) When evaluated in terms of VFI subdimensions; it was found tha professional experience duration was not significantly correlated with the VFI-Tiredness and Avoidance Subscale (r = 0.182, p = 0.159) VFI-Physical Discomfort Subscale (r = 0.142, p = 0.274). Only significant relationship was found between professional experience duration and VFI-Improvement of Symptoms with Rest Subscale (r = 0.283, p = 0.027).

The study also evaluated the impact of voice problems such as hoarseness, fatigue, and strain on the professional lives and motivation of the participants through three different subquestions. When asked how often voice problems affected their professional performance, 37.7% (n=23) of the participants answered "frequently," 42.6% (n=26) answered "sometimes," 11.5% (n=7) answered "rarely," and 8.2% (n=5) answered "never." When asked how often voice problems affected their ability to perform professional tasks, 27.9% (n=17) of the participants answered "frequently," 49.2% (n=30) answered "sometimes," 14.8% (n=9) answered "rarely," and 8.2% (n=5) answered "never." Finally, when considering the frequency with which voice problems affected communication with patients and/or their relatives in the professional environment; 42.6% (n=26) of participants answered "frequently", 32.8% (n=20) answered "sometimes", 18.0% (n=11) answered "rarely", and 6.6% (n=4) answered "never".

As the data coded according to VFI-Tiredness and Avoidance and CFS total cut-scores, 87% (n=40) of medical secretaries experiencing voice fatigue also reported high levels of general fatigue. Although Fisher's Exact Test results did not reveal a statistically significant relationship between voice fatigue and the presence of physical fatigue, a borderline significance trend was observed (p = 0.055, N = 61).

DISCUSSION

This study's primary aim was to investigate the relationship between mental, physical, and vocal fatigue among medical secretaries. Also, it was aimed to investigate how the voice problems experienced by medical secretaries influence their occupational motivation and professional lives.

Given the absence of research in the Turkish literature examining the general fatigue levels of medical secretaries and its impact on vocal health, this study fills a significant gap. Our findings revealed a highly significant positive correlation between general, physical and mental fatigue levels and the physical discomfort associated with vocal fatigue. This result aligns with Moghtader et al., who suggested that vocal and general fatigue occurs in paralell. [7]The heavy workload driven by intensive telephone calls, administrative duties, and patient information processes leads not only to physical exhaustion but also to substantial vocal fatigue, directly undermining vocal performance and communication quality. The results indicated that as mental fatigue increases, the vocal tiredness and physical discomfort also increase significantly. As highlighted by Al Ma'mari et al. regarding healthcare workers, high mental workload and stress impair overall employee performance.[8]The demanding work environments of medical secretaries heighten their mental burden, thereby reducing control and endurance over the vocal musculature. Surprisingly, the present study found no significant correlation between mental fatigue and vocal recovery through rest. This suggests that vocal rest, which is having a break in silence, is insufficient to compensate for the vocal deterioration caused by mental fatigue; rather, the issue involves a complex mechanism with psychological and affective dimensions. The high overall fatigue scores observed by O'Hara et al. in individuals with functional dysphonia further support this structural link between the vocal mechanism and mental fatigue.[9]The fact that most participants reported that voice problems negatively impacted their professional performance, motivation and patient communication highlights the organizational productivity dimension of the issue. Although medical secretaries are not traditionally classified as "voice professionals," a significant portion (37.7%) stated that vocal issues affected their work. In Turkey, a previous study by Kalınkara et al. across various occupations also found that loud and prolonged speaking impairs professional functionality.
[6]Furthermore, considering Shekaraiah et al., who noted that high number of patients and use of face masks exacerbate vocal load, our results suggests that medical secretaries struggle to protect their primary communication tool.[10]Consequently, vocal fatigue in this cohort should not be viewed as an isolated physiological issue, but as an occupational risk factor that threatens professional quality of life, individual psychology, and the overall quality of healthcare delivery.

CONCLUSION AND RECOMMENDATIONS

Our study demonstrated that voice fatigue in medical secretaries is associated with both physical and mental fatigue. Furthermore, a significant portion of medical secretaries reported that voice problems alleviated their ability to perform their jobs, affecting their professional motivation and communication with patients. Our research findings shed light on voice interventions and preventative voice practices for professionals with long working hours and heavy workloads. Rather than focusing solely on voice complaints, a more holistic approach to intervention is needed, considering individuals' professional requirements and overall fatigue levels. While our study revealed the presence of voice complaints in medical secretaries, the prevalence of voice disorders in this group is unknown. Future studies with larger sample sizes, taking into account of gender and age factors, and addressing issues such as the prevalence of voice disorders, risk factors for voice disorders, and preventative measures will significantly contribute to the voice disorders literature.

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DIGITAL SUPPORT FOR VOCAL PRACTICE BETWEEN LESSONS: DESIGN AND EVALUATION OF THE VOCALY APP

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ABSTRACT

Many students practice inconsistently between lessons, so as a solution to this challenge we developed a digital tool that combines vocal pedagogy with technology. We present an integrated digital tool that supports both singing teachers and students in independent vocal training between lessons. The Vocaly app acts as a communication bridge by improving the consistency and effectiveness of practice. When the teacher is not present, it supports daily practice with homework reminders and a set of clearly designed vocal exercises, each with a defined goal and focused on a specific technical skill. In parallel, the tool provides teachers with feedback on practice regularity and time spent training, which supports more targeted pedagogical guidance. An additional component of the system is a community of coaches built around training and exchange of experience with invited mentors.

We conducted an evaluation using in-app analytics and teacher testimonials. From system logs, we measured between-lesson practice frequency for students' cohort, completed exercise repetitions, and summarized these indicators for teachers. We also collected qualitative teacher feedback on usability and perceived value.

The results of student activity measurements and initial teacher feedback indicate that voice training based on our system increases practice regularity, supports the formation of a habit of consistent practice, and translates into faster student progress. The conclusions confirm that our tool is a comprehensive and effective extension of traditional vocal training, combining pedagogical expertise with digital technology while increasing the accessibility and effectiveness of contemporary voice education methods.

The significance of the solution stems from addressing the widespread problem of students' irregular practice, which reduces the teacher's job satisfaction. The use of new technologies makes it possible to support both the coach and the student while offering an effective approach to building a lasting practice habit.

Keywords: *Voice Training; Mobile Applications; Singing;*

INTRODUCTION

Many students practice inconsistently or without structure between lessons. This "betweenlesson gap" is critical because, without a teacher present, students often forget instructions, use incorrect technique, or follow poorly matched online materials. Such misdirected practice stalls progress, reduces satisfaction, and carries vocal health risks. From the teacher's perspective, the gap is also informational. Relying on student self-reports can lead to incorrect pedagogical decisions, as stalled progress might reflect no practice, incorrect practice, or a mismatch in homework. Regularity is thus a key concept: frequent, smaller sessions are often safer and more effective for technical learning than sporadic intensive training. This aligns with long-standing practice advice: improvement depends on deliberate, consistent practice rather than occasional effort.[1–4] Two practical barriers exacerbate this gap: (1) unclear instructions (what, how, and how much to practice), and (2) missing materials (e.g., no piano or recordings). Moving homework into the Vocaly app helps diminish these barriers by providing a structured environment (Mariusz, personal communication (written testimonial), 2025). Ultimately, the goal is not just "more practice," but structured, safe practice that allows technical learning while minimizing risk. To address this, we developed Vocaly—a digital system designed to bridge teacher instruction and student execution. This manuscript focuses on the system design and the student activity patterns observed in application logs.

METHODS

Study Type

This work is a descriptive cohort study based on aggregated in-app analytics exports and teacher testimonials.

The Vocaly App (System Description)

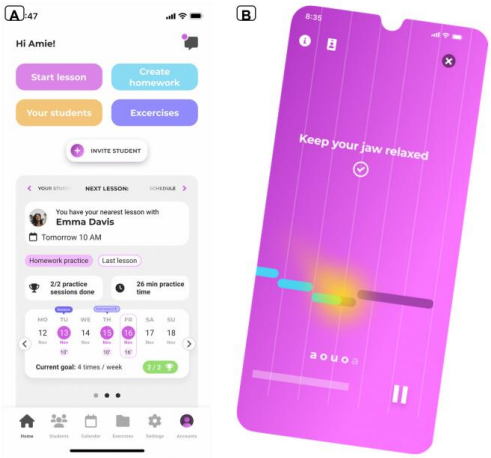

Figure 1: Vocaly app interface examples: (A) a teacher dashboard with next-lesson information, student homework practice summary, practice time, and the current student goal; (B) an exercise practice screen with in-exercise guidance.

Core: Teacher-Assigned Homework

• Teachers create and assign individualized homework composed of vocal (and, where relevant, movement) exercises.
• Homework is structured with explicit sequencing and recommended repetitions/rhythm (what to do, how to do it, and how much to do), directly addressing common teacherreported constraints in between-lesson practice—unclear instructions, inconsistent execution, and difficulty managing training load.
• Each student receives one active homework plan: an ordered sequence of exercises, plus a recommended weekly frequency (e.g., how many times per week to complete the sequence).
• In the current model, teachers typically adjust the homework during face-to-face lessons; between lessons, the plan stays stable so students can focus on executing the same sequence consistently.

Study Experience

• Students execute assigned exercises in the app with exercise-specific instructions intended to reduce ambiguity about correct performance. 3
• Figure 1B illustrates an example exercise screen with in-exercise guidance.
• Practice materials (e.g., backing tracks) are accessible within the tool, reducing common barriers such as lack of an instrument or misplaced lesson recordings, as mentioned by one teacher (Mariusz, personal communication (written testimonial), 2025).
• Backing tracks are provided in six voice-type variants—soprano, mezzo-soprano, alto, tenor, baritone, and bass—to better match students' ranges.

Reminders And Habit Scaffolding

• The system reminds students about practice and supports follow-through on teacher-assigned exercises through in-app gamification elements. These components are part of the broader Vocaly ecosystem designed to make between-lesson self-directed learning more feasible.

Teacher Monitoring

• Teachers can review high-level indicators of student practice regularity and practice volume derived from assigned homework execution logs.

• Figure 1A shows an example teacher dashboard view with next-lesson information, student homework practice summary, practice time, and the current student goal.

Community Component

• The ecosystem includes a coach-development component for professional growth (e.g., sharing practices, refining pedagogy). While part of the overall design, it is not evaluated with the analytics in this study.

Data Sources And Operational Definitions

We used aggregated in-app event exports. We also used teacher testimonials (cited as personal communications). Any statements about progress are presented as subjective impressions. In the logs, an "assigned homework execution" means a student completed an exercise that a teacher had assigned as homework. "Weekly active" means a student had at least one such execution in the prior 7 days; "monthly retention (streak)" means activity in each consecutive calendar month after the cohort start; and the monthly frequency distribution counts assigned homework executions per active student per month (Oct 2024–May 2025).

RESULTS

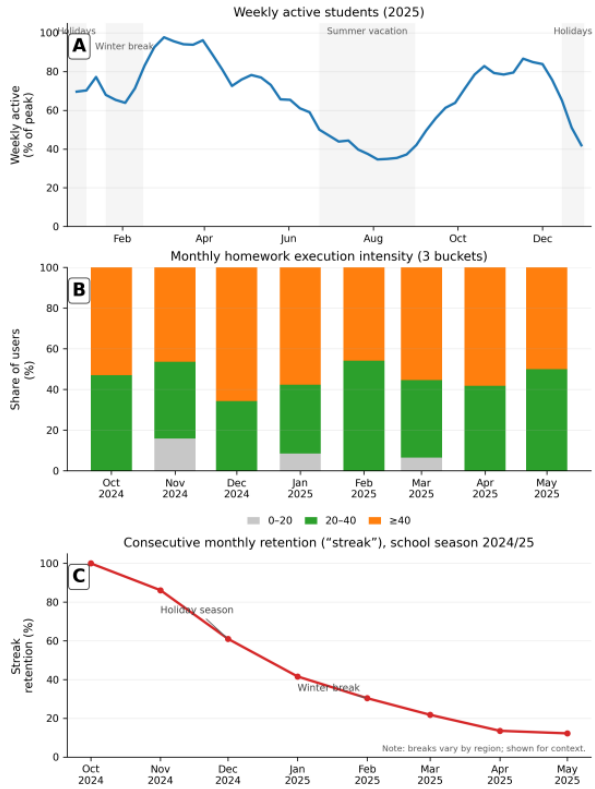

Figure 2: Student activity and retention indicators from application logs (school season 2024/25): (A) weekly active students (% of peak) across 2025; (B) monthly homework execution intensity (0–20, 20–40, ≥40) for Oct 2024–May 2025; (C) consecutive monthly retention ("streak") across Oct 2024–May 2025.

Figure 2A

Weekly activity suggested a clear seasonal rhythm (Figure 2A): engagement was typically higher during school-term months, decreased substantially during summer weeks, and declined around major break periods (holiday season and winter break). Because Figure 2A is normalized to the peak week (100%), these patterns are best interpreted as seasonality in this context rather than an effect of the app.

Figure 2B
Monthly frequency distributions showed a simple, teacher-friendly picture (Figure 2B): across months, most users were in the 20–40 or ≥40 ranges, while the split between these two intensity bands shifted over time. Very low monthly activity (0–20) was rare in this distribution, which means we are mostly looking at students who actually engage with the homework plan rather than occasional one-off use. Within that engaged group, the data suggest a move toward a more repeatable rhythm rather than random spikes: across Nov 2024–May 2025, the share of users in a moderate-to-high band (30- <90 executions/month) increased overall from 51% to 76%. For teachers, these ranges offer a practical way to talk about between-lesson work: some students maintain a "good" rhythm (20–40), while others consistently do more (≥40), and monthto-month fluctuations likely reflect both seasonality and differences in student follow-through on the assigned structure.

Figure 2C
Consecutive monthly retention (a strict "streak" definition) describes how many students stay active in every consecutive calendar month across the school-year window from October to May—so it will naturally decline as soon as someone misses a month due to holidays, illness, exams, or simply a break in lessons. In the first three months after cohort start, streak retention dropped from 86.1% (month 1) to 41.6% (month 3), and across the following four last months it tapered from 30.4% to 12.2%, forming the familiar "early drop + long tail" pattern seen in selfdirected digital interventions.[5,6] Read practically, this curve highlights two realities: continuity is hard to sustain across a whole school year, and a smaller committed core keeps the routine going—useful information for planning how to re-start students after predictable low-activity periods.

DISCUSSION
These descriptive results suggest that between-lesson practice can be made visible and easier to talk about in a way that aligns with how singing teachers already think: not as "did you practice, yes/no," but as patterns of regularity, continuity, and workload. The main value of such visibility is pedagogical rather than technological. When a teacher can see whether homework was executed regularly, lesson planning becomes less of guesswork and more of a targeted decision: if a student did not execute the plan, the next lesson may need to focus on removing barriers and simplifying the homework; if the student executed the plan but progress is limited, the teacher receives a different signal—perhaps the exercise selection, sequencing, or cues need adjustment, or the limiting factor lies outside the voice technique being targeted.
Importantly, Vocaly acts as an ecosystem: structured teacher-assigned plans, instructions, accessible materials, reminders, and visibility for teachers work in synergy to target the core difficulty of self-directed learning. This study reports descriptive usage patterns and does not isolate the effects of individual features.
In the same window, the growing share of users in the 30–<90 band suggests that more students settle into a repeatable between-lesson routine, not just occasional bursts. Regularity As A Pedagogical Signal (Not A Score) In vocal training, "regularity" is actionable because it sits at the intersection of safety and learning. Smaller, consistent doses are often preferable to sporadic intensity, especially when students practice unsupervised and may drift toward unsafe practice patterns. In this context, Vocaly's design target is not to push "more repetition," but to reduce the cognitive and organizational burden of doing the right work: the student knows what to practice, how to practice, and how much to practice, in a teacher-defined sequence. Teachers described this clarity as practically useful: when instructions are embedded in the workflow, less lesson time is spent re-explaining and more can be devoted to coaching and refinement (Olga, personal communication (written testimonial), 2025). Because completed-execution counts are not time-on-task and do not capture technique quality, they should not be read as "training minutes" or "skill gains." However, a persistent highintensity subgroup raises a practical coaching concern: some students may overdo it. In voice training, that can be a risk if students equate repetition with progress and neglect technique cues, recovery, or appropriate load.

A teacher-facing system should therefore support not only compliance but also safe practice framing—for example, emphasizing coordination goals over loudness and reinforcing that quality and consistency matter more than maximal volume.

Seasonality Is A Domain Feature, Not An App Effect

Weekly activity patterns showed a rhythm that is familiar to teachers: practice continuity is shaped by the school year, vacations, and holidays. This matters because it changes how we should interpret "drops" in activity. A seasonal dip is not automatically a motivational failure or a failure of the tool; it may reflect predictable constraints in students' schedules, reduced contact with the teacher, or changes in singing demands (e.g., performance periods vs. rest periods). For teaching practice, the implication is pragmatic: homework expectations and safety guidance may need to be adapted around low-activity periods, and re-entry after breaks may benefit from a deliberately conservative "ramp-up" rather than an immediate return to high load.

Monthly execution-frequency distributions among engaged users highlight heterogeneity: some students follow a moderate footprint, while others consistently execute at high intensity. This likely reflects differences in student follow-through and teacher assignment styles (e.g., how often homework is updated). While these remain hypotheses in the current descriptive analysis, they point teachers toward two key levers: the clarity of the plan and the student's capacity to follow it.

Teacher testimonials help interpret this practical picture. Teachers described the system as making work more efficient and more enjoyable by keeping materials and structure "in one place," enabling assignment, notes, and monitoring convenience (Dominika, personal communication (written testimonial), 2025), and reducing the "missing piano / lost recordings" barrier for students (Mariusz, personal communication (written testimonial), 2025).

Teachers also reported that students became more systematic and, in their experience, progressed faster over several months of use—presented here as subjective impressions rather than mea sured outcomes (Dominika, personal communication (written testimonial), 2025; Kinga, personal communication (written testimonial), 2025; Mariusz, personal communication (written testimonial), 2025).

Limitations And What The Paper Does Not Claim

This study is descriptive and does not measure causality or voice outcomes. Our analytics omit session duration and contextual user variables (e.g., exams, illness). Furthermore, we do not link teacher-student relationships in this analysis, limiting our ability to test teaching-style hypotheses directly.

Future Work

Future steps include connecting homework assignment data to individual students to analyze how plan structure relates to practice patterns. We also aim to incorporate time-on-task proxies and independent voice-outcome assessments for more rigorous evaluation, while preserving the teacher-centered, safety-aware framing of this work.

CONCLUSION AND RECOMMENDATIONS

This manuscript describes a teacher-centered design approach to the between-lesson gap in vocal training and presents descriptive evidence that between-lesson homework execution can be tracked as meaningful patterns of regularity, continuity, and workload. The core contribution is the "communication bridge" between teacher assignment and student execution: a structured homework plan (what/how/how much, with sequencing), accessible practice materials, and teacher visibility into practice regularity. The observed activity, retention, and frequency patterns underscore that between-lesson practice is heterogeneous and seasonal, and that continuity is difficult to sustain—facts that teachers already know anecdotally, but rarely have a shared, objective footprint for discussing and adjusting. Across the observed months, a larger share of users fell into a sustainable moderate-to-high practice band (30- < 90 monthly executions), which aligns with the goal of building a stable between-lesson habit.

Recommendations For Singing Teachers (Practice Design)

• Keep homework concrete: define what to do, how to do it, and how much to do, and state the intended technical goal for each exercise.

• Treat the order as part of the instruction: if the homework is an ordered sequence, ask students to start from the first exercise each session (instead of skipping ahead) and return to the planned rhythm.

• Prioritize "small and frequent" over occasional intensity, especially for students practicing without supervision.

• Use regularity information diagnostically: if a student did not execute the plan, simplify and remove barriers; if they executed it consistently, adjust exercise choice, cues, and load rather than assuming "no effort."

• For students who do "a lot," keep it safe: say clearly that more reps are not the goal, and remind them to focus on good technique, take breaks, and follow the cues.

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BONE-CONDUCTION AUDITORY FEEDBACK WITH FORBRAIN® FOR VOCAL FATIGUE PREVENTION IN PROFESSIONAL VOICE USERS

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Purpose: Vocal fatigue affects nearly half of professional singers, jeopardizing vocal health and career sustainability. Despite the prevalence of preventive strategies, optimal tools for reducing vocal effort remain limited. The present investigation evaluated short-term outcomes of the Forbrain® bone-conduction device on perceived vocal fatigue and acoustic parameters.
Methods: A randomized two-period crossover trial enrolled 25 professional singers (mean age: 31 years), encompassing soloists, choir members, singing teachers, and advanced students. Sessions incorporated a 20-minute vocal loading protocol. Each participant completed both experimental sequences, device active versus inactive, separated by a washout interval. Subjective vocal fatigue was quantified using the Vocal Fatigue Index (VFI), Singing Voice Handicap Index (SVHI), Professional Activity and Participation Profile (PAPV), and a Visual Analog Scale (VAS) administered at 5-minute intervals. Acoustic analysis examined standardized recordings of sustained /a/ and "Happy Birthday to You," processed using Praat 6.3.9 under strictly controlled laboratory conditions.
Results: Improved phonatory efficiency emerged during active device use, manifesting changes in intensity, harmonics-to-noise ratio (HNR), and long-term average spectrum (LTAS) values suggestive of more balanced vocal energy distribution. VAS scores indicated progressively diminished perceived effort throughout the vocal loading task, while questionnaire data reflected reduced vocal fatigue and handicap severity. The observed acoustic and subjective modifications suggest enhanced vocal economy and better breath-voice coordination. Although inter-individual variability occurred, the aggregate pattern consistently favored the active condition.
Conclusions: Within pilot study limitations, Forbrain® use was associated with attenuated perceived vocal fatigue and beneficial acoustic modifications. Bone-conduction auditory feedback appears to represent a promising preventive approach for vocal health. Confirmation through larger samples and longitudinal designs remains necessary.

Keywords: *Voice disorders, Bone conduction, Feedback, Singing, Acoustics*.

INTRODUCTION

Vocal fatigue is a frequent and clinically relevant condition among voice professionals, with a reported prevalence of 46% among professional singers. Notably, significant differences are observed between voice teachers (55%), singing students (21%), classical singers (40%), and non-classical singers (40%)[1]. This condition is characterized by subjective symptoms such as dryness, pain, tension, and increased phonatory effort, which, if persistent, may lead to objective alterations in laryngeal structures[2]. In recent years, the literature has progressively distinguished between vocal load (the amount of vocal use), vocal demand (the functional requirement), and vocal fatigue (the subjective and physiological response to effort). It is not solely the intensity or duration of vocal use that determines the risk of dysfunction, but also the individual's capacity for neuromotor self-regulation and sensory feedback management[2]. Traditional preventive strategies (vocal hygiene, semi-occluded vocal tract exercises, management of laryngopharyngeal reflux) have demonstrated efficacy, particularly in the short term[3 4]. However, realtime tools capable of modulating audio-motor control during performance are still limited. While vocal hygiene practices and gastroesophageal reflux management are recommended, they have proven insufficient when applied in isolation. Similarly, vocal training and semi-occluded vocal tract exercises (SOVTE) have shown short-term benefits but are not optimal over the long term[5 6]. Within this context, the introduction of innovative technological devices represents an opportunity to enhance preventive approaches. The Forbrain® device has emerged as a promising tool for reducing vocal fatigue and effort among professional singers.

Based on bone conduction, Forbrain® transmits the user's voice through transducers positioned on the mastoid processes, leaving the ears free and preserving natural auditory perception. The signal is digitally processed to emphasize high frequencies and modulate intensity, thereby optimizing auditory feedback[7 8]. The purpose of the present study is to evaluate the potential efficacy of Forbrain® as a preventive instrument in voice care, analyzing its short-term effects on objective acoustic parameters and the subjective perception of fatigue in professional singers.

METHODS

A two-phase randomized crossover design was adopted. Each participant completed two experimental sessions: one with the device active and one with the device inactive, separated by a washout interval ranging from 3 to 7 days. Randomization was performed with 1:1 allocation using balanced blocks. The order of conditions was assigned randomly.

Participants

Twenty-five voice professionals (mean age: 31 years; 18 women, 7 men) were enrolled, selected from an initial pool of 100 subjects contacted through music schools and digital platforms dedicated to singing.

Inclusion criteria:

- age between 18 and 65 years;
- normal hearing function;
- professional vocal activity or advanced training;
- absence of laryngeal pathologies.

Exclusion criteria:

- organic lesions of the vocal folds;
- oecent laryngeal surgery;
- neurological or systemic diseases interfering with phonation.

All participants underwent otolaryngological assessment with laryngoscopy and laryngostroboscopy, which revealed no morphological or functional abnormalities. The average singing experience was approximately 10 years, with daily vocal use of about 3 hours.

Study Design

The study utilized a two-period randomized crossover design, allowing each participant to experience both device conditions, active and inactive, in randomized order.

T0 Phase: After detailed medical history and informed consent, the initial objective was to evaluate the integrity of anatomical structures involved in phonation via laryngoscopic and laryngostroboscopic examinations. Once standard laryngeal structures were confirmed, eligible subjects were randomly assigned to one of two experimental sequences: Sequence A: Forbrain® active → Forbrain® inactive; Sequence B: Forbrain® inactive → Forbrain® active.

Randomization was performed using the random.org software, with a 1:1 allocation ratio between sequences A and B, and block randomization (blocks of 4 or 6) to minimize temporal imbalances. To maintain allocation concealment, A and B codes were placed in opaque, sealed, consecutively numbered envelopes, kept by a colleague not involved in participant management. At the end of T0, each participant selected the envelope corresponding to their enrollment number in the presence of a witness. The experimenter then recorded the pathway and explained the first experimental condition (T1) in accordance with the assigned sequence, avoiding any preliminary disclosure that could introduce procedural bias. After recruitment, the fundamental characteristics of groups A and B were compared. In case of imbalance, the covariate sequence was included in the analysis to ensure that observed effects were attributable to treatment rather than random group characteristics.

T1 Phase: Participants underwent a speech therapy evaluation during which the following data were collected:

- personal and family history;
- professional category of the singer;
- years of vocal experience;
- preferred musical genre;
- average duration of daily vocal use;
- singer classification (voice type);
- postural evaluation of neck, shoulders, and spine, with any asymmetries noted;
- administration of subjective questionnaires: SVHI[9], PAPV[10], and VFI[11].

Subsequently, each participant completed a vocal training session with Forbrain® in the assigned condition (active or inactive), during which study parameters were acquired. Sessions were systematically scheduled in the early afternoon to minimize circadian variability and optimize physiological comparability, all held in the same soundproofed room under stable environmental conditions. A standardized protocol was applied under speech therapy supervision, including vocal warm-up, range extension exercises, and the performance of a standardized song, with audio recordings obtained using a Shure MV5 microphone for spectrographic analysis with Praat 6.3.9. The choice to use two distinct vocal tasks (sustained /a/ vowel and the song "Happy Birthday to You") allowed for exploration of phonatory behavior in both controlled and more complex musical contexts. During training, the Visual Analog Scale (VAS) was administered every five minutes to monitor the progression of perceived vocal fatigue in real time. At the same time, acoustic analysis examined fundamental frequency (F0) and its range, mean intensity, vibratory stability measures (jitter and shimmer), the harmonics-to-noise ratio (HNR) as a signal quality indicator, and long-term average spectrum (LTAS) for characterizing sound energy distribution12, 13. Primary outcomes included within-subject variation in VAS scores over time and changes in LTAS, while secondary outcomes included variations in other acoustic parameters and changes in VFI, SVHI, and PAPV questionnaire scores.

T2 Phase: After a washout period of three to seven days, each participant completed a second session in the opposite condition to the previous phase: participants who had used the active device in T1 deactivated it, and vice versa. The entire protocol was replicated. At the end of T2, new acoustic recordings were obtained, and the same questionnaires were re-administered. Participants were asked to provide responses referring to the previous week, including their experience during the experimental phase. This approach enabled the comparison of subjective voice perceptions before and after participation, while recognizing that the second administration reflects the overall postintervention state rather than the isolated effect of the active device. Direct comparison between the two experimental conditions (Forbrain® active vs. inactive) was based on real-time VAS scores and acoustic parameters measured at T1 and T2.

Statistical Analysis

Analysis was performed using linear mixed-effects models for repeated-measures data, with experimental condition (active vs. inactive device), time, and session as fixed effects. The primary outcome included within-subject variation in VAS and changes in LTAS; secondary outcomes included questionnaire scores (VFI, SVHI, PAPV) and acoustic parameters. FDR correction was applied to control for multiple errors. The p-value, 95% confidence interval, and effect size were reported, with both clinical and statistical interpretation.

RESULTS

Demographic and Professional Characteristics

The sample included 25 participants selected from an initial pool of 100 individuals contacted. The professional composition consisted mainly of singing students (n=14), five singers/vocal teachers, and four professional performers. Artistic specialization was predominantly pop (n=22), with three jazz influences and one in rock. The average singing experience was approximately ten years, with daily vocal use of about three hours.

All participants completed comprehensive otolaryngological assessments without morphological or functional abnormalities.

Acoustic Parameter Results

Acoustic analysis revealed significant variations between the two experimental conditions. Regarding the sustained /a/ vowel, results indicated a significant reduction in intensity and an increase in HNR, by 6% and 19%, respectively. These findings suggest greater phonatory efficiency, reflected in more energy-efficient vocal production, a more stable and harmonic signal, and reduced glottal noise. During the performance of "Happy Birthday to You", the most notable differences were observed in the reduction of intensity and the shift of LTAS towards less negative values, both statistically significant. These modifications indicate an effect of the device on more economical control of vocal energy and a more balanced spectral distribution, with greater energy concentration in the mid-high frequencies. HNR showed a mean increase of 4%, although high intra-sample variability precluded statistical significance. Overall, device use appears to promote a better balance between energy efficiency, stability, and harmonic richness of the voice, with the most notable improvements observed in reduced phonatory effort and optimized acoustic signal quality.

VAS Scale Results

Analysis of VAS scores, recorded at regular intervals during vocal exercise sessions, revealed an overall trend of decreased perceived effort in the active device condition compared to the inactive condition. After 5 minutes, the mean difference between the two conditions was -0.092; after 10 minutes, -0.232; after 15 minutes, -0.848; after 20 minutes, -0.884; after 25 minutes, -0.868. Negative values indicate a progressive reduction in mean score until the fifteenth minute, after which the trend stabilizes, suggesting a lower perception of vocal fatigue associated with device use.

Self-Assessment Questionnaires

Analysis of questionnaires administered at baseline (T0) and at the end of the study (T2) revealed changes in mean scores. Results showed negative mean values across all scales, indicating a decrease in total scores at the end of the experimental protocol. Specifically, the Vocal Fatigue Index (VFI) showed a mean difference of -4.12 points, the Singing Voice Handicap Index (SVHI) of -5.96, and the Professional Activity and Participation Profile (PAPV) of -7.61. These values represent the overall change observed between T0 and T2, providing a quantitative description of changes related to vocal fatigue, singing voice handicap, and subjective phonatory effort.

DISCUSSION

Analysis of self-assessment questionnaires revealed significant changes in mean scores for the Vocal Fatigue Index (VFI), Singing Voice Handicap Index (SVHI), and Professional Activity and Participation Profile (PAPV). Although these tools represent secondary outcomes in the study, they hold considerable clinical relevance as they offer a direct perspective on the subjective experience of voice and vocal fatigue. The present study contributes to this perspective by systematically applying these principles to the singing voice, demonstrating that a bone conduction device can optimize audio-vocal feedback and reduce the subjective perception of fatigue in singers. The overall reduction in mean scores across the three questionnaires indicates an improvement in perceived vocal well-being at the end of the study, confirming a more positive perception of vocal quality, a reduced sensation of fatigue, and a lower self-reported phonatory effort. These results suggest that Forbrain® use not only improved phonatory efficiency but also increased participants' awareness and control of their voices, fostering a greater sense of naturalness and comfort during phonation.

The data obtained from the VAS scale followed a similar trend. Measurements taken at regular intervals during vocal sessions showed a progressive decrease in perceived effort when the device was active compared to when it was inactive. Although the difference was minimal in the first five minutes, a steady decline emerged from the tenth minute onward, reaching its lowest point around the fifteenth minute before stabilizing. This pattern suggests that the enhanced auditory and proprioceptive feedback provided by bone conduction enabled participants to regulate vocal intensity and quality more effectively, progressively reducing their perceived effort.

Subjective improvements captured through questionnaires and the VAS scale were corroborated by objective acoustic data, confirming consistency between perceptual and physiological levels of observation. Variations in vocal parameters, both in the sustained /a/ and during singing performance, reflect more efficient phonatory function and more economical voice use. In particular, the decrease in intensity and increase in the harmonics-to-noise ratio (HNR) in the active condition indicate greater vibratory stability of the vocal folds and more efficient glottal closure, resulting in a clearer, more harmonic, and less noisy sound signal. Concurrently, the long-term average spectrum (LTAS) demonstrated a steeper negative slope, indicating a more balanced spectral distribution and more effective use of resonances. This configuration is characterized by a less fatigued, more efficient voice, with better control of breath management and subglottic pressure, and more evenly distributed acoustic energy across frequencies. Parameters relating to fundamental frequency (F0) and pitch variability showed similar trends, indicating greater vocal flexibility and more precise modulation, particularly during singing. The integration of subjective and objective data suggests that the use of Forbrain® promotes simultaneous improvements in vocal perception and phonatory behavior by refining the audio-vocal self-monitoring circuit. By transmitting the user's own voice via bone conduction, the device enhances and anticipates auditory feedback, making the signal clearer, more immediate, and more centered. This expanded perceptual awareness encourages users to spontaneously and accurately modulate intensity, pitch, and timbre, thereby facilitating automatic regulation of phonation and resulting in more balanced and energy-efficient vocal production.

CONCLUSIONS

Within the limitations of a pilot study, the use of Forbrain® was associated with reduced perceived vocal fatigue and beneficial acoustic modifications. Auditory feedback via bone conduction represents a promising preventive approach for vocal health, improving phonatory efficiency, breathvoice coordination, and the subjective perception of effort. The results suggest that the device optimizes the audio-vocal self-monitoring circuit, facilitating more economical and efficient automatic regulation of phonation. Clinical implications extend from preventing vocal fatigue in professional singers to potential applications in the rehabilitation of functional dysphonias and disorders of pneumo-phono-articulatory coordination. Nevertheless, the limitations of the present study must be acknowledged, particularly the small sample size and the limited timeframe for data collection and analysis. These constraints do not compromise the reliability of the observed trends but underscore the need for further research. Future developments should include a larger sample and a longer experimental timeline to consolidate preliminary results and more robustly validate the device's effectiveness.

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"OROLOGIO DELLA RISONANZA", A METAPHORICAL APPROACH TO VOCAL TRACT PROPRIOCEPTION AND SINGERS' PEDAGOGY: EXPLORATORY STUDY

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ABSTRACT
In the field of vocal training, working on the vocal tract is a key elements that helps singers in increasing their proprioception and physical awareness. Regarding resonance and indirect ways to influence laryngeal activity, we propose a new pedagogical tool in vocal training called the "Resonance Clock".
This method is based on a metaphorical pedagogical approach that associates resonance cavities with an imaginary clock, guiding singers to explore resonance through auditory and proprioceptive feedback rather than direct muscular control. Aim of this exploratory study was to present pedagogical training for resonance "Orologio della Risonanza" as a teaching strategy that facilitates singers' understanding of the physiological and perceptual adaptations of the vocal instrument, allowing access to a wide range of vocal qualities. The training process is illustrated through audio examples, acoustic analysis, and participants' self-assessments, highlighting the progressive development of the singers' proprioceptive awareness. We conducted an exploratory pilot study employing a mixed-methods approach. The research involved two groups of singers (n=25 and n=3, respectively) practicing the 'Resonance Clock' technique. Data were gathered through ad-hoc self-administered surveys for both groups; for the second group, the qualitative data were integrated with objective acoustic analyses of vocal recordings, specifically focusing on the Singing Power Ratio (SPR).
Surveys indicate that participants find the model helpful in reaching different qualities and incorporating it into their daily training. Acoustic analysis, shows that Singing Power Ratio increases when singers use positions perceived in the anterior part of the vocal tract. Our preliminary findings show that pedagogical training for resonance: "Orologio della Risonanza" enhances singers' proprioception of different vocal qualities, both amplified and unamplified, by improving their ability to recognize and modulate sound direction along the imaginary clock. This indirect, perception-based approach supports effective technical control, in particular for what concerns laryngeal behaviour, without explicit mechanical instruction

KEYWORDS *pedagogy, resonance, proprioception, vocal training, acoustic analysis*

INTRODUCTION
In the field of contemporary vocal training, working on the vocal tract stands as one of the pillars of technical development. Each specific vocal quality—whether it be the rounded warmth of a classical "Legit"[1] sound or the metallic "edge" of a modern belt—requires a unique physiological adaptation. When singers direct their conscious attention toward these subtle internal shifts, they experience a profound change in physical sensation. This heightened awareness allows vocalists to significantly improve their proprioception, the internal sense of the relative position of neighboring parts of the body and the strength uses for their movement. Consequently, it is well-established in modern vocology that focusing on the vocal tract is a precious tool in the development of a singer's perception and technical mastery.
The concept of using internal perception to guide vocal production is not a modern invention. Even at the dawn of the 20th century, legendary singers and pedagogues emphasized the importance of the singer's proprioception of their vocal tract to help students achieve efficient technique. Figures such as Lilli Lehmann[2] and Mauran[3] provided extensive considerations regarding their own perceptions of sound directionality within the resonance cavities. They understood that where a singer "aims" the sound or "feels" the direction of it, can dictate the obtainment of particular voice qualities.

In seeking a modern method to simplify the transition between different vocal qualities and styles—and to facilitate ease of singing across the entire vocal range—we find that anchoring the singer's attention to specific coordinates within the vocal tract is exceptionally useful. This necessity led to the birth of a pedagogical expedient we called the Resonance Clock (or Orologio della Risonanza). Developed within the framework of Legitimate Vocal Training[4] , the Resonance Clock was originally conceived in 2023 to assist crossover singers in reaching diverse sound qualities with greater ease. The formal study of this method began in early 2024 and continues to evolve today. The metaphorical device asks the student to imagine a clock face superimposed on their left cheek. In this visualization:

- 9:00 o'clock is located near the mouth.
- 12:00 o'clock (Midnight) is positioned in the center of the resonance cavity.
- 3:00 o'clock is located deep in the back of the cavity.

By utilizing this clock, singers are instructed to consider the movement of a single imaginary "hour hand." Each numerical position or movement of the hand provides a different sensory suggestion, leading to specific physiological adaptations of the vocal tract without the need for complex anatomical commands that might cause tension.

METHODS

To test the efficacy of this vocal training technique, we conducted an exploratory pilot study, employing a mixed-methods approach on two groups of singers practicing the 'Resonance Clock' technique. Data were gathered through ad-hoc self-administered surveys for both groups; for the second group, the qualitative data were integrated with objective acoustic analyses of vocal recordings, specifically focusing on the Singing Power Ratio (SPR).

The first group (n=25, both males and females, with a mean age of 35 years) consisted of a wide variety of subjects: students, professional singers, and hobbyists, with an age ranging from 15 to 75 years old. These participants practiced various styles, from opera to pop and classical crossover. The Resonance Clock was integrated into their regular singing lessons. While some students participated in weekly systematic training, others used the method in a more sporadic, non-systematic fashion. The goal for this group was to observe how the metaphor affected their ability to navigate their range and change vocal colors. We administered a self-reported survey covering three areas: proprioception, vocal technique, and the "clock's" effects on their instrument.

The second group involved three professional singers with similar vocal types, technical backgrounds, and knowledge of vocology. Particularly, this section of the study focused more narrowly on "classical styles" and their repertoire. Participants were asked to perform the incipit of George Frideric Handel's famous aria "Lascia ch'io pianga" from the opera Rinaldo. They performed the incipit in four different "clock positions" (14:30, 12:00, 10:30 and 9:30) at constant pitch and intensity to ensure consistency. Each singer utilized the same standardized vocal warm-up before the recordings. All recordings were made using a Neumann TLM103 condenser microphone and a Universal Audio Volt 476 USB high-fidelity audio interface connected to a Mac mini. Recording sessions took place in a silent (<40 dB) professional recording studio environment, maintaining consistent recording parameters (48.000 Hz sampling frequency with 16-bit depth) via Logic Pro.

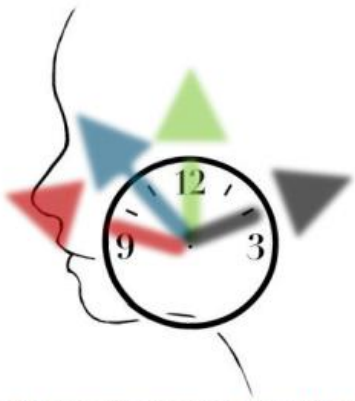

Figure 1 Schematic representation of the four vocal positions of the Orologio used in the study: S.30 (red), 10:30 (blue), 12:00 (green), 14:30 (black).

The audio tracks were then analyzed extracting Long Term Average Spectrium (LTAS) using software PRAAT. We compared LTAS of the four different positions, focusing in particular on the frequency range 2000-4000 Hz and Singing Power Ratio. This parameter, originally proposed by Omori and colleagues [5] , is calculated as the difference (in dB) between the highest spectral peak in the 2000–4000 Hz range and the highest peak in the 0–2000 Hz range, as derived from LTAS analysis. For each vocal position, the mean and standard deviation of the SPR were calculated. Following the sessions, the singers completed a qualitative interview and answered some questions about their feeling and sensations during the recordings using the clock's position.

RESULTS

Findings from the survey submitted to the first group of participants is summarized in the subsequent table.

Parameter	Result
Determinant in Technique Building	> 50% of participants
Improved Range and Stability	100% of participants
Improved Proprioception	100% of participants
Utility for Breath Control	90% of participants
Think about the clock during independent practice	89% of participants

Findings emerging from the acoustic analysis carried out in the second group of participants are showed in figure 2.

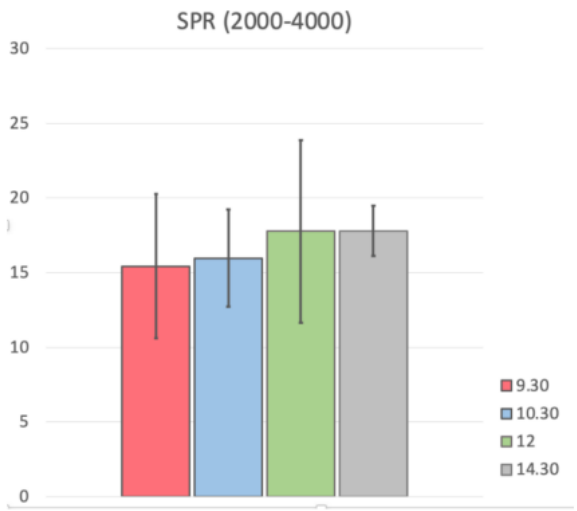

Figure 2. Mean SPR values across the four vocal positions considered. Error bars represent standard deviation (SD).

Lower SPR values were found for the 9:30 and 10:30 clock positions, indicating higher spectral peak intensity in the 2000–4000 Hz range compared to other positions.

All participants of the second group referred to the 9:30 and 14:30 positions as sounding closer to a heavy mass. They also recognized an increase in penetrance in the frontal positions, specifically at 9:30 and 10:30. These findings are consistent with the trends observed in the acoustic analysis.

DISCUSSION

In vocal training, working on the vocal tract is of paramount importance. Each vocal quality requires a specific adaptation and, by focusing on it, singers can perceive different physical sensations. This awareness allows singers to improve their proprioception.

It is well known that paying attention to the vocal tract is invaluable in developing a singer's perception and technical control. To simplify transitions between vocal qualities and styles, or to facilitate singing across the entire range, we found that focusing on different parts of the vocal tract is highly effective.

Thus, we developed a new pedagogical tool, known as the Resonance Clock (Orologio della Risonanza). In fact, this metaphorical approach was originally conceived to help crossover singers achieve different vocal qualities and styles more easily. Over time, this metaphorical training has been applied to various singers across diverse repertoires from Opera to Pop.
Findings from this paper were previously presented at the 15th International Course on Phoniatrics and Logopedics "La Voce Artistica" (Ravenna, Italy) in November 2025.[6]
This pilot study was established in 2023 and continued throught 2024 and 2025.
In our exploratory pilot study, integration of pedagogical feedback and acoustic analysis yielded several fascinating insights into how proprioceptive metaphors influence physical output. All singers in the first group reported improvements in proprioception, vocal range, and stability; furthermore, the vast majority perceived the technique as effective for breath management and successfully integrated it into their regular vocal practice. The decrease in SPR values observed in the 9:30 and 10:30 positions suggests a greater concentration of spectral energy in the higher harmonic range (2000–4000 Hz), indicating increased vocal projection and "penetrance" for the anterior positions of the Clock. This parameter is widely utilized in the study of the artistic voice, as it shows a strong correlation with voice "ring" and with singer's formant, showing robustness in both classical and contemporary commercial music contexts[7,8] . However, given the exploratory nature of this analysis and the small sample size (n=3), these values are intended to illustrate preliminary trends rather than to provide definitive statistical inference.

Pedagogical considerations
In both groups, visualizing the clock hand at the half past 2 position helped singers achieve a powerful, "thick" vocal quality. This position encourages a heavier vocal fold mass. Interestingly, all participants reported that singing in this position felt remarkably easy and comfortable. It allowed for a robust sound without the sensation of "pushing".
For the first group, the clock proved essential for managing the transition between Mechanism 1 (chest voice/M1) and Mechanism 2 (head voice/M2). When singers were asked to move the imaginary hand closer to the center of the resonance cavity (near the 12:00 position), they found it much easier to execute the passaggio. The 12:00 ("Midnight") position appeared to naturally correlate with Mechanism 2, providing a lighter, more "lofted" sensation. Within the second group, two out of three participants associated this position with a sound closely resembling the "Legit style". One of the most significant findings of the study occurred at the half past 10 position. When singers sought a "heavy" feeling while remaining in a light mechanism, this position provided an "energetic lightness". Remarkably, for this production mode, acoustic analysis showed an increase in projection. This position often resulted in a more metallic, piercing quality, sometimes reminiscent of vocal damping[9,10] . When a very heavy mass was required, moving the hand to the 3:00 o'clock position (the back of the cavity) was most effective. This position was frequently associated with the "Belt" quality, where a high degree of acoustic energy and thyroarytenoid dominance is required.
The second group's interviews mirrored these findings. When using the half past 9 (9:30) position, they reported a sense of heavy mass and high penetrance, which they instinctively associated with the late 19th-century Verismo repertoire. The half past 10 (10:30) position emerged as a crossroad. It was deemed useful for Recitar Cantando (early Baroque monody), providing the necessary "energetic lightness" to maintain delicacy without losing vocal presence; it is also valuable for modern repertoires. The acoustic analysis confirmed the singers' sensations. In fact, "ring" and penetrance peaked at the 9:30 position, decreasing as the imaginary hand moved from the front toward the center of the cavity. Despite its exploratory nature, the study yielded several interesting insights regarding the "Resonance Clock", suggesting it can be a functional trigger for physiological change.
In cases of voices with excessive breathiness, asking the singer to visualize the "Midnight position" often helped achieve better vocal fold abduction, even in young female voices prone to air leakage. Furthermore, the method appeared helpful for singers recovering from vocal fatigue or vocal folds minor damage, as it offers a way to controlled the larynx activity indirectly.

We also observed a specific "directional" trend in the range:
• In Classical qualities, as the singer moves from the low range to the high range, the hand of the clock tends to move from the front to the back of the cavity.
• In Modern qualities, a similar front-to-back or back-to-front shift occurs depending on the specific "color" required.

CONCLUSION AND RECOMMENDATIONS

The convergent evidence between the survey feedback and the trends observed in the acoustic analyses suggests that the method may yield consistent effects. It is important to acknowledge that as a metaphorical approach, the Resonance Clock is not a "one size fits all" solution. Its effectiveness depends heavily on a student's cognitive style. We observed that individuals who naturally maintain a very high laryngeal position often struggle to feel comfortable with this specific expedient. Additionally, because every human instrument is unique, the teacher must be skilled enough to calibrate the "clock" to the individual characteristics of the student's voice.

Naturally, our exploratory findings require further investigation through a larger sample sieze to allow for robust statistical analysis. However, this pilot study confirms that indirectly addressing the larynx remains one of the most effective ways to stimulate the right sinergy between power source, vocal folds and resonance.

In conclusion, the Resonance Clock shows how different singing styles are not as far apart as they might seem. By using this metaphorical approach, singers can access a wider palette of colors, improved stability, and a deeper connection to their own internal sensations.

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COMPARATIVE ANALYSIS OF VOCAL HYGIENE BEHAVIORS OF OPERA AND THEATRE DEPARTMENT STUDENTS

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ABSTRACT

Objective

This research aims to comparatively examine the vocal hygiene behaviors of opera and theatre students, who are prospective elite vocalists, and to identify possible interdisciplinary differences.

Methods

In this study, a total of 132 students studying in the opera (n=60) and theatre (n=72) departments of state conservatories in Turkey were evaluated. The vocal hygiene behaviors of the participants were scored using a structured form that included criteria such as voice use intensity, irritant substance use (smoking-alcohol-caffeine), dietary habits, water consumption, sleep patterns, environmental exposure, and throat clearing habits. Since the data did not show a normal distribution (Shapiro-Wilk $p < .05$), the Mann-Whitney U Test was used for comparisons of total scores between groups. The distribution of categorical variables according to departments was evaluated with Chi-square analysis.

Results

According to the analysis results, no statistically significant difference was found between the total vocal hygiene behavior scores of opera and theatre students ($U = 1998.0$, $z = -.74$, $p = .453$). Similarly, no statistically significant differences were found between the departments in any of the variables of voice use ($p = .962$), irritant substance use ($p = .269$), dietary habits ($p = 1.000$), water consumption ($p = .644$), sleep duration ($p = .489$), exposure to dusty environments ($p = .715$), and throat clearing habits ($p = .174$) ($p > .05$). When descriptive data were examined, intensive voice use was reported as 45% (n=27) in opera students and 43.1% (n=31) in theatre students. Irritant substance use was at the level of 50% (n=30) in the opera group and 38.9% (n=28) in the theatre group. Daily water consumption exceeding 2 liters was determined to be 50% (n=30) among opera students and 55.6% (n=40) among theatre students. Sleep duration exceeding seven hours was found to be 61.7% (n=37) in the opera group and 54.2% (n=39) in the theatre group. Exposure to dusty environments was reported by 46.7% (n=28) of opera students and 51.4% (n=37) of theatre students; throat clearing or shouting habits were reported by 45% (n=27) and 31.9% (n=23), respectively.

Conclusion

The research findings showed no significant difference between the vocal hygiene behaviors and total scores of opera and theatre students ($p > .05$). The observation of similar risk behaviors in both groups suggests that vocal hygiene and voice health training aimed at behavioral change should be strengthened in conservatory education.

Keywords: *Hygiene, Occupational Health, Singing, Voice.*

INTRODUCTION

Professional voice users are a group who utilize their voices as a fundamental tool in the performance of their profession, and even the slightest deterioration in voice quality directly affects their work performance. Opera and theatre artists fall into the category of "elite voice users" who utilize their voices at the highest level of performance[1]. Opera and theatre students receiving conservatory training, despite being at the beginning of their professional careers, are at high risk for voice pathologies due to high vocal load, intense rehearsal processes, and vocal stress resulting from stage performance[2].

Opera and theatre disciplines have different technical and aesthetic requirements in terms of the artistic use of the voice. Opera students receiving classical vocal training develop a technique with a wide vocal range to be able to project the acoustics of the voice in large halls without microphone support. Theatre students use the timbre variety and projection of the voice with high performance to convey the dramatic text[3]. Despite these differences, students in both disciplines are exposed to common risk factors such as prolonged phonation and emotional stress[4–5].

Vocal hygiene refers to behavioral strategies that an individual applies in their daily life to protect vocal health, prevent voice disorders, and improve existing voice quality. These strategies consist of multifaceted components such as ensuring adequate hydration, avoiding phonotrauma behaviors like overuse and misuse of the voice, restricting irritants such as smoking, alcohol, and caffeine, and regulating dietary habits[6]. Studies show that aspiring elite voice users generally have a high level of knowledge about vocal hygiene, but this knowledge does not always translate into behavior[6–7].

Although the literature has shown that holistic voice training for theatre students significantly increases vocal hygiene awareness, Sezin et al.[8] note that studies directly comparing the vocal hygiene behaviors of opera and theatre students and examining the relationship between them are limited. Especially in the Turkish context, the analysis of discipline-based vocal habits of conservatory students is critically important for determining the content of voice health training that should be included in the curricula of both departments.

This research aims to comparatively examine the vocal hygiene behaviors of opera and theatre students, who are aspiring elite vocalists, and to determine if there is a significant relationship between these two disciplines. The findings are intended to contribute to the development of vocal protection strategies in conservatory education.

METHODS

This research is a descriptive study that comparatively examines the vocal hygiene behaviors of opera and theatre students. The sample of the study consists of a total of 132 students studying in the Opera (n=60) and Theatre (n=72) departments of state conservatories in Turkey. Participants were selected based on the following criteria: absence of upper respiratory tract infection at the time of evaluation, absence of diagnosed voice disorders, absence of prior head and neck surgery, and absence of regularly used upper respiratory tract medication. Participants voluntarily participated in the study.

A structured Personal Information Form was used to inquire about participants' lifestyles and voice use habits. The form questioned seven basic vocal hygiene behaviors: daily voice use, irritant substance use (smoking/alcohol/caffeine), water consumption, preferred food and beverage types, sleep patterns, environmental exposure, and throat clearing. Each negative behavior was scored as '1', and a positive behavior as '0'; the total vocal hygiene score was calculated on a scale of 0-7. An increase in the score indicates that the individual exhibits more negative vocal hygiene behaviors.

Data analysis was performed using SPSS software. The normality of the data distribution was examined using the Shapiro-Wilk test, and it was determined that the data did not show a normal distribution ($p < .05$). Therefore, the Mann-Whitney U Test was used to compare total vocal hygiene scores. Categorical variables (voice use, irritant use, dietary habits, water consumption, sleep duration, environmental exposure, and throat clearing) were analyzed using the Pearson Chi-square test.

RESULTS

The distribution and numerical data of the seven basic parameters determining the vocal hygiene behaviors of the participants are presented in detail in Table 1.

Table 1. *Distribution of Vocal Hygiene Behaviors of Opera and Theatre Department Students.*

	Category	Opera (n=60)	%	Theatre (n=72)	%
Voice Usage	Low	33	55.0	41	56.9
	Excessive	27	45.0	31	43.1
Irritant Substance (Cigarettes, Alcohol, Coffee, Tea)	Not Using	30	50.0	44	61.1
	Using	30	50.0	28	38.9
Dietary Habits (Spicy Foods And Acidic Drinks)	Not Consuming	30	50.0	35	48.6
	Consumes	30	50.0	37	51.4
Daily Water Consumption	>2 Liters	30	50.0	40	55.6
	0–2 Liters	30	50.0	32	44.4
Sleep Time	>7 Hours	37	61.7	39	54.2
	0–6 Hours	23	38.3	33	45.8
Dusty Environment Exposure	None	32	53.3	35	48.6
	Yes	28	46.7	37	51.4
Throat Clearing	None	33	55.0	49	68.1
	Yes	27	45.0	23	31.9

A detailed examination of the participants' vocal behaviors revealed that 45% (n=27) of opera students and 43.1% (n=31) of theatre students reported overuse of their voices. The habit of clearing the throat, a phonotraumatic behavior, was found to be higher in the opera group (45%, n=27) compared to the theatre group (31.9%, n=23). The use of harmful substances was 50.0% in opera students and 38.9% in theatre students. In other parameters, both groups showed similar risk rates: consumption of spicy/acidic foods was 50% and 51.4% in opera and theatre, respectively; daily water consumption exceeding 2 liters was 50% and 55.6%; sleep duration exceeding 7 hours was 61.7% and 54.2%; and exposure to dusty environments was 46.7% and 51.4%.

Table 2. *Chi-Square Analysis of Vocal Hygiene Behaviors of Opera and Theatre Department Students.*

	Level	Opera (n=60)	Theatre (n=72)	$\chi 2$	p
Voice Usage	Low	33	41	.002	.962
	Excessive	27	31		
Irritant Substance (Cigarettes, Alcohol, Coffee, Tea)	Not Using	30	44	1.220	.269
	Using	30	28		
Dietary Habits (Spicy Foods And Acidic Drinks)	Not Consuming	30	35	.000	1.000
	Consumes	30	37		
Daily Water Consumption	>2 Liters	30	40	.213	.644
	0–2 Liters	30	32		
Sleep Time	>7 Hours	37	39	.478	.489
	0–6 Hours	23	33		
Dusty Environment Exposure	None	32	35	.134	.715
	Yes	28	37		
Throat Clearing	None	33	49	1.848	.174
	Yes	27	23		

Analysis of the data revealed no statistically significant relationship between the groups (Opera and Theatre) and the lifestyle and vocal hygiene variables examined (voice use, irritant use, dietary habits, water consumption, sleep duration, exposure to dusty environments, and throat clearing) ($p > .05$). Pearson Chi-square test results were reported because the expected cell values were above 5 in all analyses. Since all analyzed variables formed 2x2 tables (2 groups x 2 levels) with 1 degree of freedom, continuity correction results were considered in the Chi-square analysis.

The comparison of total vocal hygiene behavior scores between opera and theatre students was conducted using the Mann–Whitney U test. The analysis indicated that there was no statistically significant difference between the two groups. Opera students had a mean rank of 69.20, whereas theatre students had a mean rank of 64.25. The difference between groups was not statistically significant ($U = 1998$, $z = -0.74$, $p = .453$). These findings suggest that the overall vocal hygiene behavior profiles of opera and theatre students are similar.

DISCUSSION

This study compared the vocal hygiene behaviors of opera and theatre students, and no statistically significant difference was found between the two disciplines ($p = .453$). This finding indicates that, despite differences in educational content, performing arts students have similar vocal risk factors and habits.

The findings are consistent with previous studies that have shown a non-linear relationship between knowledge level and behavior in the field of performing arts. Flynn[3] stated that vocal health education in performing arts programs varies in terms of content and continuity. He noted that although opera and musical theatre students have high levels of theoretical knowledge about vocal hygiene, this knowledge is not directly reflected in their behavior. The findings of our study also suggest that habits, environmental conditions, stress, and lifestyle may be decisive in the transformation of knowledge into behavior.

This similarity between opera and theatre students can be explained by the fact that both groups are exposed to similar vocal loads as candidates for "elite voice users." In our findings, it was observed that the perceptions of voice use were similar in both groups ($p = .962$). In both groups, approximately 43-45% of participants reported using their voices intensively. This can be interpreted as the intensity of performance and rehearsal during the training process creating a similar vocal load in both disciplines. In the literature, Maria et al.[4] and Reckers et al.[5] emphasized that prolonged phonation and stage stress are common risk factors in performance artists. The lack of a significant difference between disciplines in our study suggests that vocal hygiene behaviors are influenced more by student lifestyle and general awareness levels than by professional technique.

No statistically significant difference was observed between the groups in terms of hydration ($p = .644$). 50% of opera students and 55.6% of theatre students reported consuming more than 2 liters of water daily. Achey et al.[6] stated that hydration awareness is high among classical singing students, but this does not always translate into sufficient vocal moisture. The lack of significant differentiation between the two groups in the current study suggests that hydration knowledge is similarly conveyed to both disciplines. However, the approximately 45- 50% inadequate water consumption in both groups indicates that this knowledge still needs support in terms of translating into behavior.

When examining harmful habits and dietary behaviors, although the average ranks for smoking, alcohol, and caffeine use were numerically higher among opera students, this did not create a statistically significant difference between them and theatre students ($p = .269$). The remarkably high levels of these rates in both groups suggest that general lifestyle patterns are more decisive than interdisciplinary differences. Although Park and Kim (2024) reported that classical singing students tend to exhibit protective behaviors during performance periods, it appears that this tendency is not always reflected in daily habits. Furthermore, the consumption of spicy and acidic foods at approximately 50% in both groups ($p = 1.000$) poses a potential risk for laryngopharyngeal reflux. When considered together with the high prevalence of reflux reported by Özdoğanoğlu[9] among opera students, the current findings suggest that this may threaten voice quality in the long term.

Although throat clearing habits were numerically more frequent in opera students (45%) than in theatre students (31.9%), this difference between the two groups was not statistically significant ($p = .174$). This situation may be related to the technical sensitivity of opera training and increased sensitivity to the voice. The belief that even the smallest change in voice can affect performance may develop hyper-awareness in students and increase phonotraumatic behaviors. D'haeseleer et al.[2] stated that vocal symptoms are common in musical theatre artists, but behavioral regulation is not always sufficient. In this context, it can be said that increased awareness does not always have a protective function and can turn into risky behaviors without proper guidance.
Overall, the lack of a significant difference in vocal hygiene behaviors between opera and theatre students indicates that interventions for voice health should be addressed with a holistic approach rather than branch-based distinctions. Given the positive effects of structured and holistic vocal training programs reported by Sezin et al.[8], it is becoming increasingly important to develop practice-based training in conservatory curricula that focuses not only on knowledge transfer but also on behavioral change.

CONCLUSION AND RECOMMENDATIONS

In this study, the vocal hygiene behaviors of opera and theatre students, who are candidates for elite voice users, were analyzed comparatively. In light of the statistical findings, it was determined that there was no statistically significant difference between the total vocal hygiene behavior scores of opera and theatre students ($U = 1998.0$; $z = -.74$; $p = .453$). This result reveals that there is no interdisciplinary differentiation in terms of vocal hygiene behaviors and that both groups have similar habits.
The data obtained from the research shows that the department studied is not a determining factor in vocal hygiene behaviors; on the contrary, students studying in both disciplines have a similar risk profile. It is thought that vocal hygiene behaviors are influenced by common environmental conditions, similar academic loads, and lifestyle factors specific to the student period, rather than the type of education. The lack of a significant difference between opera and theatre students shows that both groups carry a similar level of vocal risk before their professional lives and have common needs in terms of protecting vocal health. Based on these findings, the following recommendations can be offered to performing artists:

- Conservatory curricula should not focus solely on technical vocal training; mandatory and practice-based vocal hygiene courses should be included to ensure that theoretical knowledge is translated into behavior.
- To increase students' awareness of vocal health, the technical training process should be supported by behavioral interventions.
- Regular vocal health screenings should be institutionalized to monitor students' vocal development and detect possible pathologies early.
- Preventive and protective programs should be developed to identify and correct phonotraumatic habits such as throat clearing, overuse of the voice, and inadequate hydration at an early stage.

In conclusion, the similarity in the attitudes of opera and theatre students towards vocal health reveals that the technical dimension of conservatory education must be integrated with preventive health approaches. The sustainability of professional vocal health is directly related to the correct vocal hygiene habits that students acquire during their education.

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EVALUATION OF FOREIGN BODY ASPIRATION KNOWLEDGE AND FIRST-AID SELF-EFFICACY OF SPEECH AND LANGUAGE THERAPY DEPARTMENT STUDENTS

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Aim
Foreign body aspiration (FBA) occurs when an object enters the larynx or airways, ranging from mild symptoms to life-threatening emergencies. It is more common in infants and children due to oral exploration behaviours and immature laryngeal protective reflexes. Collaboration between families and professionals working with children helps reduce these risks. This study aims to examine foreign body aspiration knowledge and first-aid self-efficacy among speech and language therapy students.

Method
The study included 316 participants (279 females, 37 males) enrolled in speech and language therapy programs at universities in Türkiye. Data were collected using the "Sociodemographic Information Form," the "Foreign Body Aspiration Knowledge Assessment Form for Children," and the "First-Aid Self-Efficacy Form for Children with Foreign Body Aspiration." Analyses included descriptive statistics, Mann-Whitney U test, and Spearman correlation.

Results
The mean knowledge score was 10.70 ± 2.31. First-aid self-efficacy scores averaged 2.41 ± 2.25 for children under one year and 3.02 ± 2.63 for those over one year. Participants who had taken a first-aid course scored significantly higher in both knowledge and self-efficacy than those who had not ($p < 0.001$). Knowledge scores correlated positively and moderately with self-efficacy for both age groups ($r = 0.337$, $p < 0.01$; $r = 0.358$, $p < 0.01$).

Conclusion
Findings indicate a strong link between foreign body aspiration knowledge and first-aid self-efficacy among speech and language therapy students. The association between theoretical knowledge and practical confidence suggests that academic instruction enhances preparedness for emergency intervention. The study underscores the need to strengthen theoretical and practical training on first aid and foreign body aspiration in undergraduate curricula.

Keywords: *foreign body aspiration, first aid, larynx, airway, child*

Introduction

Swallowing represents a complex sensorimotor function that requires the synchronized activity of multiple anatomical regions to ensure both nutritional intake and airway safety[1,2]. During this process, sensory feedback and motor coordination integrate the actions of the lips, tongue, pharyngeal musculature, laryngeal structures, and oesophagus. Because the upper digestive tract shares structural continuity with the respiratory pathway, airway protection must occur within fractions of a second through mechanisms such as laryngeal elevation, glottic closure, and epiglottic inversion[3]. When these protective responses fail or become discoordinated, ingested material may enter the airway, resulting in penetration or aspiration. Such events can have serious clinical implications, including aspiration pneumonia, chronic respiratory compromise, extended hospital stays, and elevated mortality rates, particularly among individuals with underlying medical vulnerabilities[4].

In pediatric populations, foreign body aspiration (FBA) constitutes one of the most critical airway emergencies[5]. Children are predisposed to aspiration episodes due to behavioural and anatomical characteristics unique to early development. Oral exploration, incomplete tooth eruption, immature mastication patterns, and developing airway reflexes increase susceptibility[4].

In addition, the relatively narrow diameter of the pediatric airway heightens the risk that aspirated material may produce significant obstruction. Beyond accidental inhalation of food particles or small objects, children with pre-existing swallowing dysfunction represent a particularly high-risk group[6]. Dysphagia related to neurological disorders, developmental conditions, or structural anomalies further amplifies the likelihood of aspiration-related morbidity[6,10]. For this reason, early detection of aspiration risk and immediate intervention are essential components of pediatric care.

Speech and Language Therapists (SLTs) are central professionals in the identification and management of swallowing impairment[7]. Their responsibilities encompass clinical assessment of deglutition, evaluation of airway safety, implementation of compensatory strategies, and education of families and caregivers. In many practice settings, SLTs routinely supervise children with feeding and swallowing disorders who are vulnerable to airway compromise. Consequently, familiarity with the mechanisms, risks, and emergency management of foreign body aspiration is integral to competent practice. In dysphagia-related clinical work, first-aid capability is not peripheral but foundational to ensuring patient safety.

Within health professions education, structured first-aid and life-support instruction has consistently been shown to enhance knowledge retention and increase confidence in emergency situations[8]. Educational models that incorporate experiential components such as simulation exercises and scenario-based practice appear particularly effective in strengthening applied competence and self-efficacy[8]. Despite the evident importance of airway emergency management within swallowing-focused practice, empirical data concerning first-aid knowledge and perceived preparedness among SLT students remain limited[9]. Assessing this domain is therefore necessary to inform curricular refinement and to reinforce safety standards in clinical training programs.

Methods

The study employed a cross-sectional research design that included both comparative and correlational designs to address the research objectives.

The study sample consisted of 316 undergraduate students registered in Speech and Language Therapy programs at various universities in Türkiye. Eligibility required active enrollment in an SLT undergraduate program at the time of participation. Students represented different academic years, allowing variability in clinical exposure and educational experience. Participation was voluntary, and informed consent was obtained electronically before data collection commenced.

Data collection involved three instruments. The Sociodemographic Information Form, developed by the research team, gathered information regarding age, gender, academic year, and prior exposure to first-aid training. Knowledge related to pediatric foreign body aspiration was measured using the Knowledge Evaluation Form About Foreign Body Aspiration in Children[9]. This 15-item multiple-choice instrument assesses understanding of aspiration risk factors, recognition of clinical symptoms, and knowledge of age-specific first-aid procedures. Each correct answer contributes one point, yielding a total possible score ranging from 0 to 15. Higher scores indicate greater knowledge. Perceived competence in delivering emergency intervention was assessed using the First Aid Self-Efficacy Form for Foreign Body Aspiration in Children[9]. This instrument uses an 11-point numerical rating scale from 0 (no confidence) to 10 (complete confidence). Participants rated their perceived ability to manage airway obstruction in infants younger than one year and in children aged one year and older. Previous validation studies have demonstrated acceptable reliability and content validity for both instruments[9].

Ethical approval was granted by the İstanbul Kent University Non-Interventional Ethics Committee. Data were collected through an online survey platform to facilitate broad participation. Descriptive statistics were used to summarize participant characteristics and score distributions. Spearman's rank-order correlation coefficients were calculated to examine associations among knowledge and self-efficacy variables. The Mann–Whitney U test was applied to compare knowledge and self-efficacy scores between students who had received undergraduate first-aid training and those who had not. Statistical significance was defined as $p < 0.05$.

Results

A total of 316 students completed the survey. Exposure to first-aid education varied across participants. One-quarter reported receiving first-aid instruction during high school, and a smaller proportion had attended formal external first-aid courses. At the undergraduate level, 41.8% indicated that they had completed a first-aid course, whereas 58.2% had not received such training. Among those who had participated in undergraduate instruction, more than half perceived the training as insufficient in preparing them for emergency situations.

Practical exposure to airway emergencies was limited. Only 7.6% of participants reported that they had needed to apply first-aid skills during therapy or assessment sessions, and 5.4% had implemented such interventions. Consistent with limited real-world experience, 68.0% indicated that they did not feel competent in applying first-aid procedures, suggesting a gap between knowledge acquisition and perceived readiness.

Swallowing disorders were identified by most participants as the primary therapy area requiring first-aid competence. Feeding disorders and resonance-related conditions were mentioned less frequently. Among the small group who had applied first-aid skills in practice, most reported doing so within swallowing-related interventions, reflecting the centrality of dysphagia management in SLT practice.

The mean total knowledge score was 10.70 ± 2.31, indicating a moderate level of knowledge regarding pediatric foreign body aspiration. In contrast, perceived self-efficacy scores were relatively low, averaging 2.41 ± 2.25 for infants and 3.02 ± 2.63 for older children. These findings suggest that theoretical knowledge does not necessarily translate into high levels of perceived competence.

Students who had completed an undergraduate first-aid course showed significantly higher knowledge scores and greater self-efficacy in both age groups. Self-efficacy for infants ($Z = -3.97$, $p < .001$), self-efficacy for older children ($Z = -4.83$, $p < .001$), and total knowledge scores ($Z = -5.13$, $p < .001$) were all significantly higher among trained students.

Correlation analyses demonstrated that risk-factor knowledge was moderately associated with overall knowledge ($r = .561$, $p < .001$). Total knowledge showed a strong positive relationship with first-aid knowledge ($r = .833$, $p < .001$) and a moderate association with symptom recognition ($r = .484$, $p < .001$). Higher total knowledge scores were moderately correlated with self-efficacy for both infants ($r = .337$, $p < .001$) and older children ($r = .358$, $p < .001$). First-aid knowledge similarly demonstrated moderate associations with perceived competence in both age groups. In contrast, symptom recognition was not significantly related to self-efficacy. Self-efficacy ratings for infants and older children were strongly correlated ($r = .820$, $p < .001$), indicating consistency in perceived competence across pediatric age categories.

Discussion

The present findings indicate that undergraduate first-aid education is positively associated with both knowledge levels and perceived competence in managing pediatric foreign body aspiration among SLT students. Students who had received formal training demonstrated higher knowledge scores and stronger confidence in delivering age-appropriate emergency interventions. These findings align with prior research demonstrating that structured emergency training enhances preparedness and self-efficacy in healthcare learners[8].

A notable finding is that procedural first-aid knowledge showed stronger associations with self-efficacy than symptom recognition. While identifying clinical signs of aspiration is essential for early detection, confidence in performing emergency maneuvers appears to depend more heavily on applied and practical training experiences. This observation is consistent with literature emphasizing the importance of experiential and simulation-based learning in strengthening emergency-related self-efficacy[8].

The identification of swallowing disorders as the primary context requiring first-aid competence is clinically coherent. Dysphagia has been widely recognized as a significant risk factor for aspiration and aspiration pneumonia[6, 10]. Given that SLTs routinely manage swallowing disorders across various clinical settings[7], preparedness for airway emergencies is directly aligned with professional responsibilities.

Despite moderate knowledge scores, perceived competence remained relatively low. Similar discrepancies between knowledge and confidence have been documented in healthcare education research[8, 9]. These findings suggest that isolated theoretical instruction may not be sufficient to ensure sustained emergency readiness. Repeated practice, structured simulation sessions, and scenario-based reinforcement may be necessary to enhance competence in managing low-frequency but high-risk pediatric airway events.

The cross-sectional design limits causal interpretation, and reliance on self-reported data may introduce bias. Nevertheless, the study provides valuable insight into emergency preparedness within SLT education and highlights the importance of strengthening practical training components in undergraduate curricula.

Conclusion and Recommendations

Undergraduate first-aid education was associated with higher knowledge levels and greater perceived self-efficacy in managing pediatric foreign body aspiration among Speech and Language Therapy students. Procedural competence appeared to contribute more substantially to confidence than symptom recognition alone. Integrating structured, hands-on, and age-specific first-aid training into SLT curricula may enhance clinical preparedness and promote improved patient safety in swallowing-related practice. Future research should employ longitudinal or experimental designs to examine the long-term effects of structured first-aid training and incorporate objective performance-based assessments to better evaluate clinical competence.

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EVALUATING SYNTHETIC SPEECH IN SECOND LANGUAGE PROSODY ASSESSMENT

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Abstract
Prosody assessment in Computer-Assisted Language Learning (CALL) has historically relied on imitation-based models, which evaluate how closely a learner mimics a specific native reference. However, prosody is inherently "one-to-many", meaning multiple valid realizations can convey the same communicative intent. This research evaluates whether Text-to-Speech (TTS) models can serve as a viable substitute for native ensembles to establish a prosodic ground truth for unconstrained text. By generating 50 diverse synthetic references per prompt, we compare non-native (L2) productions against a distribution of plausible native-like patterns. Our findings indicate that while aggregated label-level correlations are strong — particularly for Loudness and Duration — utterance-level correlations remain weak due to the limited variability of current TTS models. Consequently, while TTS provides a flexible framework for generating references, it does not yet capture the full spectrum of population-level diversity required for robust assessment.

Keywords: *prosody, non-native, L2, synthetic speech*

1. Introduction

Speech is a unique marker of identity, encoding aspects as age, gender, health, emotional state, and, critically, linguistic background. Prosody — the "suprasegmental" aspect of speech including pitch, energy, and rhythm — is critical for conveying meaning and intention that text alone cannot capture. For second-language learners, mastering prosody is essential for intelligibility and fluency, yet traditional CALL systems often reduce assessment to simple mimicry.

TTS technology has advanced significantly, achieving notable improvements in expressivity, variability, and naturalness[1] . In L2 language learning, TTS is acknowledged as a valuable tool, including for prosody-related applications[2]. Nevertheless, its role in assessment has been largely limited to serving as a reference for learners. Traditional L2 prosody teaching focuses on the evaluation of intonation or prominence on prescribed prompts, not informing the learner about the prosodic quality of their production, nor where nor how they are deviating from the norms.

The central challenge in prosody assessment is the "one-to-many" problem: there is no single "correct" way to utter a sentence. Therefore, to define the possible fluent prosodic productions of a text, an ideal scenario would be to benchmark against an ensemble of native speakers uttering the same sentence, as experimented in the work of Truong[3]. However, since those data are often not available, we propose using synthetic speech instead. We want to test the hypothesis that its consistency and similarity to native speech make it a viable substitute for native ensembles in assessing L2 prosody. This would allow for a more plural assessment of speech, but also for a constructive feedback to the user, regarding where and how they underperformed. Further details can be found in the work of Coelho[4].

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2. Methods

The methodology consists of comparing probe utterances with TTS references. This is validated by comparing the resulting scores with the labels of the L2 (probe) utterances. To validate the use of TTS references, we tested if high-quality L2 utterances were closer to the references than low-quality ones. Although we aim for transparency and to be able to locate faulty spots in the utterances, available data only include general prosodic quality annotation. Therefore, we do not have a ground truth of where speech has deviated from an ideal production, as would ideally happen. Given these facts, we pursued two main sets of experiments: one in which we apply regression to approximate the labels of the utterances using similarity to the TTS references, and another one in which we inspect the behaviour of L2 speech in comparison to reference intervals defined by TTS references.

2.1. Feature Extraction and Representation

Three primary prosodic features were extracted using perceptually motivated normalization:

Pitch: Fundamental frequency (F0) was converted to semitones to reflect perceived intonation and normalized by subtracting the lowest pitch value of the utterance.

Loudness: Derived from the auditory spectrum using GeMAPS[5] LLDs, loudness was normalized by the maximum value within the utterance.

Duration: Measurements included the length of individual words and the inter-word intervals (pauses) obtained through forced alignment, using Montreal Forced Aligner[6].

Pitch and Loudness, were sampled at N × 3 points per word, where N is the number of syllables. Utterances were represented by the concatenation of these word points. For Duration was represented by the value of duration of each word and the duration between two adjacent words. Because of this dependency on word number and total number of syllables, this approach is mostly suitable to same-text comparison.

2.2. Reference Generation via TTS

We utilized the XTTS_v2 model[7] , a multilingual zero-shot system capable of voice cloning. To emulate a native population, 50 versions of each prompt were generated, each using a different reference speaker from the VCTK corpus[8] to provide distinct timbres and styles. These synthesized references exhibited variability in dialectal patterns (e.g., rhoticity) and intonational styles, providing a broader benchmark than a single native reference.

2.3. Corpora and Annotation

The primary dataset for evaluation was the Brave New Approach (BNA)[9] corpus, which contains L2 English speech annotated for prosodic quality on a scale of 1.0 (highest) to 5.0 (lowest). Validation also utilized the Speech Accent Archive (SAA)[10] for L1/L2 comparisons and the VCTK corpus for style transfer.

2.4. Validation of TTS as a Native Proxy

To justify replacing native speakers with TTS, we conducted a validation analysis using Multidimensional Scaling (MDS) to visualize the distributions of L1, L2, and TTS speech. Results for the Loudness dimension were particularly promising: the TTS and L1 distributions overlapped significantly, while L2 productions remained distinct and dispersed. However, for Pitch and Duration, the L2 data was often as close to L1 as the TTS references were, suggesting that current TTS models may not be sufficiently distinct from proficient L2 speech in these dimensions to serve as an authoritative benchmark.

3. Results

3.1. Utterance and Label Correlation Experiments

We evaluated the relationship between similarity scores (S) — computed via the average Pearson's correlation between TTS and L2 utterances — and the human-assigned prosodic labels. This evaluation was computed using Spearman's correlation coefficient. Results are in Table 1.

	Utterance-Level	Label-Level
Pitch	0.062	0.745
Loudness	0.214	0.973
Duration	0.205	0.982

Table 1. *Utterance correlation for similarity scores computed between TTS-generated utterances and L2 utterances, for utterance level and aggregated label level.*

3.1.1. Utterance-Level Correlation

On an utterance-by-utterance basis, the correlation between TTS similarity and proficiency was relatively low. For Loudness and Duration, correlation values hovered around 0.2, while Pitch showed almost no significant relationship (near 0.0). This indicates that a high similarity to a TTS reference does not always guarantee a high human rating for a specific utterance.

3.1.2. Label-Level Correlation

When similarity scores were aggregated by label (averaging scores for all utterances of a given label), the correlations became strikingly strong. For Loudness and Duration, the absolute Spearman's rank correlation reached 0.973 and 0.982, respectively. For Pitch, it reached 0.745. This suggests that while TTS cannot pinpoint the quality of a single utterance, it accurately models the general prosodic trends associated with increasing L2 proficiency.

3.2. Regression Analysis and Predictive Power

To test the utility of these similarity features for automated scoring, we trained a Random Forest Regressor using similarity scores (S) for Pitch, Loudness, and Duration. The model achieved a Spearman's rank correlation of 0.440 on the BNA test set. Crucially, this system outperformed the baseline for this data set: 0.415[9] , which utilized a much larger set of 6,373 functional features. Ablation studies revealed that Duration was the most impactful feature, while Pitch contributed the least to the final score.

3.3. Local Analysis and Reference Intervals

To explore the potential for explainable feedback, we established Reference Intervals (RIs) based on the 2.5th and 97.5th percentiles of the TTS distribution. This allowed us to identify "outliers" — specific points where a learner's prosody deviated from the synthetic norm. We focus on utterances corresponding to the prompt *I'd like a one-way ticket to London, please:* one with highest rating (Utt1.0), one with average-good rating (Utt2.4) and one with averagelow rating (Utt3.2). We plotted the feature sequences alongside the TTS references in Figure 1.

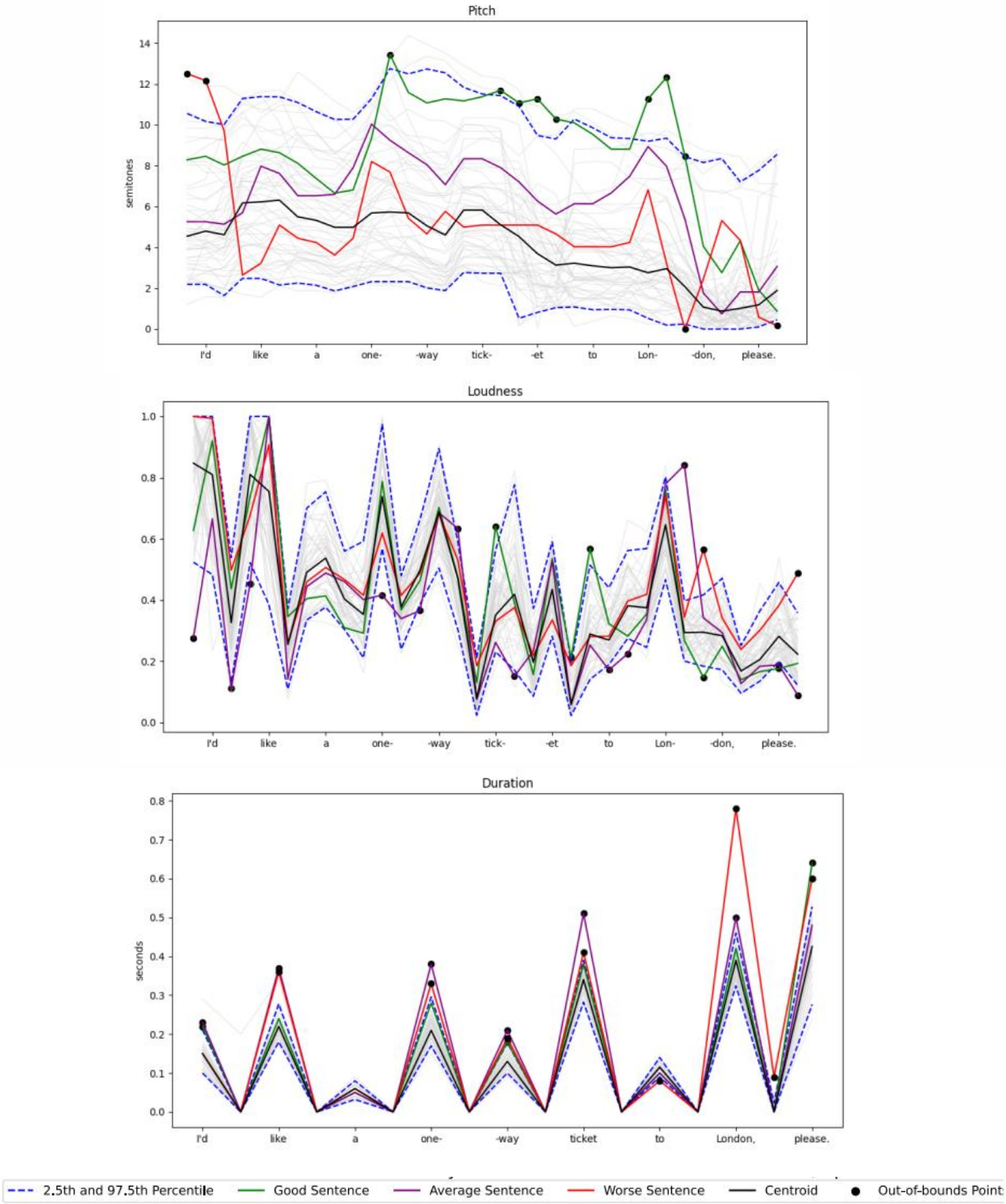

Figure 1. Pitch, Loudness and Duration sequence representation for prompt *I'd like a one-way ticket to London, please.*

For Pitch, Utt1.0 has 8 outliers: twice as much as Utt3.2. Utt2.4, however, does not have any outliers. The different sequences and the centroid appear to have mostly the same monotony — Utt1.0's outliers being mostly due to major shifts upward and downward, which can be seen as just an emphasized intonation by a proficient speaker. Utt3.2, nevertheless, presents jumps that are in the opposite direction as the rest, which is mostly visible right at the beginning.

For Loudness, however, Utt2.4 is the one with the most outliers, which often correspond to an exaggeration of the tendency peaks of the distribution. Utt3.2 yields the best performance having the lowest number of outliers.
For Duration, the number of outliers correlates to the labels. The fact that the intervals between words are considered allows for differentiation between good and worse sequences — normally, due to hesitations, worse speakers can spend more time between words. This is the case of Utt3.2 between the words London and please. However, this example seems to also confirm the idea that less proficient speakers have a lower speech rate and spend more time uttering words, as pointed out by the outliers at the top of the plot.

4. Discussion

The experiments reveal a fundamental tension in synthetic prosody. TTS models, even advanced zero-shot architectures like XTTS, are trained to match text and timbre rather than to mimic the diversity of a population.

4.1. The Naturalness vs. Diversity Paradox

Current TTS systems prioritize a single "most plausible" realization to ensure naturalness. In contrast, a native population produces a wide distribution of valid prosodic choices. Because the TTS distribution is narrower than the human one, a learner might produce a valid but nonTTS-like prosodic event and be unfairly penalized as an "outlier".

4.2. Feature Expressivity

Our results consistently show that Loudness and Duration are more reliably modelled by TTS and more indicative of L2 proficiency than Pitch. This may be because intonation (pitch) is more susceptible to subtle L1 interference (e.g., tonal transfer) that TTS models do not yet simulate effectively for L2 assessment purposes.

5. Conclusion and Recommendations

The most outstanding conclusion is that trends observed at the aggregate level do not always hold at the local level. For isolated utterances, high-scoring examples do not consistently show a stronger correlation with the distribution, nor do they exhibit fewer outliers relative to the reference interval. In fact, a more detailed analysis reveals that local behavior is inconsistent, further complicating the use of this TTS model for this purpose.
While TTS offers a flexible path towards no-imitation assessment, it is currently insufficient as a standalone reference for fine-grained, local feedback. Regarding this, future research should investigate the combination of outputs from TTS diverse modelling approaches to increase variability.
In conclusion, TTS-generated references provide a robust macro-level indicator of L2 prosodic proficiency, outperforming traditional feature sets in regression tasks. However, the lack of population-level diversity in synthetic speech prevents it from resolving the "one-to-many" problem at a granular, local level. For truly explainable CALL systems, synthetic references must evolve from being "natural-sounding" to being "population-representative".

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PATIENT-SPECIFIC 3D-PRINTED LARYNGEAL IMPLANT MATERIAL: DEVELOPMENT OF A BIOMIMETIC HYDROGEL INK (ALGinate/GELATIN/NANO-HYDROXYAPATITE)

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BACKGROUND

Unilateral vocal fold paralysis (UVFP) may cause persistent dysphonia and aspiration risk. Medialization thyroplasty (Type I) is a widely used long-term surgical option, but implant shape and stiffness strongly influence functional outcomes. Patient-specific design and additive manufacturing are promising for personalization in otolaryngology.

AIM To develop and characterize a low-cost, biocompatible, extrusion-printable hydrogel-based material platform for patient-specific laryngeal implants / graft prototypes, suitable for further preclinical evaluation.

MATERIALS AND METHODS

A biomimetic hydrogel ink was prepared using:
– sodium alginate + nano-hydroxyapatite (nHA) + glycerol (Formulation 1)
– sodium alginate + gelatin + nHA + glycerol (Formulation 2)

Crosslinking: $CaCl_2$ solution added gradually until a viscous printable gel was obtained.
Characterization: Raman spectroscopy, XRD, SEM (for nHA), optical microscopy (hydrogel microstructure), and extrusion-based printing of graft prototypes.

RESULTS

– nHA quality control: Raman/XRD/SEM features consistent with hydroxyapatite; no major parasitic phases reported in the project report.
– Hydrogel spectra (Raman/XRD) indicate successful integration of mineral and polymer components and retention of the HA crystalline phase.
– Extrusion-printed graft prototypes were obtained; optical microscopy revealed air bubbles, highlighting a need for a dedicated deaeration step to improve print fidelity.
– Comparative observation: Formulation 1 provides higher structural stability, while Formulation 2 (with gelatin) shows higher elasticity, closer to soft-tissue biomechanics (preliminary).

PROJECT STATUS, SAFETY NOTE, AND LIMITATIONS

This is an experimental preclinical project focused on biomaterial development. Preclinical animal experiments are ongoing; biocompatibility has been achieved in animal studies according to the project team, but detailed quantitative data are not presented here. No clinical (human) trials have been conducted. The material / implant is not a clinically approved medical device at this stage.

CONCLUSIONS AND NEXT STEPS

The developed alginate-based nHA composite hydrogel demonstrates promising physicochemical signatures and early extrusion printability for laryngeal implant material prototyping. Next steps include: rheology window mapping, mechanical testing (compression/creep), long-term degradation and sterilization studies, and expanded preclinical evaluation focused on safety and functional performance. Potential impact: scalable patient-specific manufacturing and expected low material cost due to widely available biopolymers and mineral fillers.

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WHEN PRONUNCIATION SHAPES THE VOICE: ENGLISH PHONETICS TRAINING AS A TOOL IN VOCAL PEDAGOGY – A PILOT STUDY ON NON-NATIVE SINGING

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ABSTRACT

The relationship between English phonetic accuracy and vocal technique in non-native (L2) singers remains largely underexplored within mainstream vocal pedagogy, despite its potential impact on vocal efficiency, timbre, phrasing, and stylistic authenticity. This pilot study investigates whether short-term, targeted English phonetics training can lead to perceptible and measurable changes not only in pronunciation, but also in broader vocal and musical parameters.

The study examines singing samples produced by a Polish non-native English CCM singer before and after a two-hour phonetic training intervention (two 60-minute sessions over four days). The training focused on English vowel systems, consonantal contrasts, connected speech features, and vocal tract awareness relevant to sung English. Data were collected through the singer's self-assessment and perceptual evaluations by external listeners recruited exclusively from professional vocal and pedagogical environments, ensuring expert-based auditory judgment.

Perceptual results indicate consistent post-training improvements in pronunciation accuracy, musical phrasing, text intelligibility, and stylistic authenticity. Qualitative feedback frequently referenced smoother legato, increased fluency, reduced tongue and laryngeal tension, and timbral changes perceived as more "native-like" and stylistically credible. The singer's self-reported data aligned with these observations, highlighting increased vocal tract awareness, improved vowel tuning, enhanced overtone presence, and greater technical comfort when singing in English after training.

In addition to perceptual data, a basic acoustic analysis of pre- and post-training samples was conducted using vocal analysis software (including spectrographic and formant-related observations). The analysis revealed noticeable acoustic differences between the samples, supporting the perceptual findings and suggesting that the observed changes were not purely subjective.

Although limited in scope, this pilot study suggests that phonetic training may function as a catalyst for technical and acoustic changes traditionally addressed within vocal technique training. It also points toward pronunciation work as a potentially underappreciated pathway for supporting singers in achieving vocal goals and becoming more engaging for audiences.

Keywords: *English phonetics, non-native singing, vocal pedagogy, phonetic training*

INTRODUCTION

In contemporary commercial music (CCM), English is not only the language of lyrics but also a set of stylistic expectations. Pop and related genres circulate a supralocal norm often described as "pop song English", in which American-oriented segmental patterns and timing cues contribute to perceived genre alignment and professional polish.[1] For singers whose first language is not English, adapting to this norm involves more than being understood. It requires consistent articulatory settings that shape vowel quality, consonantal timing, and connected-speech behavior under tempo, all of which can influence how credible and stylistically authentic a performance sounds. The singing mode changes the perceptual weighting of pronunciation cues. Foreign accent in song can be detected, but it is generally harder to identify in singing than in speech.[2] This creates a pedagogical dilemma: pronunciation work is often treated as cosmetic because singing can mask some deviations, yet accent-related cues may still guide judgments of stylistic credibility and communicative force in CCM contexts where accent norms are culturally meaningful.[1,2]

From a speech-science perspective, phonetics and vocal technique share the same physical substrate. Vowels are a primary driver of acoustic output and are tightly constrained by articulatory setting. Normative acoustic descriptions of American English vowels provide benchmarks for target-oriented category work.[3] In second-language phonetic learning, L2 production reflects interaction between the L1 system and emerging L2 categories, shaped by perception and motor adaptation.[4] For Polish learners of English, difficulties in vowel perception and category boundaries are well documented and can contribute to stable near-miss productions even in advanced speakers.[5] Polish vowel-space structure also differs systematically from English, which can bias default placements in sung vowels.[6] These issues matter for singing because vowel choice and vowel shape are inseparable from vocal-tract configuration, resonance strategy, and phrase timing.

Research on pop singing and accent stylisation further emphasizes that phonetic detail can be an aesthetic resource. Acoustic studies show that singers may adopt or exaggerate American-oriented vowel qualities as part of genre performance.[7] In parallel, work on CCM resonance strategies indicates that supraglottic adjustments can alter spectral energy distribution, including patterns associated with twang-like configurations.[8] Although the present study does not aim to attribute changes to a specific physiological mechanism, these findings motivate the pedagogical hypothesis that targeted phonetic training could influence outcomes usually framed as technical: legato continuity, phrase timing, timbre consistency, and the ability to maintain efficient articulation at performance tempo.

Within this framework, the present pilot study investigates whether short-term, targeted English phonetic training can produce measurable acoustic changes in a Polish non-native CCM singer, and whether such changes correspond with perceptual evaluations by expert listeners as well as the singer's own reported vocal experience. Rather than treating pronunciation as a purely linguistic adjustment, this study approaches phonetic training as a potential catalyst for broader technical and acoustic reorganization in contemporary commercial singing.

METHODS

Study Design

This exploratory pilot used a within-singer pre-training and post-training comparison. Data sources included pre-training and post-training recordings, singer questionnaires before and after the intervention, expert listener ratings with qualitative comments, and acoustic inspection. The study was designed as applied pedagogy rather than a controlled laboratory experiment.

Participant

The participant was a 28-year-old Polish male contemporary commercial tenor living in Poland. He reported upper-intermediate English proficiency (B2) and had never lived in an English-speaking country. Prior to the intervention, he reported moderate awareness of pronunciation errors and no previous work with an accent coach or professional phonetics coaching in English. He had nine years of singing experience and was professionally active as both singer and singing teacher, working primarily in pop, soul, and funk. He reported singing in English very often and identified General American as the accent he most often uses in English singing, describing this as a conscious artistic choice. Before training, he rated his phonetic accuracy in spoken English as 4/7, his pronunciation in singing as 5/7, and his awareness of pronunciation errors as 4/7. Accent authenticity in his style was rated 6/7 in importance. He rated the perceived influence of English pronunciation on vocal technique as 3/7 and associated this influence mainly with intonation stability, legato, speech-level configuration, high pitches, and musical phrasing.

Intervention

The intervention consisted of two 60-minute online coaching sessions conducted across four days (total coaching time: two hours). The sessions were led by the author, a certified dialect coach and professional singer with experience in vocal pedagogy.

Between sessions, the singer practiced independently for approximately 20 minutes per day, applying recorded examples and lesson targets. Instruction focused on General American vowel category differentiation relevant for Polish speakers, interdental fricatives, voiced and voiceless contrasts in word-final position, rhotic environments and r-colored vowels, and connected-speech features (reductions, linking, and smooth word-to-word transitions) as they occur under musical tempo. The coaching was applied directly to the study material (song excerpt). The sequence progressed from isolated syllables to phrases and transferred into sung tempo.

Stimulus Material and Sung Phrase Tokens

For acoustic analysis, two primary stimulus types were used: isolated vowels and a song excerpt. The song excerpt consisted of the first verse from Bruno Mars' "Just the Way You Are". The same vowel sets and song's verse were recorded before training and after training. For phrase-level acoustic inspection, three tokens were selected because they represent recurring Polish-to-English challenges and were referenced in training and listener comments: "compliment" (low back vowel environment), "her" (r-colored vowel and rhotic timing), and "ask" (low-front vowel realization). These tokens were extracted from the verse for pre/post comparison.

Recording Conditions

All recordings were made by the singer in the same room and at approximately the same time of day to minimize environmental variation. The same microphone was used in both sessions: a Rode NT1-A condenser microphone. Microphone distance was maintained at approximately 20–30 cm for speech-like tasks and approximately 40 cm for sung tasks. Gain settings were kept consistent across sessions. Files were captured and prepared in Audacity. No external calibration tone was used; therefore, the acoustic analysis emphasized relative spectral patterns rather than absolute level differences.

Singer Self-Report

The singer completed a pre-training questionnaire (background, baseline ratings, goals, perceived technical impact) and a post-training questionnaire (perceived improvement, awareness changes, targets identified as incorrect before training and improved after training, and perceived influence on technique and vocal-tract awareness).

Expert Listener Evaluation

Expert listeners were recruited from professional vocal and pedagogical environments and included singers, singing teachers, and voice researchers. Twenty-seven responses were collected; one was excluded due to a non-compliant pattern of responses, leaving 26 valid evaluations (including answers of three native speakers of English). Respondents rated pre-training and post-training samples of the Bruno Mars' song's verse on 7-point scales for pronunciation accuracy, musical phrasing, stylistic authenticity, and intelligibility, and provided qualitative comments about specific changes and remaining challenges.

Acoustic Analysis

Acoustic inspection was conducted using Praat and VoceVista. Isolated English vowels were produced on a steady pitch (E-flat 3) without vibrato to support stable measurement. Formant-related measures (F1–F4) were collected for isolated vowel samples and for selected short phrase tokens. Center of gravity (COG) was calculated as an index of spectral energy distribution and used here as a compact descriptor interpretable alongside reports of increased brightness or upper partials. Token-level inspection of "compliment", "her", and "ask" focused on directional movement toward General American expectations based on established vowel descriptions.[3]

Ethics and Data Protection

Participation was voluntary. The singer provided written consent (signed statement). No directly identifying information (such as names, email addresses, or phone numbers) was collected in the listener survey. Survey data were handled in accordance with EU General Data Protection Regulation (GDPR) principles.

RESULTS

Singer Self-Assessment

Before training, the singer rated his spoken phonetic accuracy as 4/7 and his sung pronunciation as 5/7, with error awareness at 4/7. He identified interdental fricatives and multiple vowel categories as frequent issues and reported that singing in English was often technically easier than in Polish, but described moments where articulation felt too stiff and the vowels did not "match" the target style.

After training, he reported practicing approximately 20 minutes per day for four days between sessions. He rated improvement in spoken pronunciation as 5/7 and improvement in sung pronunciation as 6/7. Error awareness increased to 6/7. The perceived influence of improved pronunciation on vocal technique increased from 3/7 to 6/7, and the perceived influence on awareness of changes in the vocal tract was rated 7/7. He reported improved execution of vowel targets, TH (IPA: /θ/, /ð/), voiced/voiceless contrasts in word-final position, and vowels in rhotic environments, as well as faster tongue-position shifts at tempo. In open responses, he described clearer overtone presence and greater technical comfort when singing the verse after training.

Expert Listener Ratings

Mean ratings improved across all evaluated domains (Table 1). Qualitative comments converged on a broad pattern: the post-training sample was described as more fluid, with smoother legato/word-to-word transitions and more coherent rhythmic phrasing. Many listeners linked pronunciation change to technical parameters such as breath coordination, timbre stability, and reduced articulatory effort. Several comments explicitly framed phonetic training as pedagogically necessary, not only for intelligibility but also for legato, phrasing, timbre choices, and performer confidence.

Table 1. Mean expert listener ratings before and after training (7-point scale)

Parameter	Before	After
Pronunciation accuracy	3.04	5.42
Musical phrasing	2.96	5.38
Stylistic authenticity	2.88	5.27
Intelligibility	3.12	5.31

Qualitative Expert Observations

Across comments, improvements were often attributed to connected-speech behaviors (reductions, linking, elision) that supported a less overly crisp delivery. Several evaluators reported increased comprehension of the text and stronger perceived communicative intent. At the same time, remaining challenges were consistently identified, particularly in rhotic contexts and certain consonant-vowel sequences. Respondents noted that /r/ could still sound overemphasized or unstable in some words and that sequences such as her hair or her eyes remained challenging, with occasional voiced consonant confusions producing lexical ambiguity. Additional targets included vowel combinations after TH, aspirated or effortful consonants, and rapid clusters requiring refined tongue coordination. These observations are consistent with L2 learning accounts in which early change is detectable but stabilization under high-demand contexts requires continued distributed practice.[4,5]

Acoustic Results

COG values increased for most isolated vowels after training (Table 2), indicating redistribution of spectral energy toward higher frequencies. This pattern is compatible with the singer's report of increased bright partials and with listener descriptions of clearer sound, while acknowledging that COG is an index rather than a direct marker of a specific physiological adjustment. The r-colored vowel category showed a different direction in COG change, consistent with the complex acoustic restructuring involved in rhoticity.

Interestingly, the isolated production of /ɝ/ ("bird") in the post-training condition did not fully stabilize as a canonical American r-colored vowel but showed a more dynamic, partially diphthongal quality. Although F3 decreased substantially, indicating movement toward rhoticity, COG values (631 Hz before vs. 573 Hz after; mean of two tokens: 602 Hz and 544 Hz) suggest a redistribution of spectral energy rather than convergence on a single fixed target. This indicates a clear shift away from a Polish-like vowel quality toward r-coloring, though not yet fully stabilized. Post-training values in Table 2 represent the mean of two tokens (602 Hz and 544 Hz).

Importantly, not all vowels shifted in the same direction or magnitude. This lack of uniformity suggests that the intervention did not simply produce a generalized articulatory exaggeration, but rather more selective, category-specific adjustments. In this pilot context, the formant data are therefore interpreted as supportive evidence of targeted phonetic modification rather than as a comprehensive reorganization of the entire vowel space.

Table 2. English vowel COG values (Hz) before and after training

Vowel	Lexical set	COG Before (Hz)	COG After (Hz)	Difference (Hz)
/æ/	bat	639	804	+165
/ɑ/	box	638	818	+180
/ʌ/	but	744	834	+90
/ɪ/	bit	507	592	+85
/ʊ/	book	443	649	+206
/u/	boot	382	464	+82
/i/	beet	422	535	+113
/ɛ/	bed	639	756	+117
/ɝ/	bird	631	573	-58

Phrase-token inspection supported transfer into musically integrated performance. In "compliment", the post-training vowel showed movement toward a more open/back configuration consistent with General American expectations. In "her", the post-training token showed more integrated r-coloring relative to baseline, though expert comments indicate rhotic sequences remained among the most challenging targets. In the token "ask", the post-training vowel demonstrated a clearer low-front quality consistent with General American /æ/. This is particularly relevant given that Polish learners are reported to experience persistent difficulty in establishing a distinct phonetic category for the low front vowel /æ/, often assimilating it to adjacent L1 categories.[10]

Crucially, these changes were observed within continuous sung phrasing under tempo, supporting the pedagogical relevance of the intervention.

DISCUSSION

This pilot provides convergent evidence that targeted English phonetic training can yield changes that expert listeners and the singer interpret as relevant to vocal pedagogy, not merely to linguistic accuracy. Listener ratings increased for pronunciation accuracy, musical phrasing, stylistic authenticity, and intelligibility (Table 1). The singer's self-report indicates both perceived improvement and a pedagogically meaningful re-framing: pronunciation was experienced as part of technique and coordination, with the perceived impact on vocal ease becoming more explicit and integrated into his technical awareness. Evaluators described the post-training sample as more legato and less segmented, attributing improvements to connected-speech behaviors that can reduce micro-pauses caused by careful articulation and support continuous airflow and resonance continuity. In addition, many listeners framed the benefits in explicitly technical terms, citing breath coordination, tongue freedom, timbre choices, and overall communicative believability. This perspective is compatible with sociophonetic accounts of pop-song norms and accent stylisation in which phonetic patterns contribute to perceived authenticity and credibility. [1,6]

The acoustic results provide an objective complement to these perceptual and experiential reports. The general increase in COG across the vowel inventory (Table 2) indicates a shift in spectral distribution that can be interpreted alongside reports of increased brightness and upper partials. While the present design cannot isolate a single mechanism, the pattern is compatible with supraglottic shaping that affects spectral balance in CCM styles.[7] Importantly, the rhotic vowel category behaved differently, consistent with the complex articulatory-acoustic adjustments involved in r-coloring and with expert comments that rhotic targets remained challenging after only two hours of coaching. The articulatory-setting literature provides a wider context: L1 versus L2 differences in default settings can persist and may require targeted awareness and repetition to shift.[8] In applied teaching, this supports a focus on embodied cues and distributed practice rather than reliance on explanation alone.

The phrase-token approach is central to the pedagogical contribution. Pronunciation instruction that improves isolated drills but fails to transfer to tempo has limited value for singers. Here, token-level inspection and expert comments point to transfer into integrated phrase production for "compliment", "her", and "ask", while also identifying the sequences that require consolidation. This aligns with evidence from rapid imitation tasks suggesting that phonetic patterns can shift quickly, but stabilization under complex demands develops over longer, distributed practice.[9]

Limitations include the single-participant design, short intervention, and absence of a control condition. Listener ratings were expert-based but collected in natural listening conditions with varied playback equipment, and long-term retention was not assessed. Nonetheless, the convergence of ratings, qualitative observations, self-report, and acoustic indices suggests that phonetic training can function as a practical lever in CCM pedagogy.

CONCLUSION AND RECOMMENDATIONS

This pilot study examined whether a short, targeted English phonetic intervention could produce measurable perceptual and acoustic changes in a Polish non-native CCM singer. Across domains, the post-training condition demonstrated consistent improvement: listener ratings of pronunciation accuracy, musical phrasing, stylistic authenticity, and intelligibility increased; the singer reported greater phonetic awareness, vocal-tract awareness, and technical ease; and acoustic analyses revealed systematic spectral redistribution in isolated vowels as well as targeted adjustments in selected sung tokens.

Based on these findings, several recommendations emerge. First, pronunciation training should be considered an integral component of CCM pedagogy, particularly for singers performing in English as an additional language. Second, dialect and phonetic coaching may benefit from explicit integration with vocal technique work, especially in relation to tongue position, resonance shaping, and anterior placement strategies associated with General American production. Third, given that expert listeners repeatedly expressed a need for phonetic training in singer preparation, future studies should extend this pilot to larger cohorts and longer interventions while preserving a teaching-centered focus on transfer to performance.

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IMPACT OF FIBEROPTIC ENDOSCOPIC EVALUATION OF SWALLOWING FINDINGS ON DYSPHAGIA MANAGEMENT IN PATIENTS WITH PARKINSON'S DISEASE: A RETROSPECTIVE STUDY

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Background
Dysphagia is a common and clinically significant problem in patients with Parkinson's disease and is associated with an increased risk of aspiration pneumonia, malnutrition, and reduced quality of life. Early identification of swallowing dysfunction is therefore essential for optimizing patient care. Fiberoptic Endoscopic Evaluation of Swallowing (FEES) provides direct visualization of swallowing physiology and allows clinicians to detect penetration and aspiration in real time. In addition to its diagnostic value, FEES may also guide individualized therapeutic decision-making in dysphagia rehabilitation.

Objective
The aim of this study was to evaluate FEES findings in patients with Parkinson's disease and to assess the impact of these findings on dysphagia management, particularly with respect to therapeutic swallowing interventions.

Methods
This retrospective single-center study included 18 patients diagnosed with Parkinson's disease who underwent FEES at the Bakırçay University Çiğli Training and Research Hospital ENT clinic. Demographic characteristics, FEES findings, and post-FEES therapeutic recommendations were extracted from medical records. FEES findings were classified as normal, penetration, or aspiration. Therapeutic interventions recommended after FEES were considered functional changes in management (FCIM). Statistical analyses were performed using descriptive statistics and relevant comparative tests with a significance level set at $\alpha = 0.05$.

Results
The mean age of the 18 patients was 71.3 ± 9.0 years. Sixteen patients (88.9%) were male and two patients (11.1%) were female. FEES findings revealed normal swallowing in 7 patients (38.9%), penetration in 7 patients (38.9%), and aspiration in 4 patients (22.2%). Overall, abnormal swallowing findings were identified in 11 patients (61.1%). Following FEES assessment, therapeutic interventions were frequently recommended. The most commonly prescribed strategies included: CTAR exercise in 12 patients (66.7%), chin tuck maneuver in 8 patients (44.4%), Mendelsohn maneuver in 7 patients (38.9%), effortful swallow in 4 patients (22.2%), oral motor exercises in 4 patients (22.2%), supraglottic swallow in 3 patients (16.7%), thermal-tactile stimulation in 3 patients (16.7%), and Shaker exercise in 2 patients (11.1%). Most patients received more than one therapeutic intervention.

Discussion
The findings of this study suggest that FEES is not only a diagnostic tool but also a clinically valuable instrument for guiding dysphagia management in patients with Parkinson's disease. The real-time visualization provided by FEES facilitates identification of swallowing impairments and supports the development of patientspecific rehabilitation strategies. Through this individualized approach, FEES may contribute to reducing aspiration risk and improving clinical outcomes.

Limitations

This study has several limitations. The relatively small sample size and single-center retrospective design may limit the generalizability of the findings. Validated dysphagia severity scales, such as the Penetration–Aspiration Scale (PAS), were not available for all patients, which limited objective severity grading. Additionally, the marked male predominance (88.9%) may reflect the demographic characteristics of the study population or potential selection bias.

Conclusion

FEES plays an important clinical role beyond diagnosis by directly influencing dysphagia management in patients with Parkinson's disease. Early FEES-based evaluation may facilitate tailored rehabilitation strategies, help prevent aspiration-related complications, and improve patient safety and quality of life.

Future Directions

Future prospective multi-center studies with larger and more diverse cohorts are needed. Such studies should incorporate standardized outcome measures such as PAS and EAT10 and include longitudinal follow-up of clinical outcomes to further clarify the impact of FEES-guided management on patient outcomes.

Keywords: *Dysphagia, FEES, Parkinson's disease, Swallowing rehabilitation*

THE EFFECTS OF TONGUE AND LARYNGEAL POSİTİONS ON VOİCE PRODUCTİON AND VOCAL PERFORMANCE

Ardan Beyarslan, Seta Kürkçüoğlu

ABSTRACT

This study investigates the effects of the anatomical and functional positions of the tongue and larynx on vocal performance. Particularly among professional voice users, a low larynx and a neutral or forward tongue position are crucial in balancing resonance, sustaining vocal longevity, and achieving a natural timbre. This study assessed observations and literature data derived from the Functional Voice Training (FVT), Estill Voice Training (EVT), and Complete Vocal Technique (CVT) methodologies. The findings indicate that tongue-larynx coordination serves as a crucial determinant of both artistic performance and vocal health. The various combinations of the larynx (voice box) and tongue enable the vocalist to attain fundamental vocal quality and diverse singing styles. The extensive control that the performer exerts over these structures influences the timbre and stylistic expression of their voice. In the context of singing, variations in vocal performance and technical applications, including speaking (speech), falsetto (soft voice), and sobbing (sobbing/wailing), contribute to the emergence of styles such as belt, twang, legit, pop, jazz, and opera, among others. This study employed a literature review method, and the findings indicate that the larynx is positioned in a mid-range during the use of speech and falsetto, in a low-range position when employing sobbing and mixed voice (operatic voice), and in a high-range position when utilizing twang and belt techniques. The position of the tongue was observed to be mid-range during speech and falsetto, while it is positioned in the high-range during sobbing, opera, twang, and belt techniques.

Keywords: *Tongue position, laryngeal height, voice training, vocal techniques, vocal classifications.*

INTRODUCTION

The versatility of vocal training is unequivocally recognized by all instructors within this domain. Given its numerous subcategories of vocal interpretation, the vocal component consistently compels both performers and instructors to engage in research and remain informed about contemporary methodologies.

Vocal training endeavors to establish a defined timbre; in other words, a pattern of vocal behavior. The mastery of this vocal behavior pattern, cultivated in alignment with a particular singing style, ultimately influences the degree of artistic expression (Denizoğlu, 2020, s. 89).

Functional Voice Training (FVT), among various vocal types and techniques, aims to provide training that facilitates more comfortable singing and enhances comprehension of the voice, body, and vocal literature. It is termed "functional" due to its emphasis on accurate functional singing and breathing techniques, fostering the individual's awareness of the optimal physical utilization of their body (WEB_1).

The Complete Vocal Technique (CTV) vocal technique delineates three fundamental principles:

1. Breathing support: It refers to the maintenance of volume and regulation of subglottic air pressure beneath the vocal cords. In order to produce extended musical phrases while singing, it is essential to prolong the exhalation process, thereby enabling air to escape between the vocal cords for an extended duration.
2. Vocal transposition: This can be defined as the singer's action of opening or releasing their lower jaw in a relaxed, tension-free position, which enables the thyroid cartilage to exert a downward pull on the cricoid cartilage. This movement is essential for facilitating register transitions and enhancing the voice's strength at specific frequencies.

3. Avoiding the protrusion of the chin and the clenching of the lips: When engaging in singing, it is imperative to refrain from jutting out the chin and tightening the lips, particularly when producing higher tones. The lower jaw should be retracted in relation to the upper jaw. In addition to avoiding the clenching of the lips, it is essential to utilize the tongue effectively to articulate vowels without significantly altering the configuration of the mouth (WEB_2).

Estill Voice Training (EVT) constitutes a scientifically grounded voice training system. It emphasizes the comprehension and regulation of the anatomical structures associated with the voice to facilitate the attainment of healthy, flexible, and potent voice production. EVT analyzes voice production by categorizing it into 13 figures and six varied vocal qualities: Speech, Falsetto, Sob, Twang, Opera, and Belt (WEB_3).

While vocal needs are occasionally analogous across various vocal types, they may also differ substantially. Contemporary phonetic research suggests that the positioning of the tongue and larynx exerts a considerable influence on vocal resonance, formant frequencies, and vocal fatigue.

METHOD

In this study, the "Continuous Comparative Method," a qualitative research approach, was employed by engaging in a review of the literature; the data were interpreted in conjunction with the authors' experiential insights in "observational" vocal coaching. Ragin (1987); It underscores the significance of conducting comparisons in order to comprehend, elucidate, and interpret various phenomena.

LITERATURE REVIEW

The literature review was conducted under two headings: a) Sources addressing the effects of larynx height and its application in vocal genres, and b) Sources exploring the position of the tongue and investigating its impact on vocal interpretation. Consistent with the research findings, the data outputs concerning the utilization of larynx and tongue positions in vocal interpretation will be systematically tabulated.

a) One of the key studies on the position of the larynx is Sundberg's (1974) work titled "Articulatory Interpretation of the Singing Formant." This study is a pioneering source that scientifically demonstrated that, in classical vocal performance, the singer's formant arises from the expanded laryngopharyngeal cavity resulting from a low laryngeal position. Sundberg has conducted numerous studies in this field. Among these is the 1976 study by Sundberg and Nordström titled "Raised and Lowered Larynx – The Effect on Vowel Formant Frequencies." In his 1987 work "The Science of the Singing Voice," Sundberg uses graphs to explain the effect of laryngeal height on vocal tract resonances and acoustic output. Similarly, in his 1995 study titled "The Singer's Formant Revisited," Sundberg states that the position of the larynx plays a decisive role in the formation and control of high formants such as F3, F4, and F5. Jo Estill (1995) discusses the relationship between vocal types and the larynx in her book "Estill Voice Training: Compendium of Workbook Exercises and Figures". Bestebreurtje and Schutte (2000) examine the differences in resonance produced by the larynx and vocal tract in contemporary music (particularly in the belting technique) in their study titled "Resonance Strategies for the Belting Style: Observations and Hypotheses." In his article titled "The Effects of Anatomical Structures in the Human Voice Production System on Musical Sound Quality" (2003), Helvacı presents the effects of anatomical structures in the human voice production system on sound quality. In their article titled "Evidence for Distinguishing Pressed, Normal, Resonant, and Breathy Voice Qualities by Laryngeal Resistance and Vocal Efficiency in Vocally Trained Subjects" (2008), Grillo and Verdolini investigated whether the selected vocal qualities could be distinguished following brief experiments with participants. This study is effective for understanding the application of these vocal styles. In Echternach et al.'s (2008) study titled "Vocal Tract and Register Changes Analysed by Real-time MRI in Male Professional Singers—A Pilot Study," the movements of the larynx were observed and documented during performance. Echternach et al. (2014) conducted a more detailed study titled "Vocal Tract Configurations in Tenors' Passaggio under Different Vowel Conditions—A Real-Time Magnetic Resonance Imaging Study."

In the article titled "The Effects of Larynx Height on Vowel Production Are Mitigated by the Active Control of Articulators," written by Janssen et al. (2019), the effect of larynx position on vowel production is investigated. In their book "The Voice and Voice Therapy", which focuses on clinical vocal studies and voice therapy, Boone et al. (2019) discuss high laryngeal position in the context of muscle tension dysphonias and voice health.

b) Studies on the tongue and its position are relatively fewer in number compared to those focusing on the larynx. The earliest article on the anatomical structure of the tongue is "Observations on the Morphology of the Human Tongue," written by S. Abd-El-Malek and published in the Journal of Anatomy in 1939. Kılıç (2021) provides a comprehensive overview of all the elements involved in the act of speech in his work of the book chapter on "Anatomy and Physiology of Speech". Gerdeman and Fujimura's (1990) article "Speaking Without a Tongue" discusses the factors that cause changes in tongue position in relation to laryngeal height and tongue position. Brett R. Myers and Eileen M. Finnegan (2015) discuss the effect of articulation on the perceived loudness of the projected voice in their article "The Effects of Articulation on the Perceived Loudness of the Projected Voice." In their 2019 article "The Effects of Larynx Height on Vowel Production Are Mitigated by the Active Control of Articulators," Janssen R., Moisik, S.R., and Dediu, D. also address the relationship between the tongue and formants.

LARYNX

The systems involved in the formation of the entire vocal system are dynamic in structure and move. Structures such as the soft palate, tongue, jaw, and larynx take on different forms depending on articulation, nuance, and vocal type.

To understand the anatomy of organs whose function involves movement, it is also necessary to understand movement, which is the fourth dimension of anatomy (Denizoğlu, 2020, s.83).

Even when the larynx is observed without any phonatory activity, the up-and-down movement that occurs during swallowing can be seen. It is therefore accurate to say that the larynx is a structure capable of direct movement. The laryngeal cartilages, laryngeal joints, and especially the laryngeal muscles provide the movement dynamics. The suprahyoid muscles elevate the larynx, while the infrahyoid muscles lower it.

The suprahyoid muscle group includes the digastric, mylohyoid, geniohyoid, and stylohyoid muscles. Contraction of the posterior belly of the digastric muscle and the stylohyoid muscle moves the hyoid bone and larynx upward and backward, while contraction of the anterior belly of the digastric muscle, along with the mylohyoid and geniohyoid muscles, moves the hyoid bone and larynx upward and forward. The infrahyoid muscle group includes the thyrohyoid, sternothyroid, sternohyoid, and omohyoid muscles. Contraction of the muscles in this group causes the hyoid bone and larynx to move downward. Coordinated contraction of the suprahyoid and infrahyoid muscles fixes the larynx in place. (Kılıç, 2002).

The physical conditions of the vocal cords (length, mass/thickness, and stiffness values) during phonation can be defined as glottic geometry. Glottal geometry is a dynamic process that determines the aerodynamic phenomena and the vibrational mechanics of the vocal cords during phonation. Understanding the complex reciprocal vectorial contraction patterns of the intrinsic laryngeal muscles means understanding the movement (aerodynamic and mechanical) during phonation (Denizoğlu, 2020, s.98).

The position of the larynx is influenced by vowels, pitch, and habits formed through training. A lower laryngeal position is observed during voiced consonants (the phonation of consonants), while a higher position is observed during unvoiced consonants. In a professional singer, the larynx can descend lower during singing compared to someone who has never sung. In someone who has not received vocal training, the larynx is in its lowest position during the lowest pitches. It is in its highest position during the highest pitches. Generally, changes in laryngeal position occur in the upper and lower registers. There is almost no change in position in the middle register. Naturally, voice type and the singer's skill play a role in this (Gürel, 2023).

According to Sundberg (1995), the vertical position of the larynx determines the length of the supralaryngeal (above-laryngeal) vocal tract. Changes occurring here play a critical role in shaping vocal styles that contain high-frequency resonances, such as the F3 formant, which imparts brightness and character to the voice (Sundberg, 1995).

TONGUE

The primary function of the tongue is to taste. Its use in speech is nothing short of a miracle of human evolution. Thanks to its flexible structure, the tongue helps ensure the correct articulation of any language. In particular, it positions itself within the mouth according to the characteristics of each vowel, such as its pitch and intensity.

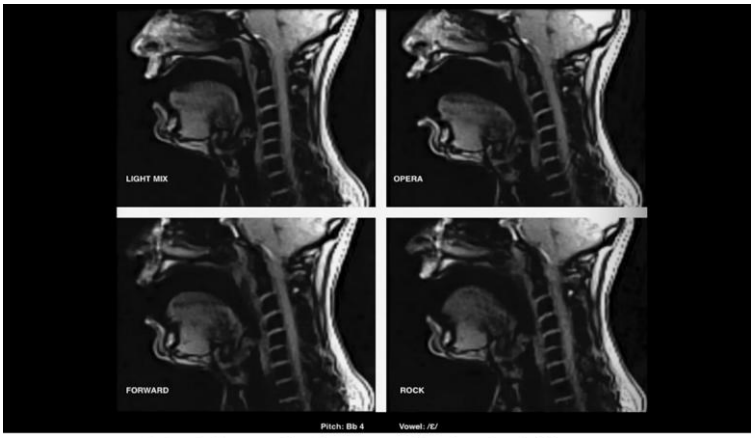
Among the articulators, the tongue plays a crucial role in the process of transforming articulatory configuration into speech acoustics. This soft-tissue organ, consisting almost entirely of muscle, produces a large deformation, and thus contributes to configuring vocal tract shape (Honda, 1996, p.39).

The tongue moves in a coordinated manner consistent with the anatomical structure of all articulators. It can move in a coordinated, up-and-down motion with the jaw, as well as independently. Just as every muscle can become overused or tense, the tongue can also move incorrectly or become stiff.

According to Honda (1996) This unique feature of tongue articulation creates critical problems which are not common in other musculoskeletal organs. The tongue consists of spatially arranged muscles which are layered and interdigitated with each other . It interacts with the floating rigid structures such as the jaw and hyoid bone (Honda, 1996). Since the tongue forms the front wall of the larynx, its position is crucial for controlling voice quality. If there is too much variation in its position between front and back vowels, voice quality may be compromised (Estill, 2019).

Tongue muscles: While the extrinsic muscles move the tongue to the desired position, the intrinsic muscles are responsible for the fine movements involved in articulation. Intrinsic tongue muscles: All intrinsic muscles of the tongue are innervated by the twelfth cranial nerve (the hypoglossal nerve) (Kılıç, 2021). The external muscles of the tongue are attached to the lower jaw, the soft palate, the upper pharyngeal ring muscles, and the skull base. This supports tongue movements and allows the tongue to exert influence on the hyoid bone. Furthermore, there is a strong correlation between the physiological capabilities of the tongue and speech quality. Because it is connected to the larynx, its movements also affect the larynx's up-and-down motion. At rest, the tongue bulges upward, covering the oral cavity (Gürel, 2023). A high tongue position can help balance resonance. Since activity at the base of the tongue can affect the larynx's vertical mobility, care must be taken to ensure that the tongue's position does not disrupt pitch during singing (Estill, 2019).

F2 (the second formant), which is associated with the high-pitched quality of a sound, is positively correlated with the anteroposterior position of the tongue constriction (TCX, TBX); forward movement of the tongue (during front vowels) increases the F2 value, giving the sound a "higher-pitched" quality (Janssen et al. 2019). The position of the tongue is important for the quality of the interpretation of a vocal piece. Just as the larynx changes its height depending on the style, so does the tongue.



Singing in the MRI with Tyley Ross - Making the Voice Visible
youtube.com/watch?v=J3TwTb-T044

RESULTS

LOCATION	POZITION	FUNCTION	STATUS ACCORDING TO VOCAL QUALITIES	MUSCLES / CARTILAGES
Larynx	Low, Mid, High	Alters the length of the vocal tract, resulting in a darker tone when lowered and a brighter tone when raised.	Opera (Low), Sob (Low), Falsetto (Mid), Speech (Mid), Twang (High), Belt (High).	Neck muscles (infrahyoid and suprahyoid muscles)
Thyroid Cartilage	Vertical, Tilt	Forward tilting of the cartilage lengthens the vocal folds, creating a sweeter tone quality and a clearer resonance.	Belt (Vertical), Falsetto (Vertical), Speech (Vertical), Opera (Tilt), Sob (Tilt), Twang (Tilt).	Adam's apple region, cricothyroid space
Cricoid Cartilage	Vertical, Tilt	Backward tilting of the cartilage thickens the vocal folds and enables very high vocal intensity, such as shouting.	Belt (Tilt), Falsetto (Vertical), Speech (Vertical), Opera (Vertical), Sob (Vertical), Twang (Vertical).	Lower part of the larynx, cricoid arch
Tongue	Low, Mid, High, Compress	The position of the tongue influences the volume of the oral cavity and the width of the pharynx. "Compress" is typically associated with operatic singing.	Twang (high), Belt (high), Opera (Mid/High/Compress – according to the pich of the voice), Sob (High), Speech (Mid), Falsetto (Mid).	Tongue root and floor of the mouth

CONCLUSION

Vocal sound quality is not only proportional to the volume of airflow from the lungs but is also directly related to the position of the tongue and larynx, as well as the width of the pharyngeal cavity, and is the result of the coordination of these structures. Research shows that both very low and very high laryngeal positions (Rht ratios) have observable effects on high formants.

There is an inherent relationship between laryngeal and tongue positions and vocal types in the context of the formation of vocal qualities. A review of the literature indicates that Opera and Sob are associated with a low laryngeal position, while Falsetto and Speech are produced with a mid laryngeal position, and Twang and Belt are supported by a high laryngeal position.

In terms of tongue positioning, Sob, Twang, and Belt are associated with a high tongue position, whereas Speech and Falsetto occur with a mid tongue position. In Opera, the tongue may assume a mid or high position, or exhibit a compressed configuration depending on pitch.

The tongue and larynx move in harmony with the structure of the vocal line, the note values, and the tempo (speed) of the piece being performed. An incorrect combination of up-and-down movements of the larynx and tongue leads to changes in vocal styles. Consequently, this can result in an undesirable outcome. Indeed, it is impossible to achieve the belting style with a low larynx and tongue position. In this context, a performer must always use their voice with an understanding of the aerodynamics and mechanics of the vocal instrument and act as a conscious interpreter.

The tongue and the larynx may function either in coordination or independently, depending on the vocal quality being produced, as well as the pitch level, tempo, and stylistic demands of the musical performance. Evaluation of the findings suggests that, in Twang, Belt, Speech, and Falsetto qualities, tongue movement tends to occur in coordination with laryngeal movement. In contrast, in Sob and Opera qualities, the tongue and larynx appear to operate more independently from one another.

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WEB_1 https://www.functionalmusic.training/voicelearnmore

WEB_2 https://completevocalinstitute.com/complete-vocal-technique/

WEB_3 https://www.thevoiceexplained.com/estill-voice-training

BREATHINESS SEVERITY IN COMMON DYSPHONIA DIAGNOSES: VOCAL FOLD NODULES, MUSCLE TENSION DYSPHONIA AND VOCAL FOLD PARALYSIS

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Abstract

Objective: To compare breathiness severity across vocal fold nodules, muscle tension dysphonia (MTD), and vocal fold paralysis (VFP), and to examine how breathiness-related acoustic measures vary across diagnoses and perceptual breathiness levels.

Methods: This cross-sectional study included patients diagnosed with nodules (n=48), MTD (n=28), and VFP (n=24). Breathiness severity was rated using the GRBAS-B scale by three raters. Acoustic measures (ABI, CPP, GNE max, jitter, shimmer) were extracted using Praat. Group comparisons were performed using non-parametric tests, and within-group associations were analyzed using Spearman correlation.

Results: GRBAS-B scores differed significantly across groups, with higher breathiness observed in VFP. ABI, CPP, and GNE max showed significant group differences, whereas jitter and shimmer did not. Strong correlations were observed between GRBAS-B and ABI (ρ=0.77–0.85), followed by CPP and GNE max, with weaker correlations for perturbation measures.

Conclusion: Breathiness varies across diagnostic groups and is best captured using multiparametric acoustic measures. ABI showed the strongest and most consistent associations, supporting its clinical relevance.

Keywords: *Dysphonia, Breathiness, Acoustic Analysis*

INTRODUCTION

Breathiness is a core perceptual dimension of dysphonia and reflects incomplete glottal closure and increased turbulent airflow during phonation.[1] It is frequently observed in a range of voice disorders, including vocal fold nodules, muscle tension dysphonia (MTD), and vocal fold paralysis (VFP), each characterized by distinct underlying physiological mechanisms.

Perceptual assessment, most commonly performed using the GRBAS (Grade, Roughness, Breathiness, Asthenia, Strain) scale, remains the clinical standard for evaluating breathiness.[2] However, due to its inherent subjectivity, acoustic measures are widely used to complement perceptual ratings.

Several acoustic measures have been proposed to quantify breathiness, including cepstral peak prominence (CPP), glottal-to-noise excitation ratio (GNE), perturbation measures (jitter and shimmer), and multiparametric indices such as the Acoustic Breathiness Index (ABI). While these measures are commonly used in both clinical and research settings, previous studies have primarily focused on their validity or diagnostic performance.[3-5]

However, beyond their diagnostic utility, less attention has been given to how these acoustic measures behave across different clinical diagnoses and perceptual breathiness severity levels. Understanding these patterns is important for interpreting acoustic findings within specific clinical contexts.

Therefore, the present study aimed to compare breathiness severity across vocal fold nodules, MTD, and VFP, and to characterize how breathiness-related acoustic measures vary across diagnoses and perceptual breathiness levels.

METHODS

Study Design and Participants

This study used a cross-sectional design including patients with three diagnostic categories: vocal fold nodules, muscle tension dysphonia (MTD), and vocal fold paralysis (VFP). All participants were evaluated at the Ear, Nose, and Throat Department of Hacettepe University Hospital and referred for voice assessment.

Diagnoses were confirmed through laryngeal examination and multidisciplinary consensus during routine voice board evaluations. Only participants with sufficient reading ability to complete the speech tasks were included.

Instead of analyzing sustained phonation and connected speech separately, a combined analysis approach was adopted. This approach integrates information from both stable phonatory segments and more ecologically valid speech production. Individuals with neurological disorders, prior voice treatment, or conditions affecting vocal function were excluded.

Laryngeal Examination

Laryngeal assessment included both flexible fiberoptic laryngoscopy and rigid videolaryngostroboscopy using standard clinical equipment. All examinations were reviewed by an experienced laryngologist, and final diagnoses were determined collaboratively.

Voice Recording Procedure

Voice samples were recorded in a quiet room where environmental noise was maintained below 50 dB(A). Recordings were obtained using a Computerized Speech Lab system (CSL Model 4500; KayPentax, Lincoln Park, NJ) with a head-mounted condenser microphone (AKG C520). The microphone was positioned approximately 5 cm from the mouth at a 45° angle to minimize aerodynamic noise.

All recordings were digitized at a sampling rate of 44.1 kHz with 16-bit resolution and stored in WAV format for subsequent analysis.

Participants were seated comfortably and instructed to produce a sustained vowel /a/ for approximately 3 seconds and to read a standardized sentence from the Pinocchio passage, using their habitual pitch and loudness.

Perceptual Assessment

Breathiness severity was rated using the “B” component of the GRBAS scale by three experienced raters. Ratings were performed independently, and inter-rater agreement was quantified using Krippendorff’s alpha.

Acoustic Analysis

All acoustic analyses were conducted using Praat software (Paul Boersma and David Weenink, University of Amsterdam, The Netherlands). A custom Praat script was used to preprocess the recordings and extract all acoustic parameters.

For the connected speech samples, voiced segments were automatically identified and extracted. These segments were concatenated and combined with the sustained vowel sample to create a unified signal following a voice-chain approach.

The following acoustic measures were obtained: Acoustic Breathiness Index (ABI), Cepstral Peak Prominence (CPP), Glottal-to-Noise Excitation Ratio maximum (GNE max), Jitter (local), Shimmer (local).

CPP was computed from the cepstral representation of the signal as an index of harmonic organization. GNE max was derived using a noise-based analysis reflecting the relative contribution of noise versus harmonic energy. Jitter (local) and shimmer (local) were calculated using standard Praat algorithms as measures of cycle-to-cycle frequency and amplitude perturbation. Unless otherwise specified, default Praat settings were used.

ABI was calculated from the concatenated signal using a multiparametric approach integrating cepstral, perturbation, and noise-related features.
This study focused not on validating the acoustic measures themselves, but on examining how these measures vary across diagnostic groups and perceptual breathiness severity levels.

Statistical Analysis
Descriptive statistics were calculated for all variables.
Given the non-normal distribution of the data, non-parametric tests were used for all group comparisons. Differences in acoustic measures across the three diagnostic groups (vocal fold nodules, MTD, and VFP) were analyzed using the Kruskal–Wallis test. Similarly, differences in GRBAS-B scores across diagnostic groups were evaluated using the Kruskal–Wallis test.
When overall group differences were statistically significant, pairwise comparisons were performed using the Mann–Whitney U test with Bonferroni correction.
Associations between perceptual breathiness (GRBAS-B scores) and acoustic parameters were examined separately within each diagnostic group using Spearman's rank correlation coefficient.
In addition, receiver operating characteristic (ROC) analyses were conducted as an exploratory approach to examine the relative discriminative behavior of acoustic measures across diagnostic groups. These analyses were not intended for diagnostic validation but to provide supplementary insight into group-level differences.
To account for unequal group sizes, sensitivity analyses were performed by randomly down-sampling the nodules and MTD groups to match the VFP group size (n = 24), and all analyses were repeated to assess the robustness of the findings.
All statistical analyses were performed using IBM SPSS Statistics (IBM Corp., Armonk, NY, USA). A significance level of $p<0.05$ was adopted for all statistical tests.

RESULTS

Inter-Rater Reliability of GRBAS-B Ratings
Inter-rater reliability for GRBAS-B ratings was high. Krippendorff's alpha coefficient was 0.823 (95% CI: 0.812–0.843), indicating very good agreement among the three raters.

Comparison of GRBAS-B Scores Across Diagnostic Groups
GRBAS-B scores differed significantly across the three diagnostic groups ($p<0.05$), with higher breathiness scores observed in the VFP group compared to the nodules and MTD groups.
Descriptive analysis of breathiness severity categories also indicated a distinct distribution pattern across diagnoses. Mild breathiness was more common in the nodules and MTD groups, whereas severe breathiness was predominantly observed in the VFP group (Table 1).

Table 1. Distribution of breathiness severity categories across diagnostic groups

Diagnostic Group	Mild (n, %)	Moderate (n, %)	Severe (n, %)
Vocal Fold Nodules (n=48)	21 (43.8%)	22 (45.8%)	5 (10.4%)
Muscle Tension Dysphonia (n=28)	16 (57.1%)	8 (28.6%)	4 (14.3%)
Vocal Fold Paralysis (n=24)	0 (0.0%)	6 (25.0%)	18 (75.0%)

Abbreviations: n, Number; %, Percentage.

Comparison of Acoustic Measures Across Diagnostic Groups
Significant differences were found across diagnostic groups for ABI, CPP, and GNE max ($p< 0.05$). ABI showed the most pronounced group differentiation, followed by CPP and GNE max. In contrast, perturbation measures (jitter local and shimmer local) demonstrated weaker and less consistent differences across groups ($p > 0.05$).

Associations Between GRBAS-B Scores and Acoustic Measures

Within-group analyses revealed significant correlations between GRBAS-B scores and acoustic parameters across all diagnostic groups (Table 2). The strength of these associations varied across groups, with the strongest correlations observed in the VFP group.

ABI showed the highest and most consistent correlations with GRBAS-B scores (ρ = 0.77–0.85), followed by CPP (ρ = −0.69 to −0.83) and GNE max (ρ = −0.59 to −0.72). Jitter demonstrated moderate correlations (ρ = 0.35–0.50), whereas shimmer showed weak and less consistent associations across groups (ρ = 0.21–0.33).

Table 2. Correlations between GRBAS-B and acoustic measures

Measure	*Nodules (ρ)*	*MTD (ρ)*	*VFP (ρ)*
ABI	ρ = 0.80	ρ = 0.77	ρ = 0.85
CPP	ρ = -0.75	ρ = -0.69	ρ = -0.83
GNE max	ρ = -0.60	ρ = -0.59	ρ = -0.72
Jitter	ρ = 0.42	ρ = 0.35	ρ = 0.50
Shimmer	ρ = 0.22	ρ = 0.21	ρ = 0.33

Abbreviations: ABI, Acoustic Breathiness Index; CPP, Cepstral Peak Prominence; GNE, Glottal-to-Noise Excitation Ratio; MTD, Muscle Tension Dysphonia; VFP, Vocal Fold Paralysis; ρ, Spearman's rank correlation coefficient. All correlations are significant at $p < 0.05$.

Exploratory ROC Analysis of Acoustic Measures

Exploratory ROC analyses indicated that ABI demonstrated the highest overall discriminative pattern across diagnostic comparisons (AUC range=0.91-0.92). CPP and GNE max also showed moderate discriminative performance, whereas perturbation measures yielded comparatively lower AUC values.

Sensitivity Analysis

Sensitivity analyses based on down-sampled groups yielded consistent findings, confirming that the results were robust to differences in group sizes.

DISCUSSION

The present study examined how breathiness severity and breathiness-related acoustic measures vary across vocal fold nodules, muscle tension dysphonia (MTD), and vocal fold paralysis (VFP). The findings demonstrated clear differences in both perceptual and acoustic profiles across diagnostic groups, supporting the view that breathiness is not a uniform phenomenon but varies depending on the underlying pathophysiology.

Breathiness severity, as reflected by GRBAS-B scores, was significantly higher in the VFP group compared to the nodules and MTD groups. This finding is consistent with the physiological characteristics of VFP, where incomplete glottal closure leads to increased turbulent airflow and more pronounced breathy voice quality. In contrast, nodules and MTD, which are typically associated with hyperfunctional voice use, showed relatively lower and more variable breathiness levels.

The analysis of acoustic measures further supported these differences. Among the evaluated parameters, ABI demonstrated the most pronounced differentiation across diagnostic groups. This likely reflects its multiparametric structure, which integrates cepstral, perturbation, and noise-related features, allowing a more comprehensive representation of breathiness compared to single-parameter measures.[6] CPP and GNE max also showed meaningful differences across groups, indicating their sensitivity to harmonic organization and noise-related components of the signal.

However, their discriminative behavior appeared more limited compared to ABI.[7] In contrast, perturbation measures such as jitter and shimmer showed weaker and less consistent differences across groups, suggesting that these measures may be less sensitive to breathiness-related turbulence and more reflective of periodicity-related features.

Importantly, acoustic measures demonstrated systematic variation across breathiness severity levels, with particularly noticeable differences between adjacent GRBAS-B categories. This finding indicates that these measures are sensitive not only to diagnostic differences but also to gradations in perceptual breathiness, supporting their relevance for clinical interpretation.

The correlation analyses provided additional insight into these patterns. While significant associations between GRBAS-B scores and acoustic measures were observed across all groups, the strength of these relationships varied depending on the diagnosis. Stronger correlations in the VFP group suggest a closer alignment between perceptual and acoustic indicators of breathiness in conditions characterized by structural glottal insufficiency. In contrast, weaker and more variable correlations in the nodules and MTD groups may reflect the more complex and heterogeneous nature of these disorders, where compensatory or functional factors influence voice production.

Findings from the present study are consistent with previous literature indicating that breathiness is closely associated with turbulent airflow and glottal insufficiency.[1,8] Previous studies have also reported that vocal fold nodules are more commonly characterized by roughness and strain, whereas breathiness tends to be less prominent, and that MTD may present with variable voice quality patterns depending on functional compensation.[8,9] In contrast, VFP has been consistently associated with pronounced breathiness due to incomplete glottal closure.[1,8] The present findings extend this knowledge by demonstrating how these perceptual differences are reflected in acoustic measures and how their relationships vary across diagnostic groups.

Although exploratory ROC analyses indicated that ABI showed the highest overall discriminative pattern, these findings should not be interpreted as evidence of diagnostic validity. Rather, they provide complementary support for the observed group-level differences and highlight the relative behavior of different acoustic measures within this clinical context.

Taken together, these findings emphasize the importance of interpreting acoustic measures within their clinical context. A multiparametric approach appears more appropriate for capturing the complexity of breathiness across different voice disorders, whereas reliance on single measures may provide a more limited representation.[10]

CONCLUSION AND RECOMMENDATIONS

Breathiness severity and breathiness-related acoustic measures differ across vocal fold nodules, muscle tension dysphonia, and vocal fold paralysis. The findings indicate that breathiness is not a uniform phenomenon but varies according to underlying pathophysiological mechanisms.

Among the evaluated measures, ABI demonstrated the most consistent and pronounced differentiation across diagnostic groups, supporting the value of multiparametric approaches in capturing the complexity of breathiness. CPP and GNE max provided additional, but comparatively more limited, discriminative information, whereas perturbation measures showed weaker associations.

From a clinical perspective, these findings suggest that combining perceptual assessment with multiparametric acoustic analysis may improve the evaluation of breathiness across different voice disorders. Future studies should further investigate the role of acoustic measures across broader diagnostic groups and explore their applicability in clinical decision-making.

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GENDER PERCEPTION OF TRANS AND CIS SPEAKERS: A COMPARISON ACROSS LISTENER GROUPS

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ABSTRACT

Introduction: Voice plays a critical role in gender perception, and listener-related factors may influence how a speaker's gender is perceived. While previous studies have primarily focused on acoustic correlates of gender perception, evidence regarding differences across listener groups remains limited. The present study aimed to compare gender perception responses across three listener groups—cisgender, transgender and gender-diverse (TGD), and expert clinicians—using speech samples from trans and cis speakers.

Methods: Sustained vowel and connected speech samples from trans women, trans men, cis women, and cis men were presented to cisgender, TGD, and expert clinician listeners via the Gorilla online platform. After each stimulus, listeners provided (1) categorical gender attributions and (2) 0–100 visual analogue scale (VAS) ratings of perceived femininity and masculinity. Gender perception responses were compared across listener groups for each speaker group using percentage distributions of categorical gender attributions and mean femininity and masculinity ratings.

Results: Gender perception responses differed across listener groups by speaker group and speech task. For cis speakers, expert listeners gave higher femininity scores for cis women, whereas TGD listeners rated cis men as more feminine than expert listeners ($p<0.01$). For trans speakers, expert listeners generally gave higher femininity scores and lower masculinity scores than cisgender and TGD listeners ($p<0.01$), whereas TGD listeners more frequently used mid-range femininity/masculinity ratings. By comparison, in sustained vowel phonation, expert listeners more frequently assigned trans speakers to the female category and less frequently to the male category than other listeners ($p<0.05$).

Discussion: The findings highlight the role of listener characteristics in shaping gender perception beyond acoustic cues. By directly comparing cisgender, TGD, and expert listeners' responses for diverse speaker groups, this study extends existing evidence on listener-related influences on gender perception and contributes comparative data that remain limited in the current literature.

Keywords: *voice and communication, gender perception, trans and gender-diverse individuals*

Introduction

Voice and communication (VAC) are fundamental aspects of human interaction through which individuals share emotions, thoughts, and ideas and express themselves as socio-cultural beings. Accordingly, VAC play a central role in shaping how individuals perceive their own gender and how others perceive their gender.[1, 2]

The voice and communication characteristics of trans and gender-diverse (TGD) individuals may be perceived by themselves and their communication partners as incongruent with their affirmed gender.[3] This incongruence may lead to social participation difficulties, such as avoiding telephone communication, unemployment, and challenges in engaging in romantic relationships, as well as a decrease in overall well-being and quality of life.[3, 4] Therefore, voice and communication interventions constitute an important component of gender-affirming services for TGD individuals. Voice and Communication Interventions are provided as part of a comprehensive and coordinated healthcare approach, including support addressing medical, psychological, and social needs.[5]

There are various approaches to modifying the voices and communication of trans and gender-diverse (TGD) individuals. These include: (1) self-directed changes made by TGD individuals using available resources to guide themselves; (2) behavioral changes achieved with the support of speech and language therapists (SLTs); (3) androgen hormone therapy; and (4) changes resulting from laryngeal surgery performed by otolaryngologists. However, for the first approach, there is no scientific evidence.[1, 5] While these interventions primarily focus on modifying the speaker's vocal characteristics, it is equally important to consider how these changes are navigated and interpreted within social interactions.

The Biocultural Assemblage (ASSEMBLE) model conceptualizes voice and communication production as emerging from the dynamic interaction between speaker practices, listener practices, and broader sociocultural and environmental forces. Within this framework, voice is not solely determined by anatomical factors, but is also shaped by how it is produced, interpreted, and situated within social contexts.[2] Consistent with this view, target selection in gender-affirming voice and communication interventions is based on three key factors: normative acoustic characteristics of cisgender speakers, listener perception of gender, and the client's personal goals.[6, 7] Among these factors, listener perception plays an important role in shaping gender perception. Rather than being determined solely by the speaker, gender perception emerges from the interaction between speaker practices and listener practices. Consequently, listener characteristics contribute to how gender is perceived.

Existing research shows that listener characteristics associated with gender perception include factors such as gender identity, sexual orientation, and professional background.[8-11] However, much of this literature has relied on relatively homogeneous listener samples, most commonly cisgender university students. Although there has been a gradual shift towards including more diverse listener groups, studies providing clear and consistent evidence on the effects of listener characteristics on gender perception remain limited. Moreover, studies examining how listener characteristics interact with different speaker groups are still limited. Consequently, the aim of the current study is to compare listener ratings of gender perception for four speaker groups (1- trans women, 2- trans men, 3- cis women, and 4- cis men) across three listener groups (1- cisgender lay individuals, 2- TGD lay individuals, 3- expert clinicians).

Methods

Participants

Participants included both speakers and listeners. Speakers were grouped based on their speaking fundamental frequency (SF0) values obtained during connected speech (reading the third sentence of the Turkish CAPE-V protocol) and their gender identity and cis/trans status. SF0 values were categorized into three ranges: (1) 80–150 Hz, (2) 150–190 Hz, and (3) ≥190 Hz. Each group included two trans women and two trans men, resulting in a total of six trans women and six trans men. Additionally, six cis men and six cis women were included in Group 1 and Group 3, respectively. In total, the study included 24 speakers.

Cisgender participants were individuals whose sex assigned at birth and gender identity aligned (female/women; male/men), whereas transgender participants were those whose sex assigned at birth and gender identity differed and who identified as men or women. Inclusion criteria for both TGD and cisgender speakers were: age between 18–40 years, being native Turkish speakers, no systemic or neurological conditions affecting voice, no diagnosed voice disorder, and no upper respiratory tract infection or similar condition affecting voice on the day of assessment.

Additional inclusion criteria for TGD speakers included normal vocal fold structure confirmed by videolaryngostroboscopic examination. Additional inclusion criteria for cisgender speakers included perceptually normal voice quality based on GRBAS ratings by two experienced SLTs and a VHI-10 score below 7.

For listener grouping, factors reported in the literature that influence gender perception were taken into account. Accordingly, three listener groups were defined: (1) lay cisgender individuals (women and men), (2) lay TGD individuals, and (3) expert listeners with experience in voice and communication interventions for TGD individuals (otolaryngologists and speech and language therapists). Common inclusion criteria for all listeners were: age between 18–60 years, being native Turkish speakers, no untreated visual impairment, and bilateral hearing thresholds of ≤25 dB HL at 500, 1000, 2000, and 4000 Hz based on pure-tone audiometric screening. Additional inclusion criteria for expert listeners included prior experience providing voice and communication interventions to at least two TGD individuals and professional qualification as a speech and language therapist or otolaryngologist. A total of 87 listeners participated in the study, including 17 experts, 40 cisgender lay individuals, and 30 TGD lay individuals.

Data Collection

Voice recordings were obtained for each speaker, including both sustained phonation (/a/) and connected speech (reading all of the sentences from the CAPE-V protocol, approximately 15–20 seconds). Recordings were carried out using the Computerized Speec Lab (Multi-Dimensional Voice Profile and Real-Time Pitch programs). After that, listeners completed an online listener experiment administered via the Gorilla platform. For each stimulus, listeners provided three types of responses: (1) femininity rating using a 0–100 visual analog scale (VAS), (2) masculinity rating using a 0–100 VAS, and (3) perceived gender (man, woman, or could not decide). A total of 24 stimuli were presented, including voices from 6 cis women, 6 cis men, 6 trans women, and 6 trans men. In addition, 16% of the stimuli (4 items) were repeated to assess intra-rater reliability, resulting in a total of 28 stimuli.

Participants were first presented with study information and an informed consent form; those who consented proceeded to the next stage. An audio screening task was then administered, and participants who failed were excluded. Those who passed continued with the listener perception experiment, followed by demographic questions.

Statistical Anlaysis

Group differences and associations between speaker and listener data were analyzed. In order to assess intra-rater reliability, 20% of the recordings were repeated. Reliability was evaluated using intraclass correlation coefficients (ICC) for continuous variables and Fleiss' kappa for categorical variables.[6, 11]

Because the same voice recordings were evaluated by three different listener groups, differences in gender perception across listener groups were analyzed using the Friedman test, appropriate for repeated-measures designs. Significant results were followed by Conover post hoc tests with Bonferroni correction.[12]

VAS scores were analyzed both as continuous variables and after categorization into three levels: low (1–25), mid (26–75), and high (76–100). For all categorical variables, frequencies (n) and percentages (%) were calculated for each recording and subsequently analyzed as continuous variables in group comparisons.

Results

Participant Characteristics

Across speaker groups, most participants had at least an undergraduate education, and many were either students or not working. Among trans women, 66.7% were receiving hormone therapy, with durations ranging from 1 month to 3 years. In contrast, 33.3% of trans men were receiving hormone therapy, with shorter durations (1–6 months).

Regarding listeners, lay cisgender listeners were predominantly female (95%) and all were students. On the other hand, lay TGD listeners showed greater diversity in both gender identity and occupational profiles. Most identified as women (70%), followed by men, with a small proportion identifying as nonbinary or other identities. Expert listeners were speech and language therapists (SLTs) and otolaryngologists, with the majority having experience in ≥10 gender-affirming VAC interventions. Most held postgraduate degrees.

Intra-rater Reliability

Intra-rater reliability results for continuous and categorical variables are summarized in Table 1.

Table 1. Summary of Intra-Rater Reliability Results

Reliability Measure	Speech Sample	Listener Group	*Coefficient Range (significant only)	Significant (%)	Interpretation
ICC	Sustained phonation	Cisgender listeners	0.807–0.993	70.0%	Good – Excellent
		TGD listeners	0.815–0.997	66.7–76.7%	Good – Excellent
		Expert listeners	0.838–0.998	94.1–100%	Good – Excellent
ICC	Connected speech	Cisgender listeners	0.815–1.000	95.0–97.5%	Good – Excellent
		TGD listeners	0.828–1.000	80.0–90.0%	Good – Excellent
		Expert listeners	0.815–1.000	88.2–94.1%	Good – Excellent
Kappa	Sustained phonation	Cisgender listeners	0.429–1.000	62.2%	Moderate – Almost perfect
		TGD listeners	0.429–1.000	30.0%	Moderate – Almost perfect
		Expert listeners	1.000	37.5%	Almost perfect
Kappa	Connected speech	Cisgender listeners	0.556–1.000	87.5%	Moderate – Almost perfect
		TGD listeners	0.556–1.000	76.7%	Moderate – Almost perfect
		Expert listeners	1.000	76.5%	Almost perfect

ICC: intraclass correlation coefficient, TGD: trans and gender-diverse
*Coefficient ranges are reported for significant values. When all significant coefficients were identical, a single value is presented.

As shown in Table 1, intra-rater reliability was generally high across listener groups. For continuous variables, significant ICC values predominantly fell within the good-to-excellent range. The proportion of significant reliability tended to be higher in connected speech (80–97.5% for femininity ratings) compared to sustained phonation (66.7–94.1%). For categorical variables, Fleiss' kappa values ranged from moderate to almost perfect. However, the proportion of significant agreement varied across groups, particularly in sustained phonation, where TGD listeners showed lower rates (30.0%) compared to cisgender (62.2%) and expert listeners (37.5%). Across conditions, reliability appeared higher for continuous measures than for categorical judgments, and generally higher in connected speech than in sustained phonation. Expert listeners demonstrated consistently high reliability for continuous variables, whereas cisgender listeners showed relatively higher reliability for categorical variables.

Comparison Across Listener Groups

Group differences in listener ratings across speaker groups are summarized in Table 2.

Table 2. Summary of Results for the Comparison Between Listener Groups

Speech Sample	Continuous VAS	Categorical VAS	Categorical Gender
Cis Men			
Sustained Phonation	• Femininity: TGD > Expert	• Mid femininity: TGD > Cis	—
Connected Speech	• Femininity: Cis, TGD > Expert	• Low femininity: Cis, Expert > TGD • Mid femininity: TGD > Cis > Expert • Mid masculinity: Cis > Expert	—
Cis Women			
Sustained Phonation	• Femininity: Expert > Cis, TGD • Masculinity: Cis, TGD > Expert	• Mid femininity : Cis, TGD > Expert • High Femininity: Expert > Cis, TGD • Low masculinity: Expert > Cis > TGD • Mid masculinity: TGD > Cis > Expert	• "Woman": Expert > Cis, TGD • "Couldn't decide": TGD > Expert
Connected Speech	• Femininity: Expert > Cis > TGD • Masculinity: TGD > Cis > Expert	• Mid femininity: TGD > Cis > Expert • High femininity: Expert > Cis > TGD • Low masculinity: Cis, Expert > TGD • Mid masculinity: TGD > Cis, Expert	—
Trans Men			
Sustained Phonation	• Femininity: Expert > TGD > Cis • Masculinity: Cis, TGD > Expert	• High femininity: Expert > Cis, TGD • Low masculinity: Expert > Cis, TGD • High masculinity: Cis, TGD > Expert	• "Woman": Expert > Cis • "Man": TGD > Expert
Connected Speech	—	• Low femininity: Expert > TGD • Mid femininity: TGD > Cis, Expert • Mid masculinity: Cis, TGD > Expert	—
Trans Women			
Sustained Phonation	• Femininity: TGD, Expert > Cis • Masculinity: Cis, TGD > Expert	• Mid masculinity: TGD > Expert	• "Woman": Expert > Cis • "Man": Cis, TGD > Expert

Cis: cisgender, TGD: trans and gender-diverse

As can be seen in Table 2, differences were observed across all speaker groups. However, no consistent speaker group–specific pattern emerged across conditions. For continuous VAS measures, expert listeners tended to use more extreme ratings, particularly in sustained phonation, as reflected in higher femininity and lower masculinity scores in several speaker groups (e.g., cis women and trans men). In contrast, TGD listeners more frequently used mid-range ratings, especially in mid femininity and mid masculinity categories, and their ratings were generally more similar to those of expert listeners than to those of cisgender listeners. For the categorical analyses of VAS scores, group differences were most evident in mid-range categories, with TGD listeners more frequently assigning mid-level ratings, whereas expert listeners showed a tendency toward high femininity and low masculinity ranges.

An effect of speech sample was also observed. Specifically, for perceived gender, no group differences were observed in connected speech, whereas differences between listener groups emerged in sustained phonation. Finally, results varied depending on the analysis approach. While continuous analyses highlighted differences in overall rating tendencies, categorical analyses revealed additional distinctions in the distribution of responses.

For example, for trans men in connected speech, no significant group differences were observed in continuous VAS analyses; however, when VAS scores were analyzed as low, mid, and high categories, group differences emerged in specific categories, including low femininity (Expert > TGD), mid femininity (TGD > Cisgender, Expert), and mid masculinity (Cisgender, TGD > Expert).

Discussion

The present study examined how listener characteristics influence gender perception across different speaker groups and speech tasks. Intra-rater reliability was generally high, particularly for continuous measures, consistent with previous literature.[6] However, a wider variability was observed compared to some studies. This may be related to the inclusion of voices with SF0 values in gender-neutral range[13] (approximately 150–190 Hz), where gender perception is known to be less stable across listeners. In such cases, lower reliability may reflect variability in perceptual interpretation rather than measurement inconsistency.

Gender perception differed across listener groups, and these differences were observed across all speaker groups. This finding is in line with previous research demonstrating that listener characteristics—such as gender identity, expertise, and sociocultural background—influence gender perception.[8, 10, 11] The absence of a consistent speaker-specific pattern suggests that listener-related factors shape perceptual judgments across different speaker groups.

Differences between listener groups were also influenced by speech task and rating method. Group differences were more evident in sustained phonation than in connected speech, likely due to the more limited acoustic and linguistic cues available in sustained phonation. Additionally, differences varied depending on whether VAS scores were analyzed as continuous or categorical variables.

A notable finding was that expert listeners tended to use more extreme VAS ratings, whereas TGD listeners more frequently used mid-range ratings. The tendency of expert listeners toward more extreme ratings may reflect a more categorical or decision-oriented listening strategy shaped by clinical experience. In contrast, the frequent use of mid-range ratings by TGD listeners may reflect a more flexible and less binary perception of gender. This interpretation is consistent with previous research suggesting that TGD individuals may exhibit greater sensitivity to gender variability.[10]

Furthermore, TGD listeners' ratings were generally closer to those of expert listeners than to cisgender listeners. This convergence may indicate shared perceptual strategies, potentially related to greater exposure to diverse voice patterns. Consistent witht the present findings, previous research suggests that both TGD listeners and experts rely on a broader range of acoustic cues—including voice quality and prosodic features—in addition to fundamental frequency, whereas cisgender listeners tend to rely more predominantly on pitch-related cues.[9, 14]

Conclusion and Recommendations

The present study demonstrates that gender perception is shaped not only by speaker-related acoustic properties but also by listener characteristics. These findings highlight the importance of considering listener variability in both gender perception research and gender-affirming voice and communication practice.

Several implications for future research arise from these findings. First, the observed effects of speech sample type suggest that the inclusion of more diverse and ecologically valid speech tasks is necessary to better capture variability in gender perception. Second, listener-related factors—such as age, attitudes toward gender roles, and social experience—require further systematic investigation to better understand their contribution to perceptual differences. Finally, the discrepancies observed between continuous and categorical analyses of VAS scores indicate that methodological choices in rating and analysis may influence outcomes; therefore, these choices should be explicitly considered and reported in future studies.

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ORAL Presentation

ETHICS IN VOICE TEACHING: A FIVE-PART PARADIGM FOR SUSTAINABLE PEDAGOGY

Justin John Moniz
Justin John Moniz

The role of ethics in voice teaching has long been acknowledged, yet it remains underexplored compared to allied fields such as medicine and education. Unlike professions that require licensure, the teaching of voice lacks formal ethical oversight, leaving pedagogues to navigate complex questions of professional responsibility without a standardized framework. The purpose of this paper is to introduce and evaluate a five-part paradigm for ethical voice teaching, developed through critical review of the National Association of Teachers of Singing (NATS) Code of Ethics and expanded through contemporary pedagogical discourse.

Methods include a synthesis of existing scholarship on professional ethics in education and applied voice pedagogy, combined with case-based analysis of studio practice. This paradigm emphasizes five core commitments: nurturing intellectual curiosity, creating challenging environments, committing to lifelong learning, collaborating with colleagues, and integrating with community. Each component is explored through illustrative applications, including scenarios such as equitable repertoire assignment across gender and cultural lines, and referral to medical specialists when signs of vocal injury arise.

Findings indicate that adoption of this model enhances transparency, equity, and student empowerment while safeguarding both vocal health and artistic integrity. Specifically, creating challenging environments fosters resilience and problem-solving, while collaboration and community integration expand pedagogical impact beyond the studio. Commitment to lifelong learning ensures that pedagogues remain current with advances in science, artistry, and professional practice.

In conclusion, the integration of a clear ethical framework into voice pedagogy strengthens trust within the teacher-student relationship, promotes sustainable teaching practices, and advances the profession as a whole. The proposed paradigm offers a practical guide for teachers seeking to align their pedagogic practice with broader principles of integrity, responsibility, and professional accountability, with implications for diverse cultural and institutional contexts worldwide.

Keywords: *voice pedagogy, ethics, professional responsibility, vocal health, equity*

INTENTIONAL VOICE DISTORTIONS: FROM EVERYDAY VOCAL GESTURES TO DISTORTED PHONATION

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The distinction between pathological hoarseness and roughness and intentionally distorted voice lies in the purpose and control exercised by the voice user. Professional voice users, particularly singers and actors, employ vocal distortions deliberately for aesthetic or interpretative purposes. While some may use these voices momentarily, such as during a dramatic shout of an actor or actress, others, including certain metal or traditional singers, incorporate them throughout their performance.

Previous studies have identified multiple anatomical structures involved in producing intentional voice distortions. These include the vocal folds, ventricular folds, aryepiglottic folds, arytenoid and epiglottic cartilages, the uvula, and pharyngeal wall, often in various combinations. The behavior of these structures plays a critical role in determining the type of distortion and its resulting timbre. For instance, aperiodic or multiperiodic vibration of the vocal folds yields distinct acoustic and perceptual outcomes.

However, accessing and coordinating these less commonly used vocal structures poses a challenge for many performers. When conventional pedagogical tools, such as imitation-based cues ("bark like a dog," "sound tired," or "imitate a cat") fail, one will need for more accessible and intuitive training approaches, this includes vocal gestures that are already known by the performer.

This workshop introduces a pedagogical approach grounded in everyday vocal gestures, such as coughing, throat clearing, swallowing, vomiting, and others, as entry points for achieving various intentional voice distortions. These familiar actions can help performers access specific laryngeal behaviors without the need for advanced technical or knowledge. Participants will observe the effects of these gestures on the larynx through recorded laryngographic images and will have the opportunity to explore their resulting vocal qualities. Each gesture evokes distinct phonatory patterns, which can be refined through changing compression levels, subglottic pressure, vowel shapes, and vocal tract configurations to expand one's expressive toolkit.

Keywords: *Singing, Voice Distortions, Vocal Training, Vocal Habilitation, Workshop*

BLENDING VOCAL INTONATION THERAPY AND CORESINGING APPROACHES TO ENHANCE VOCAL REHABILITATION OUTCOMES

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While traditional voice therapy provides essential foundations, it often faces limitations in achieving maximal and sustained rehabilitative outcomes due to an over-reliance on prescriptive methods that can stifle client exploration and critical conceptual reframing. The gap lies in the need for a systematic, non-judgmental approach that encourages both therapists and clients to look at old concepts in new ways to foster organic, lasting vocal change. Healthy phonation relies on core physiological mechanisms that are common to both singing and speaking. They are deeply intertwined, offering a rich and underused resource for voice rehabilitation.

CoreSinging is a holistic performance pedagogy that incorporates five essential elements: energy, awareness, imagination, practice and performance, that helps access the heart, soul and spirit of your singing and speaking. It emphasizes fun, play and use of the imagination. With quick and effective exercises, the concepts of CoreSinging open up a lot more possibility for how we learn – using the mind and using intent. This approach encourages teachers to withhold judgment, and initially teach without emphasis on getting it "right" or affecting any particular genres or methods.

Vocal Intonation Therapy is a singing informed vocal pedagogy technique that brings the rich tradition of singing voice pedagogy and clinical structure of Speech and Language Therapy together. Vocal Intonation Therapy draws from a deep well of singing pedagogy techniques and applies them in new functional ways. In VIT, singing is the therapy. It is the central active method in vocal intervention and leads the therapeutic context. While VIT utilizes singing as the treatment for speech, it is not a singing lesson and not about singing performance outcomes, blending CoreSinging and Vocal Intonation Therapy approaches and adapting them, could significantly enhance how we rehabilitate speakers as well as singers.

Keywords: *CoreSinging, Vocal Intonation Therapy, Vocal Rehabilitation*

THE LOWER THORACIC ANGLE AS A BIOMECHANICAL MARKER OF BREATH MANAGEMENT IN CLASSICAL SINGING

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Introduction
Breath management is a core element in classical singing technique, often described through the concepts of appoggio (support through coordinated breath control) and sostegno (maintenance of subglottic pressure). Despite their central role in vocal pedagogy, these concepts remain challenging to quantify objectively. Recent advances in ultrasonography allow non-invasive visualization of thoracoabdominal dynamics during phonation. The lower thoracic angle—formed by the costal margins at the anterior chest—has been proposed as a potential biomechanical marker of breath strategy in singers.

Objectives
This study aimed to: (1) explore the feasibility of using real-time ultrasonography to assess respiratory and postural adjustments in trained singers; (2) compare the lower thoracic angle during phonation tasks requiring appoggio versus sostegno; and (3) investigate whether angle differences correlate with singers' self-reported breath management strategies.

Methodology
A cohort of classically trained singers underwent B-mode ultrasonographic assessment during standardized phonation tasks. Tasks were designed to elicit predominant appoggio and sostegno depending on the lower thoracic angle. The lower thoracic angle was measured before the task to predict the dynamic priority of each singer.

Results
Preliminary analysis demonstrated consistent feasibility of angle measurement across participants, with high inter-rater reliability. Mean higher angle was significantly related to a predominance into the appoggio and a lower angle was related to a nigher need to use the sostegno in the former.

Keywords: *support, breath, ultrasonography, lower thoracic angle*

VOCAL FATIGABILITY AND HANDICAP IN TEACHERS: A CROSS-SECTIONAL STUDY

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Introduction:
Voice disorders are a frequent occupational health concern among teachers, marked by high prevalence but limited attention in education. The study prioritizes assessing vocal fatigability (VF) (sustained vocal effort and tiredness from cumulative demands) over state fatigue. VF is a significant factor affecting the quality of life, as inadequate recovery periods often raise the risk of developing vocal problems. Understanding the levels of fatigability, its link to vocal handicap, and associated risk factors is essential for grasping its full impact on teacher well-being.
Methods:
A descriptive cross-sectional study investigated VF among 525 Spanish teachers (mean age: 45.35 years; 16.4% men, 83.6% women) and its association with perceived vocal handicap. The research was performed collaboratively with the Department of Public Education. Data on VF and associated factors were collected via an online questionnaire. This included the VHI-10 and the Vocal Fatigability Scale for Teachers (VFS-T).
Results:
VF was reported by 57.3% of teachers, with 41.3% reporting moderate and 16% reporting high levels. A significant and high correlation was found between the VFS-T and VHI-10 scores ($r=0.79$; $p<.00$), demonstrating stable relationships between measures of handicap and fatigue, and showing that, although they evaluate distinct constructs, they are strongly related. Likewise, weekly teaching hours and gender were shown to be significant predictors of fatigability ($\beta= 0.22$; $\beta=4.61$; $p<0.05$). No differences in fatigability levels were found based on age, education level, or health coverage.
Conclusions:
More than half of the teaching workforce experiences VF, which is closely tied to the intensity of teaching (weekly hours) and gender. As an early indicator, fatigability is crucial for the detection and prevention of serious vocal disorders. It is recommended that its periodic assessment be incorporated into occupational health programs for teachers. Implementing preventative strategies is necessary to avoid decreased teaching performance and work absenteeism.

Keywords: *Vocal fatigability, teachers, vocal health, prevention*

THE AGREEMENT BETWEEN A CONTACT-BASED PIEZOELECTRIC TRANSDUCER AND A STANDARD MICROPHONE FOR IN VIVO ACOUSTIC VOICE ANALYSIS

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Background
Acoustic analysis is fundamental for voice assessment, but standard microphones are susceptible to environmental factors. Contact-based sensors, like piezoelectric transducers, may offer a robust alternative, yet their agreement with standard microphones requires in vivo validation due to the influence of tissue propagation. This study aims to assess the agreement between a standard microphone and a contact transducer in a human cohort.
Objectives
The primary objective is to evaluate the agreement between a standard headset microphone and a neck-mounted piezoelectric transducer across a range of acoustic parameters. A secondary objective is to explore how anthropometric variables influence this agreement.
Methods
In a cross-sectional study, 49 adults performed a standardized vocal protocol, recorded simultaneously with a headset microphone and a neck-mounted transducer. Agreement was evaluated using Linear Mixed-Effects Models. Sensor interchangeability was assessed by the absence of systematic bias ($p>0.05$) and reliability via the Intraclass Correlation Coefficient. For parameters with significant bias, calibration equations were derived and internally validated.
Results
Agreement between the sensors was highly parameter-specific. Thirteen acoustic parameters, including mean fundamental frequency (fo), were directly interchangeable, showing no systematic bias ($p>0.05$). Reliability for this group ranged from excellent for fo to poor for perturbation measures. Eight parameters, including harmonic-to-noise ratio and shimmer, exhibited significant systematic bias but were successfully harmonized using derived calibration equations. Finally, for a small subset of parameters, methodological issues precluded a definitive agreement analysis, rendering them unsuitable for comparison.
Conclusion
The interchangeability of contact and standard microphones is conditional, not universal. Frequency-based measures can be used directly, while spectral measures require specific, validated calibration equations, which this study provides. However, some parameters may not be comparable regardless of correction. Our findings enable the reliable use of contact sensors in challenging environments but highlight that a parameter-specific approach is crucial for valid acoustic analysis.

Keywords: *Voice Acoustics, Piezoelectric Transducer, Agreement Study, Calibration*

VOICE-RELATED CHALLENGES EXPERIENCED BY TRANSGENDER AND GENDER DIVERSE INDIVIDUALS IN BELGIUM

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Background and purpose Transgender and gender diverse (TGD) individuals often face challenges related to their voice and communication. However, research on voice and communication services for non-binary individuals, transmasculine individuals, or individuals with other gender identities remains limited. In addition, TGD individuals often face barriers to accessing care. Therefore, the purpose of this study was to investigate the voice and communication related needs of TGD individuals living in Belgium, and the barriers they experience in accessing voice and communication training (VCT).

Methods In this community-based participatory research, TGD individuals worked with the research team to develop a questionnaire through a multi-step process, addressing voice satisfaction, social impacts, and access to voice services. Several data cleaning procedures were implemented to ensure quality responses.

Findings The questionnaire was completed by 197 TGD individuals, including feminine and transfeminine (n=108), masculine and transmasculine (n=29), non-binary presumed male at birth (PMAB) (n=11), non-binary presumed female at birth (PFAB) (n=40), and 'questioning or other' (n=2) individuals. Half of the participants expressed dissatisfaction with their voice, and 48.2% felt their voice did not align with their gender expression. Misgendering and voice-related judgments negatively impacted their well-being and social lives. More than half of the participants (113/197) underwent VCT with positive outcomes, especially (trans)feminine individuals. All participants taking male sex hormones experienced influence of the gender-affirming hormone therapy on their voice. A few participants underwent gender affirming pitch changing surgery with mixed results. Non-binary participants, particularly those PFAB, faced more barriers accessing VCT.

Conclusion In conclusion, adopting a holistic approach to understand the diverse needs and experiences of TGD individuals is crucial for effective voice support and ensuring that voice and communication specialists receive comprehensive training is essential for delivering accurate assessments and culturally competent care.

Keywords: *gender-affirming care, gender perception, non-binary experiences, transgender voice, voice and communication services*

EFFECTIVENESS OF INTONATION TRAINING IN TRANSGENDER AND GENDER DIVERSE INDIVIDUALS

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Background and purpose The purpose of this research project was motivated by recent research demonstrating that intonation influences gender perception in TGD individuals and given that intonation is frequently targeted in gender-affirming VCT. Consequently, the aim of this research project was to investigate the effectiveness of isolated intonation training in TGD individuals.

Methods Two randomized clinical trials were conducted, one with TGD individuals seeking a more feminine-sounding voice (N = 30) and one with those seeking a more masculine-sounding voice (N = 23). Participants were randomly allocated to one of two groups: group 1 received 4 weeks of intonation training, while group 2 first completed 4 weeks of sham training. Assessments were performed at four time points: before training, after sham training (group 2 only), after intonation training (both groups), and at follow-up (4 weeks after the final session, without intervention). Therefore, a multidimensional approach was adopted to combine quantitative data (i.e., acoustic measures, self-perception, and listener ratings), with qualitative insights from semi-structured interviews

Findings Quantitative analyses revealed significant changes in all acoustic and perceptual intonation parameters following intonation training, consistent with the training goals. Naïve listeners perceived participants' voices as significant more feminine or masculine, while participants reported greater congruence between their voice and gender identity. Qualitative interviews further supported these Results: participants described increased awareness and control of their voice, enhanced speaking comfort, and reduced voice-related avoidance. However, some experienced difficulties transferring techniques to spontaneous speech or felt constrained by flatter intonation patterns. Many participants indicated that 4 weeks of intonation training were insufficient to achieve their desired degree of voice modification and expressed a wish for extended or complementary interventions.

Conclusion Overall, these findings highlight the relevance of intonation in gender-affirming VCT and underscore the importance of a holistic, individualized, and client-centered approach.

Keywords: *intonation training, effectiveness, transgender and gender diverse, quantitative, qualitative*

EXPLORING THE ROLE OF OUTCOME PREDICTORS IN GENDER-AFFIRMING VOICE CARE FOR TRANSGENDER WOMEN

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Background
Gender-affirming voice care for transgender women has seen significant advancements, with researchers exploring the acoustic and perceptual outcomes of various interventions. This study aimed to explore possible outcome predictors in a gender-affirming voice training program for transgender women.

Methods
This study included 30 transgender women who completed 10 weeks of gender-affirming voice training. Participant-reported outcomes, listener perceptions of femininity of the voice, and acoustic measures were assessed before and after the training. Potential outcome predictors, such as age, musicality and home exercise were analyzed using linear regression models.

Results
While the regression models lacked statistical significance, the data suggested some trends. Younger participants and those with higher musicality scores showed greater improvements in voice femininity, as perceived by listeners and self-reported by the participants. An explorative model of musicality and home exercise, also explained a small portion of variance in listener perception changes. Conclusions: Future research with larger samples is needed to better understand these relationships. The findings suggest clinicians should consider personalized approaches, assessing musicality, setting age-appropriate expectations, and emphasizing home practice to optimize gender-affirming voice training results.

Keywords: *transgender voice, gender-affirming voice, outcome predictors*

THE GUARDED LARYNX

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Laryngeal guarding is a term used informally by clinicians and teachers which has yet to be clearly defined until now. This paper examines its potential role as an unconscious block within the body, hindering progress in voice rehabilitation and limiting the development of efficient singing and speaking behaviours. The paper will trace a continuum of guarding from reflexive responses to learned behaviours, drawing on findings from pain science, fear-avoidance processes, dispositional and psychoanalytic formulations, and research on functional voice disorders and secondary gain.

The paper reframes persistent functional dysphonia as potentially underpinned by unconscious protective strategies, showing how anticipatory anxiety, trauma, and hypervigilance may contribute to maladaptive laryngeal co-contraction. In cases of hyperfunctional patterns or "guarding," the alteration is not only a loss of parasympathetic modulation but, in some instances, a reversal of its expected function. The paper proposes a theoretical account of why the system may shift from a restorative, protective parasympathetic state toward a heightened sympathetic or anticipatory mode. In this up-regulated state, the larynx adopts a physiologic posture of defence rather than rest: an adaptive contraction that becomes maladaptive when sustained over time.

This paper also offers practical insights into how therapists and pedagogues can identify the role of laryngeal guarding in voice disorders and support clients and students to move beyond this limitation. It outlines key features clinicians and teachers might observe in order to recognise and conceptualise laryngeal guarding within clinical or studio practice.

Keywords: *Guarding, voice therapy, muscle tension dysphonia, voice rehabilitation, psychogenic voice*

THE INFLUENCE OF EXPECTATION: EXPLORING THE EXPECTATION EFFECT FOR CLINICAL AND EDUCATIONAL OUTCOMES

Jenevora Williams
Vocal Health Education

The human brain is able to exist in a complex and confusing world by predicting what we are about to encounter. We map our prediction onto our experience, and if the match is good enough, we shape our perceived outcomes accordingly. This explains the placebo effect as well as dispositional attitudes such as optimism and pessimism.
This paper will examine current research in expectations, for both placebic and nocebic outcomes. As clinicians and educators, we can utilise this expectation effect by giving positive prompts to elicit positive progress. We may also be unwittingly providing negative indications which could inhibit the learning or healing process. In this paper you will be challenged to question everything that you say or suggest to your patients or students. We will dig deep into our habitual practice, to examine and expose our casual chit-chat, as well as review our considered healthcare or pedagogical instruction. Words are important, and we can choose what we say.

Keywords: *placebo, nocebo, language, expectation*

SOUL-TRAINING: RIFFS, RUNS AND R&B

Lisa Popeil
Voiceworks

In this extended presentation, participants will have an opportunity to explore a globally popular vocal style known as soul singing or R&B (Rhythm & Blues). After describing this genre's African-American roots, vital topics on learning to sing "soulfully" will be explored.

These topics include the particular relationship to “the beat” as well as the important expressive tools such as rapid shifts in dynamics, adduction, and resonance. Specific resonator shapes, a particular English dialect, idiosyncratic phrasing and stylisms such as slides, distortion and squalls can all help produce the most authentic sound for R&B singing

No discussion of Soul-Singing would be complete without strategies to master its unique improvisational ornamentation called “vocal runs, riffs or licks”.

Finally, we’ll be analyzing great singers of the R&B genre such as Whitney Houston, Mariah Carey, James Brown, Luther Vandross, and Aretha Franklin to see what we can learn about their individual approaches to this thrilling vocal style. And we’ll touch on how even Western Classical singers may benefit by incorporating subtle elements of the R&B tradition to add soulfulness to their modern artistic approach.

Keywords: *Singing, R&B, Soul, American singing style, commercial voice*

DETERMINING ABSOLUTE VOCAL RANGE AND PRODUCING DISCRETE VOCAL REGISTERS ACROSS 3 1/3 OCTAVES

Lisa Popeil
Voiceworks

Unlike instrumentalists, many singers are not aware of their "absolute range", meaning they are not certain which pitches their vocal folds can produce. Knowing one's true phonatable range, rather just performable or reliable range, is not only easy-to-determine but should be an integral part of vocal training, regardless of style or timbre.

In this workshop, participants will learn techniques to easily determine absolute range.Then, participants will be introduced to a model of vocal registers based on high-speed videography which has showed two separate vocal fold vibrational patterns (M1 "chest voice" & M2 "head voice') across a typical 3 1/3 octave (40-41 semitone) range.

From the Western Classical voice tradition, vocal registers historically have been linked to vocal range; "chest voice" for low notes and "head voice" for high notes. Using innovative techniques, singers can experience a complete separation of range and registers and be able to "belt to the top" of their absolute range in "chest voice" safely and with control.

Keywords: *Vocal range, vocal registers, singing pedagogy, belting*

VIBRATO SOLUTIONS

Lisa Popeil
Voiceworks

In traditional Western vocal pedagogy, vibrato has been intrinsically linked to healthy singing and promoted the concept that vibrato is a natural aspect of singing. In this workshop, singers will explore the volitional nature of vibrato; its use in contemporary vocal styles; and various mechanisms underlying different vibrato types which can be termed classical, pop, jazz, warble, flutter and hammer.

Using hand gestures, images, and direct physical manipulation, voice teachers will learn various innovative methods to help singers control and elicit vibrato; will learn how to teach the proper way to sing in “straight tone” and can experiment with approaches which can alter vibrato speed and control pitch fluctuations in their students and in their own voices.

Keywords: *vibrato, singing, vocal pedagogy, CCM, commercial voice*

SHORT- AND LONGER-TERM EFFECTS OF THREE INTENSIVE STRAW PHONATION INTERVENTIONS ON THE VOICE OF FEMALE SPEECH-LANGUAGE PATHOLOGY STUDENTS WITH MILD DYSPHONIA: A RANDOMIZED CONTROLLED TRIAL

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Purpose
This study examined the short- and longer-term effects (3-month follow-up) of a 1-month intensive straw phonation (SP) therapy on voice quality and voice-related quality of life of female speech-language pathology (SLP) students with mild dysphonia.

Method
Thirty-two female SLP students (mean age: 18.5 years) with mild dysphonia participated in a randomized controlled trial with three experimental groups and a control group (n=8 per group). The experimental groups received a 1-month intensive voice therapy with SP in air, SP in 2cm water or SP in 5cm water. The control group received a comparable voice therapy by using [u] phonation with similar soft onset and slightly pursed lips but without a straw. Three maintenance sessions were provided via telepractice in the following month. A multidimensional voice assessment was performed immediately before (pre) and after therapy (post 1), and at 1-month (after maintenance therapy; post 2) and 3-month follow-up (post 3)

Results
No significant time-by-group interactions were found, indicating no significant differences in evolution over time among the four groups. Primary outcomes: Within-group analyses showed a significant improvement in Dysphonia Severity Index (DSI) between post 1 and post 2 in the SP in 2cm water group. Trends of improvement were visible in DSI between pre and post1 in the SP in air group, and between pre/post 1 and post 2 in the SP in 5 cm water group. A clinically relevant improvement in Acoustic Voice Quality Index (AVQI) was found between pre and post1 in the SP in 2cm water group.

Conclusions
Positive effects were found for all SP interventions. The most promising results were found for SP in 2cm water, suggesting an optimal impedance match between the glottis and the vocal tract in this specific population.

Keywords: *dysphonia, intervention, randomised control study (RCT), therapy, voice disorder*

HOW BODY BALANCE CONTRIBUTES TO VOCAL HEALTH: A HOLISTIC APPROACH TO VOICE THERAPY

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The effect of posture and alignment on the larynx, laryngeal position, vocal tract, and thus also on the voice itself has long been observed and proven in studies in recent years. Holistic voice training/voice therapy does not stop at the pelvic floor. Through the posterior chain, which runs from the sole of the foot to the skull, we can trigger an uprighting impulse by specifically activating the physiological stretch reflex. Thich has a positive effect on the respiratory muscles on the one hand and influences voice stability on the other. The presentation will demonstrate how the posterior chain can be activated with body balance exercises, with and without exercise equipment. It will be shown how these exercises can be combined with the singing voice. This approach can support and enrich those concepts of voice training/voice therapy, which focus primarily on the larynx and vocal tract.

Keywords: *body balance, vocal health, voice therapy, voice training, singing*

PSYCHO-VOX AS A NEW QUESTIONNAIRE IN THE DIFFERENTIAL DIAGNOSIS OF FUNCTIONAL VOICE DISORDERS

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Objective
The aim of the study was to elaborate and validate the Psycho-Vox questionnaire and develop normative data for the adult Polish population. The tool was designed to assess key psychological and social dimensions relevant to the differential diagnosis of functional voice disorders (FVD), such as perseveration, coping styles, psychological resilience, burnout, family and social relationships, and self-presentation tendencies.

Methods
The validation study involved 164 participants (46.3% of patients with functional voice disorders and 53.7% of healthy individuals; 92.7% women). The participants' ages ranged from 18 to 76 years. The Psycho-Vox questionnaire comprises 80 items rated on a five-point Likert scale.

Results
Factor analysis confirmed the nine-factor structure of the questionnaire, consistent with theoretical assumptions, with 89.2% classification agreement. Cronbach's α coefficients for individual scales ranged from 0.705 to 0.837, confirming high internal reliability. The results of the FRES and Jasnopis tests indicate that the tool is understandable to adults with secondary or higher education. Significant differences were found between the patient group and the control group in terms of family relationships ($p < 0.001$), social capital ($p = 0.003$), mental state ($p = 0.007$), self-presentation ($p = 0.004$) and tendency to exaggerate symptoms ($p = 0.005$). The logistic regression model showed that belonging to the patient group was positively associated with scores on the scales of family relationships, mental resilience, mental state, self-presentation and symptom exaggeration, and negatively associated with perseverance and task-oriented coping with stress. The classification accuracy of the model was 73.2%.

Conclusions
The Psycho-Vox questionnaire is characterised by good construct validity, high reliability and practical clinical usefulness. The tool can be used in the differential diagnosis of functional voice disorders and in monitoring the progress of treatment and rehabilitation. The developed sten norms enable the interpretation of results in relation to the adult Polish population.

Keywords: *functional voice disorders, malregulative dysphonia, Psycho-Vox questionnaire, voice*

AUTONOMIC REGULATION AS AN ADJUNCT TO VOICE THERAPY IN FUNCTIONAL DYSPHONIA: AN EXPLORATORY RANDOMIZED CONTROLLED TRIAL

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Objectives
This study aimed to (1) investigate the occurrence of symptoms and/or disorders related to autonomic nervous system (ANS) dysfunction in patients with functional dysphonia (FD), and (2) explore the effects of a novel ANS-based intervention (heart rate variability [HRV] biofeedback) on autonomic and voice-related outcomes, compared to conventional voice therapy (CVT) alone or a combined intervention (HRV biofeedback + CVT)

Methods
Sixteen patients with FD (12 ciswomen, 4 cismen; mean age 43 years) participated in this exploratory randomized controlled trial. Autonomic functioning was assessed using physiological measures (e.g., HRV) and psychological patient-reported outcome measures (e.g., Depression Anxiety and Stress Scale [DASS]). Participants received one month of intervention with daily 20-minute practice. Assessments were conducted pre- and post-intervention and analyzed descriptively.

Results
All participants reported at least one symptom or disorder associated with ANS dysfunction. Elevated anxiety symptoms were observed in 50% of participants, while depressive and stress symptoms were elevated in 25%. Baseline HRV was below the normative mean (42 ms) in 81.3% of participants; 50.0% scored more than one standard deviation below the normative mean (<27 ms), and 31.3% fell below the reported normative range (<19 ms). HRV increased in most participants across all intervention groups. Psychological outcomes and sleep quality improved most notably in the HRV biofeedback group, whereas voice-related outcomes showed the greatest gains in the combined HRV biofeedback + CVT group.

Conclusions
Findings indicate a high prevalence of autonomic dysregulation in the investigated cases with FD and suggest that targeting ANS regulation may provide added value beyond CVT alone. HRV biofeedback appears particularly beneficial for autonomic and psychological outcomes, while combining HRV Biofeedback with CVT may optimize voice-related outcomes. Further investigation in larger, controlled studies is warranted.

Note
Data recruitment and analysis are ongoing; additional results will be available at the time of the conference.

Keywords: *functional dysphonia, voice therapy, autonomic nervous system, heart rate variability*

DEFINING RELATIONAL VOCAL MASSAGE

Stephen King
Voice Care Centre

Relational Vocal Massage (RVM) is a contemporary manual therapy approach that positions the therapeutic relationship as central to clinical efficacy, valuing interaction as much as intervention. Situated within the broader field of Vocal Manual Therapy (VMT) for voice, oromandibular, and swallowing disorders, RVM explicitly employs a consent-based, relational model in which treatment is understood not merely as a set of techniques, but as an embodied interpersonal process. Drawing on body psychotherapy traditions, particularly Wilhelm Reich's concept of muscular armour, RVM conceptualises chronic tension in the jaw, neck, and laryngeal region as both a functional adaptation and a protective response to prior relational and emotional experiences. Such armouring, while initially adaptive, may contribute over time to functional voice disorders, including muscle tension dysphonia. This paper situates RVM within a broader paradigm shift in healthcare away from clinician-centred, patho-anatomical models towards biopsychosocial, person-centred frameworks that emphasise safety, collaboration, and patient agency. While the effectiveness of VMT and related approaches is well supported in the literature, existing protocols remain theoretically fragmented and variably applied. Emerging evidence suggests that the mechanisms underpinning manual therapy extend beyond local tissue effects to include centrally mediated neurophysiological, autonomic, and psychosocial processes. In response to these gaps, the development of an integrative protocol, such as the proposed KING protocol, is outlined. Grounded in person-centred principles and contemporary manual therapy research, this framework seeks to unify relational ethics, consent, and embodied awareness with established clinical practices. RVM is therefore positioned as a holistic, ethically attuned intervention that addresses both the physical and relational dimensions of voice disorders, offering a coherent model for future clinical application and research.

Keywords: *vocal massage, manual therapy, vocal rehabilitation, muscle tension dysphonia*

BEYOND ACOUSTIC CHANGE: GROUP BODY PSYCHOTHERAPY AND THE LIVED EXPERIENCE OF FUNCTIONAL VOICE DISORDERS

Stephen King
Voice Care Centre

Group-based interventions for functional voice disorders frequently demonstrate improvements in patient-reported outcomes despite modest or inconsistent changes in clinician-rated voice measures, suggesting that therapeutic change may occur primarily at an experiential rather than biomechanical level. Drawing on phenomenological concepts of the life-world, this study examines whether a short-term Group Body Psychotherapy (GBP) intervention facilitates meaningful change in how participants experience and relate to their voices. A mixed-methods, pre–post observational design was used to evaluate a six-week online GBP programme for adults with muscle tension dysphonia or functional voice disorders (n = 10). The intervention excluded conventional voice therapy techniques, instead employing relational, somatic, and creative psychotherapeutic processes within a structured group format. Quantitative outcomes included the Voice Symptom Scale (VoiSS) and blinded auditory–perceptual ratings (GRBAS) of connected speech, while qualitative data were gathered through participant reflections addressing voice experience, affective stance, and expectations. Analyses prioritised effect sizes given the small sample. Changes in clinician-rated voice quality were variable, whereas patient-reported symptoms showed improvement. Qualitative analysis identified themes of reduced isolation, reconfigured vocal identity, increased trust in the voice, and enhanced communicative agency. Integrated findings suggest that GBP primarily operates by transforming the lived experience of voice, supporting its clinical value as a person-centred, cost-effective intervention for functional voice disorders and underscoring the importance of phenomenological outcomes alongside traditional voice measures.

Keywords: *body psychotherapy, psychogenic, functional voice disorder, muscle tension dysphonia*

INJECTABLE NANOGEL-STEM CELL SPHEROİDS FOR SWALLOWİNG MUSCLE REPAİR

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Background. Swallowing muscle injury caused by radiation, aging, or disease leads to severe dysphagia. While stem cell therapies offer regenerative potential, clinical efficacy is currently hindered by poor cell survival, limited engraftment, and the mechanically demanding environment of injured muscle. Research Aims. This study aimed to engineer an injectable hybrid spheroid system by integrating biodegradable nanogel spacers within adipose-derived stem cell (ADSC) spheroids. We hypothesized that these engineered constructs could prevent core hypoxia, enhance secretory function, and improve *in situ* cell engraftment and functional swallowing muscle recovery.

Methodology. Acryloyl-modified cholesterol-bearing pullulan nanogels were crosslinked via Michael addition and processed them into nanogel-microfiber fragments (NG-MF) using freeze-thaw cycles and sonication. These fibronectin-coated spacers were optimized within ADSC spheroids and refined to ~100 µm size for injection. We validated oxygen diffusion via computational fluid dynamics and assessed viscoelasticity using rheology. Treatment efficacy was evaluated in a rat mylohyoid muscle cryoinjury model (n=66) using histology, electromyography, and *in vivo* biodistribution imaging.

Results. Rheological analysis revealed that NG-MF spacers significantly reduced spheroid stiffness by lowering the storage modulus from 10.2 Pa (controls) to 3.4 Pa (hybrid spheroids), thus enhancing deformability and injectability. This structural modification also mitigated hypoxia and yielded a 5.6-fold increase in cell viability. Hybrid spheroids exhibited a potent secretory profile, with elevated IL-6 (9.0-fold), IL-10 (2.9-fold), and HGF (8.6-fold) compared to monolayer cultures. Treated animals showed reduced fibrosis (21.8% collagen area, the lowest among all groups) and increased myofiber regeneration (1420 μm^2 cross-sectional area) at Week 3. Hybrid spheroids achieved 20.8% higher cell engraftment and a 9.0% improvement in swallowing amplitude.

Conclusion. Nanogel-integrated spheroids offer a clinically translatable approach for treating dysphagia. The addition of NG-MF spacers reduced hypoxia and enhanced paracrine signaling in spheroid-based therapy. This injectable platform may extend to other muscle-wasting conditions including sarcopenia and muscular dystrophy.

Keywords: *Tissue engineering, spheriods, injectables, swallowing muscles, dysphagia*

THE CONTRIBUTION OF VOICE THERAPY TO VOICE QUALITY AND QUALITY OF LIFE IN PATIENTS WITH EARLY GLOTTIC CANCER TREATED WITH TRANSORAL CO2 LASER MICROSURGERY

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SUMMARY

Objective The purpose of the present study was to investigate the contribution of voice therapy in improving voice quality and voice-related quality of life (QOL) in patients treated for early glottic cancer with Transoral CO2 Laser Microsurgery (TLM).

Study Design. This is a randomized-controlled study of 40 patients (20-intervention group and 20-control group). All underwent TLM surgery, and only the intervention group participated in voice therapy. The same voice assessment and recording protocol was applied in both groups and included subjective and objective voice measurements. Patients in the intervention group were assessed four times (presurgery, after voice therapy, 1 month after voice therapy, and 6 months postsurgery). Patients in the control group were assessed twice (presurgery and 6 months postsurgery).

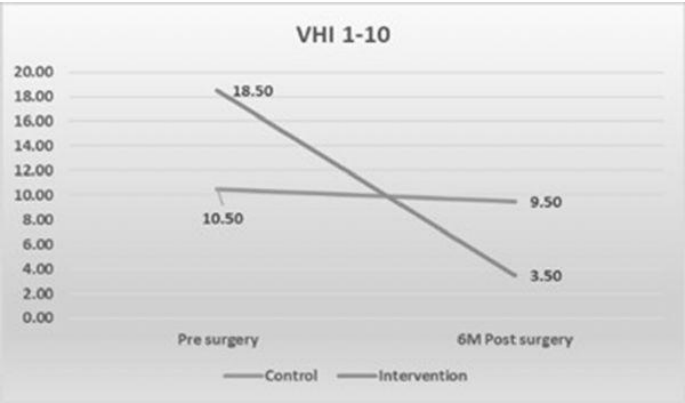
Methods Each patient of the intervention group attended eight voice therapy sessions. Voice assessment included the self-reported Voice Handicap Index (VHI-30), perceptual voice analysis using the GRBAS scale, and acoustic voice analysis [Mean F0, Jitter (local), Shimmer (local), and Mean Harmonic-to-Noise Ratio (HNR)] was computed using Praat software. For the inter-rater reliability (between raters—first author), two expert raters assessed the voice samples with the GRBAS scale for both groups.

Results Statistical analysis showed significant voice quality improvement in both subjective (perceptual) and objective (acoustic) assessments for the intervention group. Additionally, a significant improvement was observed in the QOL of intervention group patients, related to the enhancement of their voice quality after voice therapy. Inter-rater results showed similarities which were more pronounced in the "Grade" parameter for Connected Speech and less pronounced in the "Grade" parameter for Maximum Phonation Time /i/.

Conclusions The present study proved the efficacy of voice therapy in voice rehabilitation for patients treated for early glottic carcinoma with TLM surgery. Improvements in voice quality and voice-related QOL were confirmed by VHI, GRBAS, and Praat measurements.

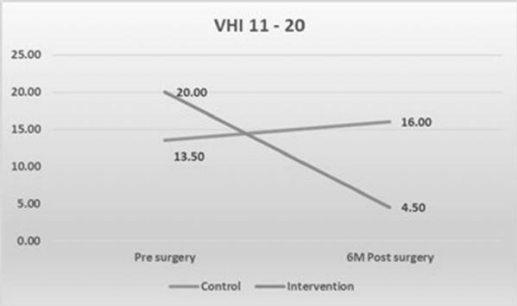
Keywords: *Voice therapy, Voice quality, Quality of life, Transoral laser microsurgery, Voice Handicap Index*

FIGURE 1



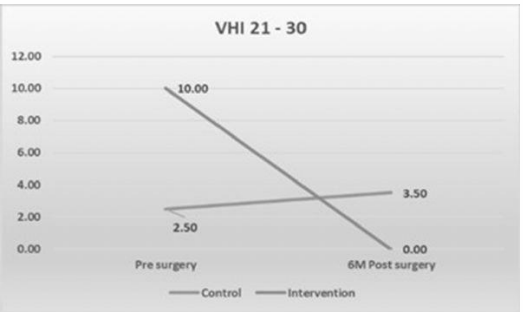
VHI-Functional (1-10) in the median value between pre-surgery and six months post-surgery, for the intervention and control groups, respectively

FIGURE 2



VHI-Physical (11-20) change in the median value between pre-surgery and six months post-surgery, for the intervention and control groups, respectively.

FIGURE 3



VHI-Emotional (21-30) change in the median value between pre-surgery and six months post-surgery, for the intervention and control groups, respectively.

TABLE 1

VOICE SAMPLE	GRBAS	GROUP	Mean (St. Dev.)	Median (IQR)	Mann Whitney U (p value)
SUSTAINED VOWEL I	GRADE	Control Intervention	-0.50 (0.51) -1.10 (0.64)	-0.50 (1.00) -1.00 (0.75)	105.00 (p=0.004)
	ROUGHNESS	Control Intervention	-0.05 (0.60) -0.65 (0.99)	0.00 (0.00) -1.00 (1.00)	126.50 (p=0.031)
	BREATHINESS	Control Intervention	-0.15 (0.37) -0.50 (0.69)	0.00 (0.00) -0.50 (1.00)	137.00 (p=0.041)
	ASTHENIA	Control Intervention	-0.20 (0.41) -0.15 (0.37)	0.00 (0.00) 0.00 (0.00)	190.00 (p=0.681)
	STRAIN	Control Intervention	-0.40 (0.60) -1.35 (0.93)	0.00 (1.00) -1.00 (1.00)	78.50 (p<0.05)
SUSTAINED VOWEL A	GRADE	Control Intervention	-0.40 (0.50) -1.10 (0.64)	0.00 (1.00) -1.00 (0.75)	90.00 (p=0.001)
	ROUGHNESS	Control Intervention	-0.10 (0.55) -0.70 (0.80)	0.00 (0.00) -1.00 (1.00)	114.00 (p=0.010)
	BREATHINESS	Control Intervention	-0.30 (0.57) -0.75 (0.78)	0.00 (0.75) -1.00 (1.00)	126.50 (p=0.027)
	ASTHENIA	Control Intervention	-0.20 (0.52) -1.15 (0.37)	0.00 (0.00) 0.00 (0.00)	198.50 (p=0.948)
	STRAIN	Control Intervention	-0.30 (0.66) -1.35 (0.88)	0.00 (1.00) -1.00 (1.00)	68.00 (p<0.05)
MPT A	GRADE	Control Intervention	-0.65 (0.59) -1.25 (0.85)	-1.00 (1.00) -1.00 (1.00)	119.50 (p=0.019)
	ROUGHNESS	Control Intervention	-0.05 (0.69) -0.85 (0.99)	0.00 (0.75) -1.00 (1.75)	109.00 (p=0.009)
	BREATHINESS	Control Intervention	-0.30 (0.66) -0.80 (0.95)	0.00 (0.00) -0.50 (1.75)	139.00 (p=0.051)
	ASTHENIA	Control Intervention	-0.40 (0.68) -0.45 (0.94)	0.00 (1.00) 0.00 (0.75)	193.00 (p=0.809)
	STRAIN	Control Intervention	-0.45 (0.51) -1.15 (1.31)	0.00 (1.00) -1.50 (1.00)	96.00 (p=0.003)
MPT I	GRADE	Control Intervention	-0.65 (0.49) -1.20 (0.95)	-1.00 (1.00) -1.00 (2.00)	131.50 (p=0.047)
	ROUGHNESS	Control Intervention	0.00 (0.46) -0.70 (1.08)	0.00 (1.00) -0.50 (1.75)	123.00 (p=0.018)
	BREATHINESS	Control Intervention	-0.40 (0.60) -1.05 (1.05)	0.00 (1.00) -1.00 (2.00)	124.50 (p=0.028)
	ASTHENIA	Control Intervention	-0.35 (0.59) -0.50 (1.00)	0.00 (0.00) 0.00 (0.75)	197.50 (p=0.931)
	STRAIN	Control Intervention	-0.35 (0.75) -0.90 (1.02)	-0.50 (1.00) -1.00 (2.00)	127.50 (p=0.036)
CONNECTED SPEECH	GRADE	Control Intervention	-0.25 (0.44) -1.00 (0.86)	0.00 (0.75) -1.00 (0.00)	87.50 (p=0.001)
	ROUGHNESS	Control Intervention	-0.10 (0.45) -0.80 (1.06)	0.00 (0.00) -1.00 (1.00)	99.50 (p=0.002)
	BREATHINESS	Control Intervention	-0.25 (0.55) -0.75 (0.97)	0.00 (0.00) 0.00 (1.75)	144.00 (p=0.067)
	ASTHENIA	Control Intervention	-0.25 (0.72) -0.20 (0.52)	0.00 (0.00) 0.00 (0.00)	197.50 (p=0.923)
	STRAIN	Control Intervention	0.00 (0.46) -1.15 (1.23)	0.00 (0.00) -1.50 (1.75)	74.00 (p<0.05)

Table 1: Post (6 months) - Pre-Surgery differences between Control and Intervention groups for Sustained Vowels (I) and (A), MPT (I) and (A), and Connected Speech (Mann-Whitney U test).

TABLE 2

Voice Sample	Voice Parameters	Time Point	Mean (St.Dev.)	Median (IQR)	Test value (*) (p value)
SUSTAINED VOWEL I	Mean Fo (Hz)	Pre Surgery 6 Months Post Surgery	245.98 (84.42) 204.96 (65.49)	226.82 (134.02) 188.49 (113.92)	z=-3.061 (p=0.002)
	Jitter (local)	Pre Surgery 6 Months Post Surgery	3.42 (2.94) 2.38 (1.79)	2.58 (2.75) 1.89 (1.41)	t=2.733 (p=0.013)
	Shimmer (local)	Pre Surgery 6 Months Post Surgery	12.99 (6.05) 10.45 (4.38)	11.92 (7.27) 9.62 (6.22)	z= -2.763 (p=0.006)
	Mean Harmonic-to-Noise Ratio	Pre Surgery 6 Months Post Surgery	8.48 (5.83) 9.86 (4.50)	8.83 (9.55) 11.07 (5.79)	t=-1.337 (p=0.197)
SUSTAINED VOWEL A	Mean Fo (Hz)	Pre Surgery 6 Months Post Surgery	234.97 (92.94) 204.29 (69.69)	208.36 (116.83) 187.62 (52.11)	Z=-2.052 (p=0.040)
	Jitter (local)	Pre Surgery 6 Months Post Surgery	2.19 (1.59) 1.83 (1.37)	1.57 (2.22) 1.48 (1.63)	t=1.184 (p=0.251)
	Shimmer (local)	Pre Surgery 6 Months Post Surgery	14.56 (5.49) 14.35 (3.61)	14.04 (6.16) 13.55 (3.77)	t=0.205 (p=0.839)
	Mean Harmonic-to-Noise Ratio	Pre Surgery 6 Months Post Surgery	6.77 (4.80) 7.78 (4.12)	7.12 (7.79) 9.04 (7.11)	t=--1.231 (p=0.233)
MPT I	Mean Fo (Hz)	Pre Surgery 6 Months Post Surgery	240.32 (74.71) 201.99 (68.26)	227.93 (132.73) 182.64 (129.97)	t=2.523 (p=0.021)
	Jitter (local)	Pre Surgery 6 Months Post Surgery	2.79 (2.88) 1.46 (1.97)	1.51 (3.96) 0.67 (1.69)	z=-3.621 (p<0.01)
	Shimmer (local)	Pre Surgery 6 Months Post Surgery	11.25 (6.35) 8.06 (5.78)	9.46 (9.46) 7.03 (6.12)	t= 2.898 (p=0.009)
	Mean Harmonic-to-Noise Ratio	Pre Surgery 6 Months Post Surgery	9.98 (8.51) 13.16 (7.36)	8.41 (12.55) 12.75 (10.69)	t=-1.894 (p=0.074)
MPT A	Mean Fo (Hz)	Pre Surgery 6 Months Post Surgery	231.41 (97.78) 198.21 (92.97)	191.72 (96.68) 167.29 (121.49)	t=2.713 (p=0.014)
	Jitter (local)	Pre Surgery 6 Months Post Surgery	2.01 (1.72) 1.20 (1.62)	1.32 (1.82) 0.55 (1.05)	z=-3.823 (p<0.01)
	Shimmer (local)	Pre Surgery 6 Months Post Surgery	13.95 (6.17) 9.76 (5.96)	14.33 (11.47) 8.08 (9.82)	t=4.070 (p=0.001)
	Mean Harmonic-to-Noise Ratio	Pre Surgery 6 Months Post Surgery	8.03 (6.20) 12.16 (7.09)	7.61 (10.70) 13.02 (13.17)	t=-3.260 (p=0.004)
CONNECTED SPEECH	Mean Fo (Hz)	Pre Surgery 6 Months Post Surgery	224.19 (81.12) 185.48 (54.87)	197.62 (67.81) 184.59 (74.64)	Z=-2.800 (p=0.005)
	Jitter (local)	Pre Surgery 6 Months Post Surgery	4.18 (2.22) 3.36 (1.03)	3.22 (2.94) 3.20 (1.21)	Z=-2.240 (p=0.025)
	Shimmer (local)	Pre Surgery 6 Months Post Surgery	17.53 (2.98) 16.79 (1.92)	17.11 (5.09) 17.00 (7.28)	t=1.226 (p=0.235)
	Mean Harmonic-to-Noise Ratio	Pre Surgery 6 Months Post Surgery	6.52 (3.05) 6.23 (2.18)	6.97 (5.18) 6.42 (3.28)	t=0.566 (p=0.578)

Table 2: Dependent Samples test for voice parameters between Post (6 Months) and Pre-Surgery, for Intervention Group (Sustained Vowels [I] and [A], MPT [I] and [A], Connected Speech).

TABLE 3

GRBAS	GRBAS	GRBAS	GRBAS
Pair of First Author with Raters	Pre - Surgery	6 Months Post - Surgery	Grade - Voice Sample
First Author vs Rater 1	r=0.509 (p=0.001)	r=0.796 (p<0.01)	Grade (Sustained I)
First Author vs Rater 2	r=0.686 (p=0.001)	r=0.578 (p=0.008)	Grade (Sustained I)
First Author vs Rater 1	r=0.515 (p=0.001)	r=0.557 (p<0.01)	Grade (MPT I)
First Author vs Rater 2	r=0.674 (p=0.001)	r=0.782 (p<0.01)	Grade (MPT I)
First Author vs Rater 1	r=0.620 (p<0.01)	r=0.761 (p<0.01)	Grade (Sustained A)
First Author vs Rater 2	r=0.710 (p<0.01)	r=0.644 (p=0.002)	Grade (Sustained A)
First Author vs Rater 1	r=0.541 (p<0.01)	r=0.766 (p<0.01)	Grade (MPT A)
First Author vs Rater 2	r=0.631 (p=0.003)	r=0.874 (p<0.01)	Grade (MPT A)
First Author vs Rater 1	r=0.725 (p<0.01)	r=0.644 (p<0.01)	Grade (Connected Speech)
First Author vs Rater 2	r=0.837 (p<0.01)	r=0.737 (p<0.01)	Grade (Connected Speech)

Table 3: Spearman's Correlation coefficient between 2 Raters and First Author for Pre & Post-Surgery (6 Months) for GRBAS Parameters.

VOICE WORKLOAD MANAGEMENT IN VOCAL ATHLETES: APPLICATION OF EXERCISE PHYSIOLOGY PRINCIPLES IN CLINICAL AND STUDIO SETTINGS

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Exercise physiology studies have reported that athletes can achieve performance improvements when their training intensity is progressively increased in a controlled manner rather than abruptly. While experts have studied athletic performance with special consideration for injury prevention, the intricate equilibrium between overtraining and insufficient training continues to be a subject of ongoing research, and a tailored approach is advocated as the most effective

The overload principle refers to challenging a muscle beyond its level of comfortable capability in order to facilitate specific adaptation of the targeted muscle(s) to an imposed demand. When applied judiciously and within an appropriate workload framework, this training strategy can offer effective vocal strengthening and conditioning while mitigating injury risk.

Similar to their sports counterparts, vocal athletes are also at elevated risk of injury. Vocal fatigue and strain are common complaints in both clinical and studio settings, yet the demands placed on many professional and pre-professional singers remain high. Voice workload is often cumulative, variable, and influenced by multiple factors, including rehearsal schedules, performance demands, technique, and recovery. Quite often, voice trainers, teachers, and speech-language pathologists receive limited formal training in minimizing risk for voice injury by helping navigate voice workload and voice fatigue.

This presentation will introduce the scientific underpinnings of the overload principle as reflected in current kinesiology and voice literature. Practical applications in both habilitation and rehabilitation contexts will be highlighted from the perspective of an experienced clinical singing voice rehabilitation specialist. Finally, this talk will underscore the unique considerations and necessary adaptations for implementing workload-based overload principles within voice studios and clinical settings.

Keywords: *exercise physiology, voice rehabilitation, habilitation, voice workload, risk mitigation*

CEPSTRALVOX: AN OPEN SOURCE USER-FRIENDLY TOOL FOR CEPSTRAL VOICE ANALYSIS

Tiago Cruz
Fonotech Academy

Objective
Cepstral measures, including cepstral peak prominence (CPP) and its smoothed variant (CPPS), are widely accepted as reliable acoustic indicators of dysphonia and overall voice quality. Despite their clinical and research relevance, accessible open-source tools for cepstral analysis remain limited, and many available solutions still require technical expertise or multi-step workflows. This article presents CepstralVox, a modern, free, open-source application for extracting and visualizing CPP and CPPS from sustained vowels and connected speech, using Praat-compatible algorithms and offering comprehensive preprocessing options

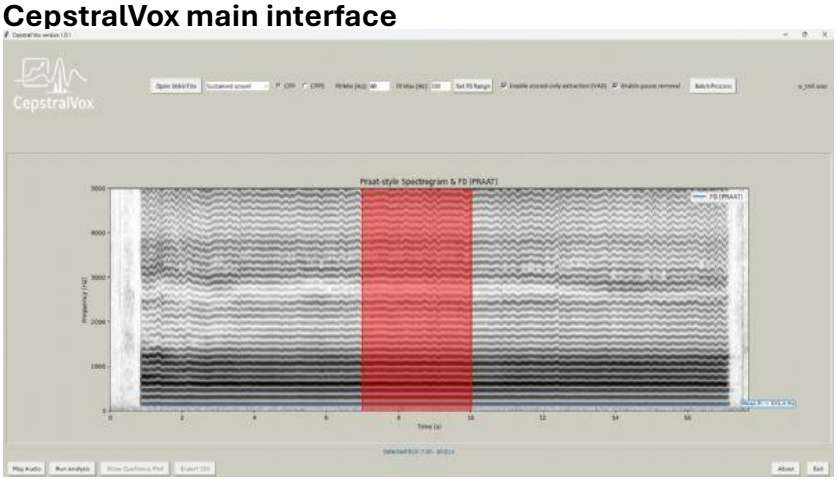
Methods
The CepstralVox workflow and core analysis procedures are described, including technical implementation details and parameter choices. Key functionalities include user-selectable fundamental frequency (fo) ranges, analysis type selection, preprocessing options for connected speech (eg, voice activity detection and pause removal), the quefrency-based analysis pipeline, interactive region selection, visualization tools, and automated batch processing.

Results
CepstralVox enables accurate and reproducible extraction of CPP and CPPS by implementing established Praat algorithms within an intuitive graphical interface. Interactive region selection, automated batch analysis, and immediate visualization of quefrency spectra and spectrograms are supported. The fo range used for cepstral analysis is configurable (default: 60–330 Hz), and outputs—including quefrency plots and CSV exports—are readily accessible to clinicians and researchers without programming requirements. Validation using the Perceptual Voice Qualities Database demonstrated negligible bias and near-perfect concordance with Praat for both sustained vowels and connected speech.

Conclusion
CepstralVox improves access to cepstral analysis for the broader voice community by delivering state-of-the-art acoustic metrics through a simple, flexible graphical user interface suitable for clinical and research contexts. The tool is freely available, cross-platform, and designed to support transparency and reproducibility in analysis.

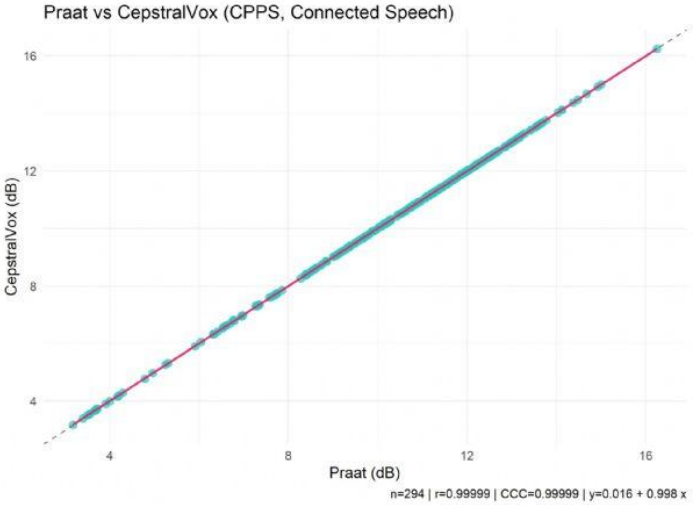
Keywords: Cepstral peak prominence, Open-source software, Clinical voice assessment

CepstralVox main interface



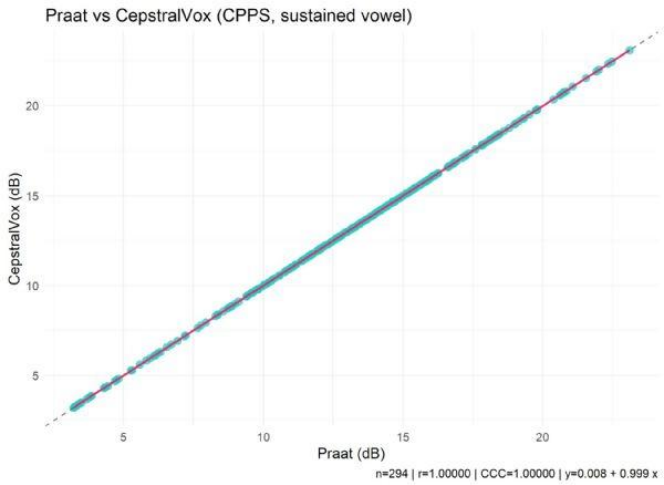
CepstralVox main interface, showing the spectrogram display, control panel with analysis options, and ROI selection.

Praat vs. CepstralVox (CPPS, connected speech)



Scatterplot of paired measurements with identity line (dashed) and regression line (solid). Each point represents one recording (n = 294). Annotations report Pearson r, CCC, and regression equation.

Praat vs. CepstralVox (CPPS, sustained vowels)



Scatterplot of paired measurements with identity line (dashed) and regression line (solid). Each point represents one recording (n = 294). Annotations report Pearson r, CCC, and regression equation.

FROM INTERDEPENDENCE TO INDEPENDENCE: JAW AND TONGUE COORDINATION STRATEGIES FOR REHABILITATION AND HABILITATION ACROSS VOCAL STYLES

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Efficient voice production is a foundational goal across both voice training and clinical practice, particularly as singers navigate increasing technical, stylistic, and workload demands. This workshop will focus on practical strategies to facilitate efficient voice production across a range of singing styles. Emphasis will be placed on approaches that support adaptability, coordination, and vocal economy rather than effort-driven strategies

A central focus of the workshop will be addressing factors that commonly interfere with efficiency, particularly patterns of tongue and jaw tension. These structures often function as an integrated unit and can significantly influence coordination, endurance, and stylistic access. Emphasizing the role of the nervous system and motor learning in facilitating more sustainable changes in vocal coordination, this workshop interweaves self-guided manual intervention techniques, along with variations of less commonly used semi-occluded vocal tract exercises that also foster tongue and jaw independence. These tools will be used to explore how subtle shifts in coordination can improve vocal efficiency, particularly during higher-demand tasks frequently encountered in singing. Participants will examine how these strategies can support a more efficient mix and belt coordination while reducing unnecessary muscular effort and compensatory behaviors

Practical demonstrations and guided exploration will allow participants to directly experience the effects of these strategies on voice production. A conceptual framework will be provided for speech-language pathologists and voice teachers to apply these approaches in both habilitation and rehabilitation contexts, supporting efficient, sustainable, and stylistically appropriate voice production across diverse singing demands.

Keywords: *jaw, tongue, manual release, singing*

TRACHEOSCOPIC EVALUATION OF ASPIRATION DURING SWALLOWING

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Shri VAS Clinic

Fibreoptic Endoscopic Evaluation of Swallowing (FEES) is a commonly used bedside tool for assessing swallowing function. A major limitation of FEES is the white-out phase during the pharyngeal stage of swallowing, during which visualization of bolus passage and potential aspiration is obscured. To overcome this limitation, we introduced a novel diagnostic technique for patients with tracheostomy: Tracheoscopic Evaluation of Aspiration during Swallowing (TEAS). This technique involves positioning a flexible endoscope at the distal tip of the tracheostomy tube while administering feeds of varying consistencies, allowing direct visualization of any aspirated bolus material entering the trachea. In addition to detecting aspiration, TEAS allows assessment of tracheal and bronchial sensation, cough effectiveness, and the ability to clear aspirated material from the airway. A standardized TEAS scoring system is employed to guide decisions regarding initiation of feeding and to aid in selecting the appropriate type of tracheostomy tube.

TEAS is a simple bedside procedure that can be performed in any intensive care setting and provides real-time assessment of aspiration risk, thereby supporting informed clinical decision-making regarding the initiation of oral or enteral feeds. Notably, even patients demonstrating severe penetration–aspiration (PAS) scores of 7 or 8 on FEES may be safely initiated on feeds if TEAS demonstrates complete airway clearance.

In our pilot study of 30 patients, aspiration of feed into the airway was observed in 9 patients. In the remaining 21 patients, no feed entry into the trachea was noted, allowing safe initiation of feeding with a reduced risk of aspiration pneumonia.

Keywords: *FEES, Swallowing endoscopy, aspiration, tracheoscopy, TEAS*

SUBGLOTTIC PRESSURE AND IMMERSION DEPTH: KEY DETERMINANTS OF VOICE OUTCOMES IN WATER RESISTANCE TUBE EXERCISES

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[3]Universidad de Chile

Purpose: The present study aimed at evaluating the effects of (1) immersion depth and (2) subglottic pressure (Psub) on (a) the oscillatory features of oral pressure (Poral) (frequency, amplitude, and regularity), (b) the degree of glottal adduction, and (c) the subjective perception of phonatory ease when performing water resistance tube (WRT) exercise. Methods: Forty participants were recruited, 20 having normal voice and 20 diagnosed with functional dysphonia. Assessment protocol included: (1) self-assessment of ease of phonation and (2) objective assessment of air pressure-related variables and electroglottographic (EGG) contact quotient (CQ). Participants were instructed to select and produce a sustained-vowel-like phonation into a tube immersed in a recipient filled with water at five different depths (experiment 1): 2 cm, 4 cm, 6 cm, 8 cm, and 10 cm. Then, they were required to phonate into the tube with three different Psub targets (10 cm H2O, 15 cm H2O, and 20 cm H2O) while keepoing a constant immersion level (experiment 2). Participants were asked to self-assess the degree of ease of phonation. Objective measurements of air pressure-related variables and CQ were acquired during WRT exercises. Results: Both different depths and different Psub levels showed significant effects on CQ and massage-like sensation in both groups. Correlations are also reported. Poral oscillation variables (amplitude, frequency, jitter, and shimmer of oscillation) were significantly influenced by changes in depth of immersion and Psub values. Conclusion: Findings confirm that modifying immersion depth and Psub during WRT exercises induces measurable changes in vocal physiology. Across both experiments, higher loads (greater immersion or increased subglottic pressure) led to a progressive rise in CQ, accompanied by increased Poral instability and a significant reduction in perceived ease of phonation. Furthermore, both Psub and immersion depth were shown to influence bubble characteristics, Poral oscillations, and potentially the massage-like sensation associated with WRT.

Keywords: *Water resistance therapy, Tube phonation, Voice rehabilitation, Voice training*

VOCAL TRAINING, HYDRATION AND LUBRICATION: A COMBINED AND EFFECTIVE ACTION FOR THE VOICE

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Over the years, numerous studies have demonstrated that one of the key elements for the proper functioning of the vocal cords and their associated structures is water.
Maintaining a well-hydrated system means providing water so that the tissue becomes softer.

As many know, Dr. Alfonso Borragàn Torre, a specialist in phoniatrics and a global guru of vocal research, had the brilliant idea of sending water particles to the laryngeal area through the mucous membranes of the upper respiratory system in a simple, fast, and direct way: by inhaling air through a cotton gauze soaked in water. This practice, performed for 10 minutes, wetting the gauze occasionally, allows the user to breathe highly humid air.
Shortly thereafter, he realized that adding a surfactant (he experimented with several, including aloe, pectin, vitamin E, and hyaluronic acid) would enhance the hydrating effect, as this substance can "lock" water into the mucous membranes, creating a much longer-lasting protective film, resulting in far better vocal performance.
In this way, the combination of hydration and lubrication proves highly beneficial for the vocal cords. It’s a bit like ensuring your car has water and oil!
Experiencing the effects of the combination of hydration, with the inhalation of moist air through the nose, and lubrication, with the simultaneous ingestion of hyaluronic acid, while performing exercises that take into account the specific action of certain laryngeal muscles, worthy of particular interest in the voice of actors, singers, and performers.
Hyaluronic acid tablets have proven to be particularly convenient because they're easy to carry and keep with you at all times

We will present a 10-minute training session that can optimize vocal warm-up and performance preparation time. It's easy to do and easy to remember.

Keywords: *vocal training, hydration, lubrication, voice health, vocal performance*

THE DERKAY SCALE AS A PREDICTOR OF VOICE DYSFUNCTION IN RECURRENT RESPIRATORY PAPILLOMATOSIS: CORRELATIONS WITH ACOUSTIC AND PATIENT-REPORTED OUTCOMES

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Objectives
The aim of the study was to gauge the clinical usefulness of the Derkay scale in assessing the severity of voice dysfunction in patients with recurrent respiratory papillomatosis (RRP).

Material and Methods
The study included 29 patients (8 women and 21 men) with a mean age of 40.2 years. To subjectively assess each patient's voice, the Polish version of the Voice Handicap Index questionnaire was used. Acoustic parameters were calculated using the Multidimensional Voice Program which returned mean fundamental frequency (F0), frequency changes (% Jitter), amplitude changes (% Shimmer), noise to harmonic ratios (NHR), and soft phonation Index (SPI). The stage of RRP was assessed using the Derkay scale, together with the anatomical location of the lesion (from laryngeal endoscopy) and the impact RRP was having on the general condition of the patient

Results
In women, Derkay clinical and total scores showed significant, positive, and strong correlations with almost all VHI-30 subscales (rho = 0.73–0.76). In men, the correlations were weaker (rho = 0.38–0.55), but were strong between Derkay total score and F0 and total score and Jitter (rho = 0.63–0.65). Patients with human papilloma virus HPV-6 had significantly higher soft phonation index values (M = 11.97) compared to patients with HPV-11 (M = 6.91, U = 34.0; p = 0.019).

Conclusions
The Derkay classification system correlates well with objective acoustic frequency measures and patient-reported voice outcomes. The system may be helpful in identifying patients at increased risk of voice dysfunction. It could be used to guide decisions about voice assessment and rehabilitation.

Keywords: *recurrent respiratory papillomatosis, dysphonia, voice parameters, voice handicap index, quality of life*

WARMING UP WISDOM: VOCAL INTERVENTIONS FOR THE AGING FEMALE VOICE

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university Ghent, department of rehabilitation, center for speech and language sciences

Objective
Presbyphonia, or age-related voice changes, is highly prevalent in older women and may negatively affect vocal function and quality of life. This study examined the immediate effects of a structured vocal warm-up program on subjective and objective voice outcomes in women aged 60 years and older, compared with a control condition.

Methods
Thirty healthy older women (mean age = 67.4 years) were randomly assigned to an experimental group (n = 15) or a control group (n = 15). The experimental group completed a 30-minute vocal warm-up protocol, while the control group performed a reading-aloud task. Voice recordings were obtained pre- and post-intervention. Outcome measures included perceptual evaluation using the GRBASI scale, acoustic measures (jitter, shimmer, NHR), aerodynamic assessment (maximum phonation time), vocal performance and multiparametric indices (Dysphonia Severity Index [DSI] and Acoustic Voice Quality Index [AVQI]). Self-evaluation questionnaires (Voice Handicap Index [VHI] and Vocal Tract Discomfort scale [VTD]) were administered once at baseline.

Results
Baseline self-evaluation scores indicated non-pathological voice perceptions with no significant differences between groups. The experimental group showed significant post-intervention improvements in jitter, frequency range, DSI, and AVQI. No comparable positive improvements were observed in the control group. Between-group analyses revealed significantly greater progression in the experimental group for jitter, highest frequency, DSI, and AVQI. No significant changes were found for maximum phonation time, NHR or intensity measures. Perceptual ratings showed limited change and no significant between-group differences.

Conclusion
A single session of a structured vocal warm-up program produced immediate improvements in objective vocal quality and capacity in women aged 60 years and older. These findings support the potential value of vocal warm-up exercises as a preventive strategy for maintaining vocal function in older women. Future studies should investigate shorter, multi-session protocols and incorporate sensitive short-term self-perception measures.

Keywords: *vocal quality, (anti) aging voice, vocal warm up, voice lift*

Vocal warm- up content based on the protocol of Van Lierde et al, 2011

Technique	Intended effect
An open-mouth approach combined with the sliding yawn-sigh technique (/a/, /e/, /u/, /ie/, and /ij/).	The technique is hypothesized to promote alternating activity between the cricothyroid (CT) and thyroarytenoid (TA) muscles. In addition, it is assumed to facilitate stretching and shortening of the vocal folds, widening of the supraglottic and pharyngeal spaces, and elevation of the velum, which may have a positive effect on oral resonance. This approach allows the vocal mechanism to be engaged without inducing excessive vocal tension.
Glottal fry (/a/, /e/, /u/, /ie/, /ij/)	This technique is proposed to engage the thyroarytenoid (TA) muscle, which contributes to shortening of the vocal folds, as well as the interarytenoid (IA) muscle, responsible for closing the posterior third of the glottis. Successful production of a pulsatile voice relies on careful regulation of airflow, allowing phonation to occur without unnecessary vocal effort.
Hyper high blowing	This technique is assumed to involve a relaxed vocal onset combined with activation of the cricothyroid (CT) muscle, leading to elongation of the vocal folds. The lips are rounded (semi-occlusion) while participants are instructed to produce an audible exhalation simultaneously with a sustained high /i/ vowel.
Tip-of-the-tongue/apical /r/	This technique is believed to engage all phonatory muscles while generating strong passive laryngeal vibrations. The limited airflow produced by the semi-occluded configuration is thought to promote efficient vocal fold closure and enhance mucosal wave activity.
Resonance (/a/, /e/, /u/, /ie/, /ij/)	These exercises are intended to encourage effective vocal fold closure, along with a lowering of the velum, which effectively lengthens the vocal tract. Resonance-focused exercises help improve the coordination between sound source and vocal tract, making phonation smoother and less effortful.
Gliding vowels performed in both ascending and descending sequences (/a/, /e/, /u/, /ie/, /ij/)	This technique is hypothesized to involve activation of the thyroarytenoid (TA) and cricothyroid (CT) muscles, with additional contributions from the posterior cricoarytenoid (PCA) and the extrinsic laryngeal musculature.
Hand-over-mouth technique (/a/, /e/, /u/, /ie/, /ij/)	The mouth is partially occluded using the palm of the hand while sustaining a prolonged vowel sound. Participants are encouraged to perceive vibrations in the open vocal tract, around the lips, and against the palm. This sensation of openness in the vocal tract is then maintained during phonation after the hand is removed from the mouth. Hypothetically, this technique engages the thyroarytenoid (TA) and interarytenoid (IA) muscles.

Vocal warm- up content based on the protocol of Van Lierde

CLINICAL EFFECTS OF VOICE THERAPY ON VOCAL OUTCOMES IN UNILATERAL VOCAL FOLD PARALYSIS: PROOF-OF-CONCEPT STUDY FOR TWO SOVT-BASED TREATMENT PROTOCOLS

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University Ghent, department of rehabilitation, center for speech and language sciences

Background
Studies on treatment efficacy in unilateral vocal fold paralysis (UVFP) often lack a predetermined treatment protocol, and little is known about the effects of specific vocal techniques on vocal outcomes and quality of life in UVFP patients. The purpose of this preliminary proof-of-concept study is to investigate the effects and feasibility of two intensive treatment protocols based on water-resistance therapy (WRT) and vocal function exercises (VFE).

Methods
Ten participants with acute or chronic UVFP/paresis were recruited in the study and randomly assigned to the WRT or VFE group. Three of these participants presented with aphonia and could not complete the program as prescribed. The remaining participants completed an intensive therapy program with the assigned vocal technique. Before, during, and after the program, a multidimensional voice assessment was performed. Maximum phonation time, acoustic, perceptual, and patient-reported outcome measures (PROMs) were obtained.

Results
WRT and VFE had positive clinical effects on instrumental and auditory-perceptual voice quality, glottal closure, and PROMs, but interindividual variability was high. Studies with larger sample sizes are necessary to confirm or refute these findings.

Conclusion
The WRT- and VFE-based therapy programs are both feasible and seem to elicit positive clinical changes in UVFP patients. Suggestions on how to improve the programs are provided, as well as considerations for implementation in clinical practice. Follow-up research is needed to examine the efficacy of both programs on group level.

Keywords: *Vocal fold paralysis, Vocal function exercises, Voice therapy, Water-resistance therapy*

ARTICULATORY SETTINGS IN VOICE TRAINING: A CROSS-LINGUISTIC APPROACH

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Articulatory settings are language-specific habitual postures of the vocal tract—including the tongue, lips, jaw, and pharynx—that speakers adopt during interspeech rest positions. These postures influence phonological patterns, vowel and consonant shaping, and resonance characteristics. Empirical imaging studies using X-ray, ultrasound, *Optotrak* (optical motion tracking), and real-time MRI have operationalized articulatory settings as measurable interspeech postures, revealing systematic differences across languages. This intersection of linguistics, phonetics, and voice pedagogy offers valuable insights for voice training.

This paper explores how cross-linguistic differences in speech production can inform and enhance voice training practices. Each language engages the articulators through distinct muscular configurations, creating a characteristic "default" vocal tract setup. These articulatory settings influence timbral tendencies, resonance strategies, and how singers approach phonation, vowel modification, and vocal registration. For example, some languages require frequent soft palate elevation, while others rely more heavily on tongue-root tension or lateral tongue movement. Such differences may create varying degrees of vocal tract flexibility or resistance, directly affecting phonatory efficiency and tone production.

By examining language-specific activation patterns within the vocal tract, this presentation demonstrates how habitual speech postures may be transferred into singing technique. Measuring and training articulatory settings through biofeedback and targeted exercises may support improved diction, stylistic authenticity, and vocal ease across multilingual repertoire.

Drawing parallels with accent reduction and second-language acquisition, the paper illustrates how retraining articulators to produce unfamiliar sounds mirrors the process singers undertake when performing in multiple languages. Increased awareness of articulatory tendencies enables teachers and singers to identify potential sources of tension or imbalance and to design targeted interventions that promote vocal adaptability, efficiency, and ease. These insights have practical applications in voice training, vocal habilitation, and rehabilitation.

Keywords: *articulatory settings, voice training, singing voice, vocal tract posture, voice pedagogy*

MASTERCLASS: CLASSICAL SINGING WITH INSIGHT - UNLOCKING EXPRESSION, MUSICAL DEPTH, AND VOCAL WELLBEING

Jale Papila
Medical Voice Center, Hamburg, Germany

This masterclass is designed for singers specializing in art song, oratorio, and opera. It emphasizes deep musical and textual interpretation, integrating expressive artistry with a solid technical foundation, while promoting sustainable vocal health.

Through selected repertoire, both fundamental and advanced technical aspects—such as breath management, vocal onset, register balance, resonance, and articulation—will be explored and applied within an interpretive context. The goal is to enable singers to use technical tools consciously and flexibly to enhance expressive freedom, textual clarity, and vocal ease. At the same time, participants will gain insight into how a deeply felt interpretation can positively influence and inform their vocal technique.

Keywords: *Art Song, Opera & Oratorio, Vocal Technique, Expression & Musical Interpretation, Vocal Wellbeing*

POST-OP INSIGHTS – DON'T KEEP QUIET

Markus Hess, Jale Papila
Medical Voice Center, Hamburg Germany

In this presentation, a phonosurgeon and a voice pedagogue specializing in post-operative singing voice rehabilitation engage in an interactive dialogue, offering participants insights into voice recovery after vocal fold surgery. The fundamental surgical principles that support optimal wound healing, along with the phases of tissue healing, will be outlined. General, therapeutic, and pedagogical postoperative goals will be illustrated through brief examples.

The presentation provides an overview of the stages of vocal recovery, the ideal timing for voice use, and the key principles guiding vocal rehabilitation. Its aim is to equip participants with practical knowledge and strategies for optimal follow-up care and successful restoration of the voice after surgery.

Keywords: *Postoperative voice care, Vocal recovery strategies, Voice rehabilitation, Phonosurgical principles, Wound healing*

CASE REPORTS IN SINGERS: HEARING, SEEING, AND TREATING VOICE DISORDERS

Jale Papila, Markus Hess
Medical Voice Center, Hamburg Germany

In this interactive format, case reports of singers are discussed step by step with the audience. Using real patient cases from our practice, the advantages of a structured diagnostic approach are demonstrated – including auditory voice analysis, targeted anamnesis, and endoscopic evaluation. By presenting auditory and visual material, participants can develop, test, or revise diagnostic hypotheses and critically reflect on the referral diagnosis. The therapeutic approach is then briefly discussed. This format highlights how medical and therapeutic diagnostics work hand in hand and illustrates the added value of interdisciplinary collaboration for the benefit of the patients.

Keywords: *Interactive case discussions, voice assessment, diagnostic strategies, interdisciplinary approach, patient-centered treatment*

BODY POSTURE AND VOICE PRODUCTION

Jenny Iwarsson
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Looking at practice within voice training for both singing and speech, the work on body posture seems well established around the world and accepted as an important prerequisite for a good voice function. Still, scientific literature and studies of body posture effect on voice is rarely seen, and this may have some natural explanations. This presentation is based on a comprehensive literature study, combined with many years of experience of clinical voice therapy for voice rehabilitation. Some essential physiological couplings between body posture and voice will be presented, together with exercises promoting a relaxed and balanced body posture.

Keywords: *body posture, voice production, voice training*

BREATHING EXERCISES FOR VOICE THERAPY

Jenny Iwarsson
Jenny Iwarsson, University of Copenhagen, Copenhagen, Denmark

In this workshop, exercises used in clinical voice therapy will presented, with specific focus on breathing. The exercises will be instructed to the workshop participants, to experience them in practice. In addition, the origin of the exercises as well as the physiological interpretation of the mechanism and how it affects the voice will be presented.

Keywords: *Respiratory exercises, voice therapy, breathing*

APDVOICE: FROM UNSTRUCTURED NOTES TO AI-READY VOICE CLINIC DATA — STANDARDIZED DATA CAPTURE, OUTCOMES TRACKING, AI-READY ANALYTICS

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INTRODUCTION

Clinical data in phoniatric and voice-disorders practice are commonly recorded as free-text notes and dispersed across devices and reports. This fragmentation limits longitudinal outcome tracking, reduces comparability across clinicians and centers, and creates major barriers to high-quality analytics and trustworthy artificial intelligence (AI) applications.

OBJECTIVE

To present the APDVoice platform concept and workflow for transforming routine voice-clinic documentation into standardized, structured, and AI-ready data while preserving clinically meaningful detail.

METHODS

APDVoice is designed as a structured data platform for phoniatric services, built around (1) a minimum core dataset for voice-clinic encounters (history, examination, diagnostics, diagnosis, treatment, follow-up), (2) standardized templates aligned with common voice assessment domains (endoscopic findings, perceptual assessment, acoustic measures, patient-reported outcomes), and (3) longitudinal outcomes tracking through visit-based timelines and dashboards. The platform organizes multimodal inputs (e.g., endoscopic media and acoustic recordings/parameters) and enables cohort creation through query-based selection for audit and research. AI-readiness is addressed through data-quality rules, consistent labeling logic, and governance principles (privacy, consent, and access control).

RESULTS

The APDVoice workflow enables conversion of narrative documentation into comparable structured variables, supports consistent follow-up and outcome measurement over time, and facilitates rapid retrieval of clinically coherent cohorts for quality improvement and research. By standardizing data capture and labeling, APDVoice establishes a practical foundation for AI-ready analytics, including benchmarking, pattern discovery, and future predictive modeling in voice-disorders care.

CONCLUSION

A structured, outcomes-oriented documentation infrastructure such as APDVoice can bridge routine clinical work and AI-enabled analytics in phoniatric clinics. Standardized datasets and longitudinal tracking are key prerequisites for reliable multicenter comparisons and clinically meaningful AI development in voice medicine.

Keywords: *apdvoice, structured data, artificial intelligence, decision support, digital health*

FROM SEMI-OCCLUSION TOWARDS AN OPEN VOCAL TRACT: A PRACTICAL WORKSHOP

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Semi-occluded vocal tract exercises (SOVTE) are very popular in voice training. It are accessible and fun exercises, with a fast and efficient working mechanism on voice quality. To obtain the most economic phonation, the natural glottal resistance of a voice has to match with the backpressure generated by the SOVTE. Practitioners can systematically build up the resistance to train the vocal folds. But the ultimate goal is to phonate without losing the benefits of the SOVT-effect. We want to work from 'greatest effect, but most artificial' to 'smallest effect, but closest to natural'. The retroflex resonance of the inverted-megaphone-posture of the vocal tract during SOVTE needs to transform in audible resonant voice quality during speech or singing. Combination of semi-occlusion with articulation provides a possibility to work on this transfer

For this workshop, exercises with an 'external resonance space' are selected. The semi-occlusion is formed around the lips, so that normal articulatory movements can be made. We provide an evidence-based framework to play with the glottal resistance in SOVTE with external resonance space. We give usefull tips and tricks to build up a tailor-made traject for each speaking voice. We will cover the following techniques: hand-over-mouth-technique, wave in a cave, cup phonation and a ventilation mask. This will enable us to make the transition from SOVTE to forward voice projection (Resonant Voice Therapy, RVT).

Keywords: *SOVTE, voice projection, resonance*

VOICE QUALITY IN MULTIPLE SCLEROSIS: INSIGHTS FROM ACOUSTIC AND CEPSTRAL ANALYSES

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Background
Multiple sclerosis (MS), a chronic demyelinating disease that can affect voice quality, can affect the neuromuscular regulation of breathing, phonation, and articulation. Knowing how MS impacts the acoustic and cepstral aspects of the voice may help with the early detection of vocal dysfunction. Objective: This study compared acoustic and cepstral parameters between MS patients and normophonic controls to assess the impact of MS on voice quality and determine whether these effects varied by gender.

Methods
A total of 126 participants were included: 63 patients with MS (mean age 36.19±10.79 years) and 63 age- and sex-matched healthy controls, all nonsmokers. Sustained /a/ phonation and the standardized reading text were recorded in a sound-treated room using a Samson Go Mic (10 cm distance). F0, Jitter, Shimmer, NHR, HNR, AVQIv2 and cepstral parameters (CPPS, Cepstral Median) were analyzed using Praat (version 6.2.01). SPSS 22.0 was used to perform statistical analyses using parametric and nonparametric tests ($p<0.05$).

Results
MS patients had significantly higher Jitter (0.50±0.32 vs. 0.30±0.18; $p<0.001$), shimmer (4.56±1.94 vs. 2.57±0.49; $p<0.001$), and AVQIv2 scores (4.12±1.00 vs. 2.82±0.34; $p<0.001$) than controls. HNR was lower in MS (18.95±4.11) compared to controls (20.55±4.26; $p<0.05$). Cepstral analysis revealed significantly reduced CPPS during both sustained phonation (14.12±2.14 vs. 16.05±1.84; $p<0.001$) and continuous speech (8.59±1.07 vs. 9.04±1.17; $p<0.05$). The cepstral median was also lower in the MS group (13.60±2.42 vs. 14.70±2.37; $p<0.05$). According to a gender-based analysis, female MS patients had significantly lower CPPS and higher AVQIv2, whereas male MS patients had higher F0 and AVQIv2 but lower CPPS and HNR than male controls.

Conclusion
MS indicates a decline in vocal fold stability and harmonic organization, which deteriorates voice quality by increasing perturbation measures and decreasing cepstral energy. Acoustic and cepstral analyses are helpful methods for detecting early vocal changes in multiple sclerosis.

Keywords: *Multiple Sclerosis, Neurogenic Voice Disorders, Acoustic Analysis, Cepstral Analysis, Voice Quality*

EFFECTIVENESS OF THE DOCTORVOX THERAPY TECHNIQUE FOR VOICE HABILITATION IN PRIMARY SCHOOL TEACHERS

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The aim of this study was to evaluate the effectiveness of the DoctorVox Therapy Technique in enhancing vocal capacity and preventing voice disorders among primary school teachers who are professional voice users. The study was conducted with 36 teachers (17 in the study group and 19 in the control group). Participants consisted of teachers who were diagnosed as free of organic voice disorders following laryngeal examinations. The study group received Vocal Hygiene Education combined with eight sessions of the DoctorVox Therapy Technique, whereas the control group received only Vocal Hygiene Education.
During data collection, voice recordings were obtained from all participants for acoustic analysis, including fundamental frequency(F0), jitter, shimmer, harmonic-to-noise ratio (HNR), and cepstral peak prominence(CPP). Aerodynamic measurements included maximum phonation time and s/z ratio calculations. Self-assessment instruments consisted of the Voice Handicap Index-10 and the Vocal Fatigue Index. In addition, a Social Validity Questionnaire was administered to the study group during the final evaluation phase.
The results indicated a statistically significant decrease in the first and second subdimensions as well as the total scores of the Vocal Fatigue Index in the study group following the intervention. In addition, a significant reduction was observed in Voice Handicap Index-10 scores, reflecting an improvement in voice-related quality of life. Acoustic analyses revealed a significant decrease in fundamental frequency values and a significant increase in cepstral peak prominence derived from connected speech. Significant improvements were also identified in aerodynamic parameters, specifically maximum phonation time and s/z ratios. Follow-up assessments demonstrated that these gains were maintained for one month. According to the social validity findings, participants evaluated the program as socially valid. In conclusion, the direct exercise-based habilitation program implemented in this study was found to be more effective in protecting and improving teachers' vocal health than informative education alone.

Keywords: *Voice therapy, teachers, DoctorVox, voice habilitation, vocal hygiene*

EVALUATION OF ROUGH VOCALS USING PHASE SYNCHRONY

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In metal singing, among oscillations of the vocal folds, various oscillations of supraglottic structures are observed. Due to the different coupling mechanisms in several voice qualities often used in metal singing, the interaction between these two oscillators can vary. This results in nonlinear phenomena, such as fixed frequency ratios, bifurcations, biphonations, and chaotic oscillations.
Additionally, the phase characteristics and the derived phase synchrony provide insight into the detailed oscillation behavior of the two oscillators. Using an adapted phase synchrony paradigm, we were able to quantify the phase relationship and the ratio of the prominent frequency of these two signals.
Firstly, we will give an overview of the theoretical foundation of the phase synchrony paradigm, discussing the results of simple oscillation patterns. Secondly, we investigated the movement patterns of these two oscillators in one professional metal singer by analyzing the glottal area waveform (GAW) and the supraglottic area waveform (SAW) for three voice qualities via high-speed imaging. Here, we will demonstrate how this paradigm is valuable in understanding realistic oscillation patterns, such as those found in irregular voice production, like metal singing.

Keywords: *irregular voice production, metal singing, phase synchrony*

THE VOCAL TRACT ORGAN AND THE UK ALARYNGEAL CHOIR

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This paper describes the Vocal Tract Organ (VTO) and its use in a live concert in London's 'King's Place' in October 2025. The VTO makes use of MRI scans of the vocal tracts of human subjects and alaryngeal choristers from the Shout At Cancer choir. These scans are 3D-printed to create vocal tract models that sit atop vocal tract organ loudspeakers to which a larynx excitation signals are sent at the pitch(es) of note(s) being played on the VTO keyboard. This process of merging biomedical imaging, sustainable instrument design, music technology and creative expression provides new sound palates as medical data is re-engineered as sound and creates new opportunities for co-creation, awareness, and empathy.

A new composition was commissioned to explore the organ's expressive potential, combining live performance, fixed media, and projected imagery. The laryngectomy choir performed alongside the instrument, enabling the real post-operation and new artificial voices of choir members to be blended together acoustically thereby establishing a musical dialogue between living and reconstructed voices.

This concert was the first public demonstration of the Laryngectomy Vocal Tract Organ with alaryngeal chorister vocal tracts. Hearing their own vocal tracts contributing to the overall sound created a profound symbolic connection between body, identity, and music for alaryngeal choir members. Audience feedback described the performance as both scientifically intriguing and emotionally moving, highlighting its capacity to transform anatomical data into shared sound. A video documented the development process and the performance.

The project confirms the functional viability of vocal-tract-based creative acoustic synthesis while demonstrating its symbolic and rehabilitative power as a new compositional palette for musicians and a novel medium for re-voicing medical experience.

Keywords: *alaryngeal singing, vocal tract organ, 3D printed vocal tracts*

TEACHING VOICE AND SINGING TO ACTORS.WHAT A CHALLENGE!

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These actors. Citizens of Poetryland and Dramaland. Ethereal beings who swing between fiction and reality. Craftsmen of the analysis of words and meanings, of diving into the sea of emotions, of the persistent gaze, through the door's keyhole, to the locked room of a work's deepest meanings. Gardeners in the orchard of the diversity of sounds, colors, expressions, gestures and movement, of words, silences, comedy, tragedy... Supermen, knights with invincible swords, fairy-tale queens—they are not daunted by any directives. They are not frightened by nothing at all. Until pieces of "kryptonite" appear: phrases such as "Your vocal technique," or even worse, "Now you will sing a solo song!"
The process of training an actor's voice presents several particularities and pitfalls compared to the process of training a singer's voice. An actor employs the voice in speech or singing, in order to serve a role that may not coincide with their own age, intellectual, psychological, or physical condition, nor with the historical period, geographical setting, social status, or, at times, even the gender of the character portrayed. Also, when an actor recites or sings as part of a group, such as in choral passages, collective breathing, rhythmic accuracy, unified timbre, and ritual energy are required.
Skills such as extended vocal range, dynamic modulation, diversity of vocal timbres and sounds, rhythmic dexterity, breath control, and sustained phonatory endurance—often in conjunction with movement or choreography—are essential. At the same time, primary requirements consistently include clear articulation, expressivity, and vocal production that safeguards vocal health.
These demands necessitate the systematic use of vocal exercises designed to address and integrate all of the above parameters. Representative examples of such exercises will be presented.

Keywords: *Actors, Voice, Singing*

WARM UP FOR SINGERS: FROM WHISTLE TO BELT

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To achieve a good vocal performance, proper warm-up is essential.
What exercises are essential and why? How long should they be performed? Is the warm-up always the same or does it vary depending on the style and length of the performance?
How does vocal warm-up change depending on the singer's condition

During this workshop, exercises will be presented to prepare the singer for the performance, focusing on the "pillars" of the voice: breathing, emission, and resonance.
It's not necessary to follow long, complex exercise protocols. On the contrary, a few simple exercises can be much more effective, and it's also easier for the singer to perform them independently and correctly. You'll be surprised to discover how useful laryngeal whistling is at the beginning of your vocal warm-up. We'll experiment with tongue trill combined with lip articulation, and lip roll combined with tongue articulation. We'll have fun with unusual and very gentle exercises, absolutely effective for singing high notes with strength and energy, in a safe way

For each exercise, the duration, the tonal range within which to perform it, and the details to focus on will be specified, because even the best vocalizations, if performed incorrectly, can be ineffective or even counterproductive.

Keywords: *singing, warm up, whistle, voice technique, belt*

SEMI-OCCLUDED VOCAL TRACT EXERCISES FOR VOICE REHABILTATION IN UNILATERAL VOCAL FOLD PALSY: AN OBSERVATIONAL STUDY FOCUSING ON SEMI OCCLUDED BUBBLE MASK (SOBM) TECHNIQUE AND SEMI OCCLUDED VENTILATION MASK (SOVM) TECHNIQUE

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Background
Unilateral vocal fold palsy (UVFP) causes dysphonia due to glottal insufficiency. Semi-occluded vocal tract exercises (SOVTE) are commonly used in voice therapy to improve phonatory efficiency, though evidence on device-assisted SOVTE in UVFP is still limited.

Methods
Ten patients with UVFP underwent a structured speech and language therapy program based on SOVTEs, focusing on the Semi-Occluded BubbleMask (SOBM) and Semi-Occluded Ventilation Mask (SOVM) using the VocalFeel® device. Voice assessment was performed pre- and post-treatment using electroacoustic measures (CPPS, AVQI), perceptual evaluation (GRBAS), laryngostroboscopies and self-assessment (VHI)

Results
Post-treatment evaluations showed improvements across electroacoustic, perceptual, endoscopic and patient-reported outcomes. Cepstral measures and overall voice quality improved, perceptual ratings indicated reduced dysphonia severity, and self-assessment scores reflected a lower perceived voice handicap.

Conclusions
Rehabilitation throguh SOVTE appears to be a feasible and clinically relevant rehabilitative approach in patients with UVFP, supporting its use in multidisciplinary voice therapy settings. Further studies are needed to confirm these findings.

Keywords: *Unilateral Vocal Fold Palsy, SOVTE, Semi Occluded Bubblemask, Semi Occluded Ventilation Mask*

EVIDENCE FOR THE STIMULATION VOCAL TRACT ARTICULATORS WITH 2D MRI VIDEOS

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Objective
Magnetic resonance images (MRI) are widely used to illustrate how to use vocal articulators in vocal pedagogy or speech therapy. Except for the lips, most articulators are not easily accessible during singing, and the feedback is therefore typically limited to the acoustic signal of the singing voice. To our knowledge, the extent to which visual models can influence the range and dynamics of articulator movements /or the extent of vocal tract adjustments are still lacking. The aim of this study is to provide insight into the possible use of animated pictures in vocal education.

Methods
The text of a song was presented to three participants with and without visual stimulation, while movements of the articulators were recorded using MRI in sagittal plane. As stimulation, a silent MRI video of a professional singer was used, and the participants were asked to adjust their articulators according to the reference video. Trajectories were calibrated using fixed anatomical reference points at the second cervical spine and hard palate. They were compared with the incoming movements of the articulators as well as changes in the articulated text with and without stimulation.

Results
Visual stimulation can induce changes in the movement of the vocal articulators. The overall path length of the trajectories at the tongue tip and dorsum, as well as the lip opening, increased significantly in two participants, and in the case of one participant also at the velum, but did not reach the movements shown in the reference video.

Conclusions: In situ MRI-based visual intervention can induce distinct changes in the vocal tract. While participants' movements during stimulation approached those of the professional singer, differences remain. In the future, the results may help to facilitate typical movements of articulators in speech therapy and vocal education.

Keywords: vocal education, vocal tract motor contoll, MRI

HOW TO TEACH THE INVISIBLE? AN MRI CASE STUDY

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Objective
Magnetic resonance images (MRI) in 2D sagittal plane are widely used to illustrate how to use vocal articulators in vocal pedagogy. While movements of the tongue, jaw, and oral cavity can be actively controlled, structures in the pharyngeal region are typically considered to elude voluntary motor control. The piriform fossae, located at both sides of the larynx structures near the vocal folds are highly important in resonances of the singer's formant cluster and can be visualisedin 3 D models. The study presents initial evidence that voluntary motor control of this structure is possible.

Methods
An animated 3D vocal tract model projected in the 2D plane was used as stimulation. The animation showed an extension of the piriform fossa in the -Z direction toward the chest. The participant had no prior training with the visual material. The participant was asked to adjust the piriform fossa according to animated images displayed during MRI acquisition following a short familiarisation phase of approximately ten repetitions. 3D MRI pictures of the region of interest were taken before and after the stimulation and segmented using Blender software.

Results
The animated visual stimulation can induce changes in the size of the piriform fossa. The total volume increased from 1.4 cm3 before the intervention to 2.5 cm3 after the exercises.

Conclusions
Since extended piriform fossa facilitates an additional resonance in the singer's formant cluster, active control of this region is highly relevant for the singing voice. The results show that visual stimulation can address physiological structures not known to the participant prior to the experiment. Further research is necessary to confirm and extend these findings. This case study highlights the potential of visual approaches for exploring otherwise invisible aspects of vocal technique.

Keywords: *Vocal education, Piriform Fossa, MRI, Body awareness, motor controll*

VOICE MAPPING IN PRACTICE: INSIGHTS FROM A CLINICIAN'S PERSPECTIVE

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Voice mapping is an emerging framework that visualizes acoustic and electroglottographic metrics across the frequency-intensity space (Hz-dB), offering a multidimensional "landscape view" of phonation beyond traditional point measures. While it has so far been primarily explored in research settings, its potential clinical applications remain largely untapped. This lecture will approach voice mapping from a clinical perspective, reflecting on how the technique may support diagnosis, treatment planning, and rehabilitation of voice disorders.
As an example, preliminary data from patients with unilateral vocal fold paralysis undergoing injection laryngoplasty will be presented, demonstrating that voice maps can capture immediate and longer-term changes in glottic contact and phonatory stability. Such patterns may help clinicians monitor the functional effects of different injectable materials and potentially anticipate their resorption over time, thus guiding the timing of repeat interventions.
In addition, the possibilities of using clustering-based voice maps as a tool for real-time biofeedback in voice therapy will be discussed. By associating specific color regions on the map with desirable or undesirable phonatory outcomes, therapists could provide patients with intuitive visual targets, turning voice mapping into a practical rehabilitation aid.
This lecture will illustrate how voice mapping, originally developed as a research tool, may gradually find its place in everyday clinical practice. While much work remains to standardize protocols and validate outcomes, the technique may prove useful in expanding our ability to objectively assess, monitor, and rehabilitate voice disorders.

Keywords: *Voice mapping, electroglottography, vocal fold contact, phonetogram, vocal cord paralysis*

ECHOES OF THE TONGUE: EXPLORING FORMANT ANALYSIS AS A BRIDGE BETWEEN DYSARTHRIA AND DYSPHAGIA

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Swallowing and speech disorders frequently co-occur in neurodegenerative diseases, reflecting the shared reliance on tongue propulsion and oropharyngeal motor control. Dysarthria usually emerges earlier, while dysphagia often remains clinically silent until compensatory mechanisms fail. Importantly, dysphagia can lead to severe complications, including aspiration pneumonia, malnutrition, and—in advanced cases—even mortality. This underscores the need for sensitive and objective screening tools that may help anticipate swallowing dysfunction before the onset of its most severe consequences. This lecture will trace the development of a research program aimed at exploring acoustic formant analysis as a potential biomarker bridging dysarthria and dysphagia. After a short introduction to the physiological basis linking vowel formants to tongue body movement, we will review three steps of investigation: (1) an initial study demonstrating that vowel formant metrics (tVSA, qVSA, FCR) reliably capture articulatory impairment in dysarthric patients with neurodegenerative disorders; (2) a pilot study in Parkinson's disease showing correlations between acoustic indices of dysarthria and swallowing efficiency; and (3) a larger study across multiple neurodegenerative conditions, in which a novel Dysphagia Formant Index (DFI) was developed by integrating the most informative formant features and validated against clinical and endoscopic swallowing assessments.
The DFI showed significant associations with swallowing performance across consistencies and demonstrated a reasonable ability to discriminate moderate-to-severe dysphagia, even in patients with mild or absent dysarthria. These findings suggest that formant analysis may provide an objective and non-invasive method to quantify clinically relevant impairments, with possible value as a screening tool for dysphagia risk in neurodegenerative diseases.
Formant-based acoustic analysis, therefore, may represent a promising complement to current clinical practice. Beyond its present applications, it also holds potential for future developments in remote voice analysis and large-scale screening strategies for at-risk populations.

Keywords: *dysarthria, dysphagia, neurodegenerative diseases, acoustic analysis, formant*

VISUALIZING VOICE IN PERFORMANCE: THE SINGING ENDOSCOPY

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Singing Endoscopy is an advanced functional assessment tool that enables laryngologists to evaluate laryngeal and extra-laryngeal dynamics during actual singing tasks. Conventional stroboscopic examination performed during speech or sustained phonation may not adequately capture the complex biomechanical and resonatory demands of singing, particularly at higher pitches and varying intensities. This study evaluates 50 singers from diverse musical genres, including classical western, pop, indian classical using flexible nasolaryngoscopy combined with stroboscopy during singing. Stroboscopic assessment of vocal fold vibration was performed across the singers' pitch ranges, allowing evaluation of mucosal wave characteristics, symmetry, and periodicity at different frequencies. In addition to glottic function, supraglottic and resonatory parameters were systematically assessed, including throat resonance behavior, tongue position and mobility, nasality and velopharyngeal function, degree of pharyngeal squeeze, and vertical laryngeal position during pitch modulation.
Singing endoscopy enabled visualization of compensatory and maladaptive patterns that were not evident during routine voice examination. Pitch-dependent and genre-specific variations in supraglottic activity and laryngeal positioning were observed, contributing to clinical complaints such as vocal fatigue, instability, and reduced vocal range.
These findings highlight the value of singing endoscopy as a comprehensive diagnostic modality for laryngologists managing singers and professional voice users. By correlating real-time visualization with vocal symptoms, singing endoscopy enhances diagnostic accuracy, guides individualized voice therapy, and supports preventive voice care in this specialized population.

Keywords: *singing, endoscopy, resonance, technique, therapy*

TRANSTHYROID VERSUS TRANSCRICOTHYROID INJECTION LARYNGOPLASTY: TECHNICAL FEASIBILITY AND CLINICAL OUTCOMES

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Background: Injection laryngoplasty is an established treatment for glottic insufficiency, most commonly performed via the transcricothyroid (TCT) route. The transthyroid (TT) approach remains less commonly described, despite potential advantages in needle stability and access. This study evaluates the safety and efficacy of the transthyroid route in a case series of 100 patients and compares outcomes with the transcricothyroid approach, with particular emphasis on age and sex related anatomical considerations.

Methods: Retrospective, multicentric analysis of one hundred consecutive patients with unilateral vocal fold paralysis or glottic insufficiency who underwent office-based injection laryngoplasty using Hyaluronic acid via TCT and TT route were done. Voice outcomes were assessed using perceptual voice analysis, patient-reported improvement, and laryngoscopic evaluation of glottic closure. Procedural ease, patient tolerance, and complications were documented. Outcomes were analysed statistically using Chi square test and univariate analysis. Subgroup analysis compared younger (<50 years) and older (>=50 years) patients to assess the impact of age-related and sex-related laryngeal and cartilaginous changes on procedural feasibility and outcomes.

Results: Except in five patients, all TT procedures were completed successfully without major complications. In these five cases, the procedure was converted to the transcricothyroid approach due to significant thyroid cartilage calcification. Voice outcomes and improvement in glottic closure were comparable between TT and TCT groups across age categories. Patient tolerance was high, with no significant difference in complication rates.

Conclusion: The transthyroid route is a safe and effective alternative to the transcricothyroid approach for injection laryngoplasty. Awareness of age-related cartilage calcification is essential, as it may necessitate intra-procedural conversion in select cases. The ability to achieve paraglottic augmentation without airway entry makes the TT approach a valuable option in office-based laryngeal interventions.

Keywords: *injection laryngoplasty, transthyroid, transcricothyroid, office based procedures*

ASSOCIATION BETWEEN DIAGNOSED RESPIRATORY ALLERGIES AND VOCAL SYMPTOMS – A CROSS-SECTIONAL POPULATION-BASED STUDY

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The purpose of this study was to evaluate the prevalence of diagnosed respiratory allergies (DRA) and their association with vocal symptoms in a population-based sample. Additionally, we wanted to examine gender differences in the relation between diagnosed respiratory allergies and vocal symptoms.

This study utilized data from a questionnaire on language, speech, and voice, answered by 1728 twins in the age range 18-46 years. After data refinement to account for twin bias, 1220 responses were analysed. The questionnaire included questions on six vocal symptoms occurring during the last year and questions related to DRA, common health issues, lifestyle factors, and medication use

In this sample the prevalence of diagnosed respiratory allergy was 25.6%. A total of 19.8% experienced two or more vocal symptoms occurring daily or weekly during the past year. Vocal symptoms were more common in women, and vocal symptoms were significantly more frequent in participants with DRA. Also, women with DRA reported significantly more vocal symptoms compared to men.

In this study DRA seems to be a contributing factor to frequently occurring vocal symptoms and an additional risk factor for voice and throat problems. This should be considered during assessment and treatment of both respiratory allergies and voice disorders.

Keywords: *vocal symptoms, voice problems, respiratory allergies, risk factor*

CASE SERIES: LEARNING OUTCOMES AFTER TRAINING BRUNI® FOR M0 AND SUPRAGLOTTIC EXTREME VOICE

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Objective:
To discuss the learning outcomes after two months of Training Bruni® for M0 and supraglottic extreme voice in three professional singer.

Methods:
Monitoring medium- and long-term learning is crucial in understanding how a specific training is effective and works well. In this study all participants had an initial assessment (T0) and a two-month follow-up (T1). The assessment included: laryngostroboscopy, electracoustic assessment, and self-assessment questionnaires. After an initial two-days workshop, over the two months, the work was home-practice based and included short daily sessions and two longer weekly sessions. Each participant had access to instructional videos for both short and long sessions. Additionally, during the two months, each completed an individual lesson with the voice teacher Eleonora Bruni, to monitor progress.

Results:
Analysis of the results, despite individual variability, shows clear signs of learning, in terms of awareness and confidence in engaging supraglottic structures during phonation.

Conclusions:
Training Bruni® for M0 and supraglottic extreme voice demonstrated good learning outcomes. This approach seems to be effective in increasing knowledge of supraglottic structures and promoting a better management of extreme voice. In conclusion, this training appears to be a solid didactic choice for students that want to experience extreme and supraglottic vocal techniques.

Keywords: *Training Bruni, M0, Supraglottic Extreme Voice, Learning Outcomes*

PREVIOUS MUSICAL TRAINING AND VOCAL SELF-CONCEPT IN PRESERVICE TEACHERS: BELIEFS AND PERCEPTIONS ABOUT SINGING

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This study examines the role of previous musical training (PMT) in shaping preservice teachers' vocal self-perceptions, beliefs about singing competence, emotional responses, and confidence in using singing for teaching purposes. Prior studies show that musical experience enhances vocal confidence, competence, and well-being, encouraging the use of singing as a pedagogical resource. However, the specific relationship between musical background and vocal self-concept remains underexamined. This cross-sectional study was conducted in teacher education programs at six Spanish universities during 2024–2025. An online questionnaire about vocal self-concept, beliefs about singing was administered to 1,793 students, of whom 365 had PMT and 1,428 did not (no-PMT), with 84% of women. Despite the imbalance in group sizes, the groups were comparable in terms of their internal characteristics.

Group differences were analyzed using non-parametric tests and independent-samples t-tests. The results show that PMT group have a more favorable self-perception of vocal attributes ($p < 0.001$), particularly regarding perceived musical ability, singing quality, ease of singing, vocal attractiveness, intonation accuracy, and the belief that they could serve as a vocal role model for their students. They also obtained significantly higher scores in expressive singing and absence of vocal tension ($p < 0.05$), as well as higher levels of well-being ($p < 0.025$) and confidence ($p = 0.013$). In contrast, among no-PMT, beliefs related to vocal self-efficacy and perceived vocal competence increased the likelihood of singing, whereas embarrassment reduced it.

In sum, previous musical training is associated with a stronger vocal self-concept and more positive emotional responses to singing, enhancing confidence and perceived vocal competence. However, PMT does not directly predict classroom singing; instead, feeling capable and secure in one's own voice emerges as the key factor. These findings highlight the educational value of musical experience and the importance of addressing vocal self-concept in teacher education.

Keywords: *voice, musical training, singing, preservice teacher*

VALIDATION OF CEPSTRAL PEAK PROMINENCE SMOOTHED (CPPS) AND ACOUSTIC VOICE QUALITY INDEX (AVQI) FOR THE ACOUSTIC ANALYSIS OF SUBSTITUTION VOICES

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Background
The acoustic evaluation of substitution voices remains challenging due to the inherent irregularity of these signals, which often limits the reliability of traditional acoustic measures. This study aimed to investigate the validity of cepstral-based parameters, namely Cepstral Peak Prominence Smoothed (CPPS) and the Acoustic Voice Quality Index (AVQI), in comparison with conventional acoustic measures—Jitter (Jitt%), Shimmer (Shimm%), and Harmonic-to-Noise Ratio (HNR)—for the assessment of voice quality in patients after open partial horizontal laryngectomy (OPHL).

Methods
A retrospective analysis was conducted on 66 patients who underwent OPHL types II and III. Sustained vowel /a/ phonations (SV) and continuous speech (CS) samples were recorded for each participant. Voice samples underwent auditory-perceptual evaluation by expert clinicians and acoustic analysis using CPPS, AVQI, HNR, Jitt%, and Shimm%. Acoustic parameters were calculated on SV samples and on concatenated SV+CS samples. Voice severity was classified using the I subscale of the INFVo scale, and acoustic measures were compared across perceptual severity levels.

Results
Strong correlations were observed between auditory-perceptual ratings and CPPS ($r = -0.77$) and AVQI ($r = 0.69$). Traditional acoustic measures showed weaker associations with perceptual severity, particularly when derived from SV samples alone. CPPS calculated on concatenated SV+CS samples demonstrated the highest ability to discriminate between mild, moderate, and severe voice alterations, followed by AVQI. Both CPPS and AVQI showed good diagnostic accuracy.

Conclusions
CPPS and AVQI appear to be reliable acoustic parameters for the evaluation of substitution voices following OPHL. Their inclusion in a standardized multidimensional assessment protocol may improve diagnostic accuracy and support clinical decision-making in both surgical and speech therapy management.

Keywords: *Acoustic analysis, Substitution voice, Partial laryngectomy, Cepstral peak prominence, Acoustic voice quality index*

GLOTTAL AWARENESS AND BREATH FLOW FOR A BALANCED VOICE IN CLEAN AND DISTORTED VOCAL QUALITIES

Eleonora Bruni
Bruni Voices srl

Objective:
To introduce Bruni Training® and exercises that balance constrictive tendencies. The various steps focus on opening and closing the glottis, managing airflow and support ("appoggio" and "sostegno"), and developing resonance.

Method:
The exercises are explained step by step using slides. The exercises are then demonstrated in videos featuring various artists. Self-assessment tests are shown for various parameters (vocal fatigue, endurance, ease of connection between mechanisms, intonation, elasticity). Spectrographic examinations are shown before and after a training session with professional singers and beginner singers. Endoscopies are shown during the practice of conscious opening and closing exercises. The various stages of the training program lead to a reduction in fatigue and constrictive tendencies. It also improves the management of breath support and resonance, which is essential for all vocalizations, even energetic ones, preventing fatigue and injury.
Great attention is paid in the training to the ability to perceive the opening and closing of the glottis and to distinguish between light and constrictive closure. Starting from this bodily awareness, the training helps to use the voice in all its qualities - clean and distorted - to create virtuous automatisms in singing and performance.

Conclusions:
Bruni Training can be used as a balancing tool to help manage performance, warm up correctly, and remove excess tension and vocal fatigue. It is also used in speech therapy to reduce constriction and excess subglottic pressure. Further studies with a larger sample are planned.

Keywords: *Distorted, clean, Bruni, awareness, breath*

HOW TO SOUND LOUD(ER) AT A GIVEN SPL?

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Voice assessment traditionally relies on sound pressure level (SPL) measurements, which characterize acoustic output in the physical domain. However, the respective loudness level – a perceptual construct – may prove more informative for assessing voice in clinical and pedagogical settings. Considering both metrics and quantifying their difference yields "Excess Loudness Over SPL" (ELOS), a novel index of how much louder a sound is perceived relative to its actual sound pressure level.
A recent investigation by these authors has demonstrated that across individuals' entire vocal ranges, as documented with voice maps, specific regions exhibit clearly elevated ELOS values. Notably, these regions correspond neither to maximum SPL production nor to peak singers' formant prominence. Understanding the acoustic mechanisms underlying these high-ELOS regions is therefore of considerable interest, as they may reveal how singers achieve greater perceptual impact at equivalent physical levels.
The present study examines systematic relationships between spectral characteristics of the radiated voice signal and corresponding ELOS values, drawing on a comprehensive dataset of complete voice maps from 65 adult singers of both sexes with varying training backgrounds. Analysis reveals that ELOS fundamentally correlates with several signal and spectral parameters: the crest factor, the absolute level of the first harmonic (H1), the level difference between H1 and the remaining spectrum, and the spectral balance. Preliminary statistical modeling indicates these metrics account for substantial variance in ELOS across all voice maps examined.
Our findings suggest that spectral factors systematically contribute to enhanced perceptual loudness at a given SPL. Given that SPL correlates strongly with subglottal pressure and, consequently, phonatory effort, this work illuminates acoustic properties associated with efficient voice production. The results have implications for both speech and singing pedagogy, potentially informing training approaches that optimize the perceptual impact of vocal output while minimizing physiological demand.

Keywords: *Loudness, VRP, Voice Mapping, ELOS*

FROM THE BODY TO THE VOICE: ACOUSTIC AND SELF-PERCEPTIVE ANALYSIS OF THE IMPACT OF BODYWORK ON THE SINGING VOICE

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Bodywork is increasingly used in vocal pedagogy, though supporting evidence remains limited. This pilot study analyzes the impact of a bodywork intervention on acoustic parameters and on vocal, corporal, and emotional self-perception in undergraduate singing students. The inclusion of corporal and emotional variables is based on the body as the instrument of the voice and the influence of emotion on vocal production

The sample comprised eight singing students (1 male, 7 female) from the Liceu Conservatory of Music in Barcelona. The intervention comprised four sessions based on the Armor Release Method (MLC), focusing successively on the pelvis, respiratory structures, the shoulder girdle, and the neck–jaw–palate structure. Standardized vocal tasks were recorded before and after each session, and self-perceptive data were collected through questionnaires addressing vocal, corporal, and emotional parameters. Acoustic analysis of the vocal samples included harmonic-to-noise ratio (HNR), singing power ratio (SPR), and cepstral peak prominence smoothed (CPPS).

Self-perceptive results revealed a generalized improvement in voice, body, and emotional state following the intervention. Vocal self-perception showed significant improvements in harmonic richness, ease of phonation, and vocal beauty, particularly in the pelvis and shoulder girdle sessions. Corporal self-perception highlighted increased relaxation, well-being, and availability, while all emotional variables improved, with the strongest effects in session 3.

Acoustic results showed improvements in 39% to 53% of participants depending on the session, increasing in sessions 3 and 4. CPPS was the most consistent parameter, associated with greater vocal clarity and stability; HNR improved across more tasks, and SPR stand out in the neck–jaw–palate session.

Overall, session 3 showed the strongest coherence between acoustic and perceptual improvements. Despite the small sample size and individual variability, the results suggest that focused bodywork may promote relevant improvements in the singing voice, reinforcing the value of body-mind approaches in vocal training.

Keywords: *bodywork, singing voice, vocal pedagogy, acoustic analysis, self-perception*

MEASUREMENT OF VOCAL TRACT RESONANCES DURING PHONATION: EXPERIMENTATION ON REPLICAS

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The experimental characterization of vocal tract resonances remains a challenge in phonetics and voice science.
One approach initially proposed by (Epps, 1997) consists in analyzing the acoustical response of the vocal tract to a wide-band chirp signal prescribed at the lips. The amplitude modulation of the chirp due to the filtering by the vocal tract can be analyzed in order to extract the modal parameters quantifying the vocal tract resonances. Our goal is to extend this non-invasive experimental tool to enable the real-time assessment of the vocal tract resonance during musical practice.
When this experimental technique is performed during phonation, the recording of the radiated pressure contains the combination of the filtered chirp and of the vocal signal, requiring thus the separation of voice and chirp. This processing is performed using an higher-order chirplet transform (Maison, 2025) informed by the voice fundamental frequency fo. Numerical simulations based on the synthesis of the vowel /æ/ at 330 Hz with an added chirp 3 dB lower in level show that the method is accurate enough for the first five resonance frequencies (and their quality factors) to deviate by no more than 7 cents (and 8%, respectively) (Maison, 2023).
The experimental implementation is carried out on simplified replicas derived from the articulatory configurations of the vowels /ɑ/, /o/, and /ə/ (Arai, 2007). Signal separation is tested using a glottal-flow input to the model at several frequencies ranging from 90 Hz to 1100 Hz. We present the results obtained and discuss the robustness of the method.

Keywords: *Vocal tract, resonance, formant, source separation, replica*

VOCAL HEALTH AND VOICE PROBLEMS IN DOG AGILITY TRAINERS

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Dog agility is a fast paced sport where human handlers direct dogs around obstacle courses. The training for this sport involves verbally coaching the dogs' handlers, often in noisy environments and at a distance. Despite these demands, the vocal health of dog agility trainers has not been examined. This study aimed to (1) determine the prevalence and severity of self-reported voice problems and vocal tract discomfort in dog agility trainers, and (2) identify occupational and environmental vocal factors associated with higher Voice Handicap Index-10 (VHI-10) scores.

An international cross-sectional survey collected data from 129 dog agility trainers via online social groups using convenience sampling. Participants reported demographic and occupational characteristics and completed the VHI-10 and Vocal Tract Discomfort Scale (VTDS). Prevalence was estimated using self-reported diagnosis and VHI-10, with cut-off scores >=11 indicating clinically significant voice problems. VTDS frequency and severity ratings were combined to generate a composite symptom burden score. Univariate ordinal regression examined associations between occupational/environmental factors and higher VHI-10 scores.

Five participants (3.9%) reported a pre-existing voice diagnosis. Thirty (23.3%) had VHI-10 scores >=11, with a median score of 14.5 (range 11-24). The most burdensome VTDS symptom was dryness, followed by tightness, soreness and irritability. VHI-10 and VTDS scores were strongly correlated (r_s=.688, p<.001). Higher VHI-10 scores were associated with working over background noise (p<.001), providing feedback while setting up sequences (p=.006), taking no or short breaks (p=.012), and frequent reflux (p=.007).

Despite low diagnosis rates, trainers reported substantial voice-related impact and symptom burden. Several modifiable occupational factors were associated with higher VHI-10 scores. Limitations include cross-sectional design, self-report, unadjusted analyses, lack of objective assessment, and potential limits to generalisability given international training contexts. Greater attention to vocal health education and occupational voice care may reduce voice-related burden.

Keywords: *Voice, Occupational voice use, Vocal load, Dog agility trainers, Professional voice users*

MENOPAUSE EFFECTS ON MAXIMUM PHONATION TIME

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A decline in lung function in postmenopausal women has been described in studies based on spirometry measures. Controversy still exists concerning the effects of menopause on maximum phonation time (MPT). Here, we hypothesise that MPT is reduced, further inspecting its relationship with flow rate and phonation types.
Seventeen singers experienced in different musical genres were recorded, 7 post-menopausal. They were all asked to perform a sustained vowel, for as long as they could after a deep inhalation (MPT task) in Neutral, Breathy and Pressed phonation, a task repeated 3 times while keeping vocal loudness similar. Both audio and lung volume (LV) signals were recorded synchronously using the free software FonaDyn (by Sten Ternström, Sweden) and an AC/DC coupling system attached to an RME sound card and a portable computer. LV was recorded in terms of two respbands, one placed on the ribcage and the other on the abdominal wall. For each participant, the highest respband voltage for the entire vowel sequence was set to 100 % LV, whereas 0 % LV was set to the lowest respband voltage observed during the entire sequence. The differences between the groups were analysed in terms of MTP and flow rate, the latter computed as the ratio between the LV difference and the duration, averaged across takes. Results showed no difference for the Neutral and Breathy phonation. However, for Pressed phonation, postmenopausal singers revealed a clear reduction of MPT combined with a greater flow rate than the pre-menopausal group. The reason for this difference could be related to muscle force reduction of both adductory and respiratory muscles in association with menopause.

Keywords: *Menopause, Maximum Phonation Time, Lung Volume, Flow rate, Singers*

GENDER ROLE EFFECTS ON PHONATORY FLOW RATE IN SPANISH SPEAKERS

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Acoustic cues of gender stereotypes have been demonstrated mainly in studies focussing on acoustic parameters, such as fundamental frequency and formants spacing. Here, we investigate effects of gender and biological sex on physiological metrics, such as phonatory airflow.
Thirty four cisgender heterosexual Spanish young adults were recorded while repeating the same phrase at 5 different portrays: the same gender as biological sex, (1) with and (2) without stereotyping for that gender; the opposite gender of biological sex, (3) with and (4) without stereotyping for that gender; and (5), the same gender as biological sex after stereotyping for that gender with a visual cue. These portrayals were recorded in a sequence from 1 to 5, so that 1 could be used as a perceptual reference. All recordings were made in a sound treated portable cabinet using FonaDyn software (by Sten Terntröm, Sweden) for synchronous recordings of audio and lung volume signals. The latter was measured by means of a RespTrack system (Columbi computers, Sweden), placing the upper and the lower elastic respbands around the chest and the abdominal wall, respectively.
As expected, results showed that male voices present higher phonatory airflows as compared to females when assuming the gender role that matches their biological sex. However, when visualising a cue for a feminine stereotype, their phonatory airflow rate increased when portraying a female role, a phonatory behaviour suggesting that males assume that feminine voices are breathier. The reverse was found for female voices. Thus, gender stereotypes seem also to be depicted from phonatory airflow.

Keywords: *Gender stereotyping, Acoustic cues, Spanish speakers*

WILL TEACHERS SING IN THE FUTURE?

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There is a growing perception that many teachers do not incorporate singing into their classroom practice. This issue is particularly relevant, as singing constitutes a fundamental pedagogical resource for pupils' cognitive, emotional, social, and communicative development. The present study aims to analyse the extent to which future teachers visualise themselves singing in the classroom, as well as to identify the educational, perceptual and emotional factors influencing this visualisation.

A descriptive–inferential quantitative design was adopted. Data were collected in 2024–2025 through a questionnaire administered to education undergraduates (N = 1.284) from six Spanish universities, with a predominantly female sample (83.4%). The instrument gathered information on educational background, self-perceived musical and vocal skills, and beliefs and expectations regarding the use of the voice in future practice. Data analysis was conducted using descriptive statistics and inferential tests (χ^2, contingency coefficient, and Kendall's Tau-b), with the central variable being the visualisation of seeing oneself singing in the classroom.

The results indicate that 39.2% of the students do not visualise themselves singing in the classroom. It is noteworthy that 21.7% of students specialising in music also do not foresee themselves using singing in their future practice. This visualisation is positively associated with self-perceived vocal competence and negatively related to emotional factors such as embarrassment. Notably, 80% of the students do not share the idea that it is necessary to sing well in order to be a teacher, and this view significantly affects their visualization of themselves singing in the classroom ($\chi^2 = 114.2$, $p < 0.001$; $C = 0.286$).

These findings reveal a limited projection of singing into future teaching practice, underscoring the need for faculties of education to explicitly address students' vocal self-concept and to strengthen singing as a transversal pedagogical competence.

Keywords: *teacher education, music education, singing practice, vocal competence, vocal self-concept*

HIGH NOTES, LOW LARYNX? ENDOSCOPIC AND PALPATORY EVALUATION OF BEL CANTO SINGING IN A TENOR

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Bel Canto is regarded as a fundamental technique in classical opera singing; however, its physiological correlates within the vocal tract remain a topic of ongoing discussion among voice scientists, clinicians, and vocal pedagogues. The aim of this presentation is to demonstrate functional differences in vocal tract behavior when Bel Canto principles are consciously applied during opera singing, compared with opera singing performed without this technique.
The presentation is based on endoscopic recordings of the vocal tract obtained during a controlled examination of a male classical singer (tenor). During the examination, the singer performed identical vocal exercises, first using the Bel Canto technique and subsequently performing the same tasks without applying Bel Canto principles. The recordings allow direct visualization of the pharyngeal and laryngeal structures during phonation. In addition, the position of the larynx on the neck was assessed palpatorily throughout the examination.
Endoscopic analysis revealed clear differences in vocal tract configuration between the two conditions. Singing with Bel Canto technique was associated with characteristic postural and dynamic changes, particularly evident on higher pitches. These included posterior retraction of the tongue root, modification of pharyngeal space, and increased anterior–posterior compression of the larynx when compared to non–Bel Canto singing. Palpatory assessment demonstrated that during Bel Canto singing the larynx was positioned lower in the neck than during opera singing without Bel Canto, especially within the higher tessitura.
By presenting synchronized endoscopic video and audio material, this session provides an opportunity to observe real-time physiological mechanisms underlying Bel Canto singing. The findings may have practical implications for vocal pedagogy, voice therapy, and clinical voice assessment.

Keywords: *Bel Canto, classical singing, vocal tract physiology, laryngeal function, endoscopic evaluation*

HYPERFUNCTIONAL VOICE BEHAVIORS IN LEBANESE SINGING STYLES: A PRELIMINARY STUDY BASED ON SPECTRAL COMPARISON OF URBAN BEIRUT AND RURAL BEKAA REGIONS

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Across cultures, researchers have documented vocal strategies related to high vocal load and hyperfunctional voice behaviors, in traditions involving sustained intensity, increased vocal saturation, and elevated acoustic output. Such strategies have been described in controlled screaming, distortion-based singing, and other forms of so-called high-load vocal production, including metal, flamenco, and comparable intensity-driven vocal practices. Lebanese singing has not, to date, been investigated from this perspective.

This study proposes a comparative framework positioning Bekaa singing, a predominantly rural vocal tradition, as an internal high-load extreme within Lebanese singing practices, contrasted with Beirut singing, which is described as urban, lighter, less force-anchored. Rather than comparing distinct repertoires, the analysis is based on identical melodic material performed in two stylistic realizations, enabling direct comparison of vocal strategies independent of melodic, modal, or textual variation. The analysis examines ornamentation density and timing, emphatic consonant loading, patterns of vocal emphasis, and spectral characteristics associated with increased vocal saturation and elevated vocal load. A corpus of melodic samples in Beirut and Bekaa styles was analyzed, with focus on spectral measures as objective indicators of vocal load distribution, resonance strategy, and acoustic output. Results show that Bekaa realizations exhibit greater spectral energy concentration in mid-to-high frequency, increased indicators of vocal saturation, denser, more force-anchored ornamentation, and stronger emphatic consonant loading compared to Beirut performances of the same melodies. In contrast, Beirut realizations display lighter spectral profiles, reduced saturation, and less ornamentation, consistent with lower vocal load.

These findings indicate that Bekaa singing relies on systematic, culturally stabilized high-load vocal strategies, comparable in functional terms, to high-intensity vocal behaviors in other cultures. This study contributes to understanding how elevated vocal load can be organized, efficient, and potentially sustainable, informing voice assessment, preventive strategies, and pedagogical approaches to high-intensity singing.

Keywords: *high vocal load, spectral analysis, Lebanese singing*

DEMONSTRATION OF EPITHELIAL OSCILLATION AT SMALL GLOTTAL ORIFICES IN PHONATION FREQUENCIES ABOVE 1000 HZ

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Recently, hypotheses on the production mechanisms of fundamental frequencies above 1000 Hz are being discussed regarding epithelial dominated vocal fold oscillations. The investigation of such mechanisms in-vivo is usually impaired by constricted supraglottal or pharyngeal settings, tiny amplitudes of the vocal folds and too low sampling rates of laryngoscopic high-speed cameras. Using simultaneous high-speed videolaryngoscopy at 20,000 fps, electroglottography (EGG), and audio recordings, it was possible to detect oscillations with small amplitudes at orifices of the vocal folds when producing frequencies above 1000 Hz in male and female subjects. The fundamental frequencies derived from Audio-, EGG and glottal area signals corresponded. The oscillating orifices were smaller than 25 % of the total visible vocal fold length. Several types of vocal fold configurations with complete closure or additional open chinks were detected, with various manifestations in the acoustic spectra. An attempt is being made to classify the phenomena into existing categories of M3 and M4.

Keywords: *epithelial oscillation, high-pitched phonation, high-speed videolaryngoscopy*

DEVELOPMENT OF A SOCIAL VALIDITY QUESTIONNAIRE FOR VOICE THERAPY: A PILOT STUDY

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The purpose of this study was to present the pilot application results of a Social Validity Questionnaire developed to evaluate the social validity of voice therapy practices and to examine the preliminary psychometric properties of the instrument. The Social Validity Questionnaire was developed based on the literature on social validity and previous studies on voice therapy practices. The questionnaire consists of a total of 12 Likert-type items assessing the dimensions of meaningfulness, applicability, and usefulness. Content relevance and clarity of the items were reviewed by two speech and language therapists and one otolaryngologist. The pilot application of the questionnaire was conducted with 17 participants who attended a voice therapy program. Quantitative data were analyzed using descriptive statistics, the Wilcoxon signed-rank test, and Cronbach's alpha coefficients, while qualitative data were analyzed through content analysis of open-ended questions. The results indicated that social validity scores across all subdimensions were significantly higher than the neutral value of 3 ($p < 0.001$). The Cronbach's alpha coefficient for the total scale was calculated as 0.73, indicating acceptable internal consistency. Examination of the subscales revealed acceptable internal consistency for the meaningfulness ($\alpha = 0.74$) and usefulness ($\alpha = 0.64$) dimensions, whereas the applicability dimension demonstrated low internal consistency ($\alpha = 0.27$). Responses to the open-ended questions yielded themes that supported the content validity of the items. The findings of this pilot study suggest that the developed Social Validity Questionnaire may be a useful measurement tool for assessing perceived social validity in voice therapy practices. Further studies with larger samples are required to support the construct validity and reliability of the questionnaire.

Keywords: *Voice therapy, social validity, scale development, therapy efficiency, measurement and evaluation*

TRADITIONAL ROMANIAN SINGING AND VOICE THERAPY: EXPLORING VOCAL STYLE AND THERAPEUTIC APPROACHES

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Traditional Romanian singing is characterised by unique vocal techniques, ornamentation, and expressive intensity that reflect the rich cultural heritage of the region. However, these stylistic features often place specific demands on the vocal mechanism, which can lead to voice strain or dysfunction when performed without proper technique or awareness.

This presentation explores the intersection between traditional Romanian vocal style and modern voice therapy approaches. Through clinical case studies and stylistic analysis, we will examine how voice therapy can support singers in maintaining vocal health while preserving stylistic authenticity. Emphasis will be placed on the role of specialised assessment, individualised vocal exercises, and culturally informed rehabilitation strategies.

The goal is to bridge the gap between traditional vocal artistry and evidence-based therapeutic practice, offering insight into how voice professionals can address the needs of singers performing within culturally specific genres.

Keywords: *traditional singing, voice, therapeutic approaches*

VOICE DIFFICULTIES AND VOCAL CONGRUENCE FOLLOWING RADIOTHERAPY FOR HEAD AND NECK CANCER

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Radiotherapy for head and neck cancer commonly results in persistent voice difficulties affecting communication and quality of life. While voice impairment has been widely studied, the relationship between post-treatment voice difficulties and vocal congruence has not been examined. This study aimed to (1) characterise self-reported voice difficulties following radiotherapy and (2) examine relationships between voice-related quality of life, self-perceived voice characteristics, and vocal congruence.

An online survey of adults treated with radiotherapy for head and neck cancer was advertised via Irish clinical sites and online support groups. Voice difficulties were summarised descriptively. Functional impact was measured using the Voice Handicap Index-10 (VHI-10), vocal congruence using the Vocal Congruence Scale (VCS), and self-perceived voice quality using a slider from 0-100. Spearman's rank correlations with Holm-Bonferroni correction examined associations between measures.

Forty-seven valid responses were analysed. Time since radiotherapy ranged from <1 month to >2 years and was not associated with VHI-10 (r_s=.006, p=.971), VCS (r_s=.113, p=.448), or voice quality (r_s=-.278, p=.072). Most participants reported voice changes, and over half avoided activities or conversations because of their voice. Median VHI-10 score was 16 (IQR 5-27) and median VCS score was 21 (IQR 9-31). Voice quality varied widely (median 50, IQR 5-68). Functional impact was strongly associated with voice quality (r_s=.771, p<.001). The association between vocal congruence and voice quality (r_s=-.325, p=.033) did not remain significant following Holm-Bonferroni correction. No significant association was observed between functional impact and vocal congruence (r_s=-.226, p=.127).

Voice difficulties following radiotherapy are common and impactful. Self-perceived voice quality was strongly associated with functional impact, while associations with vocal congruence were not significant after correction. Clinical management should therefore address not only vocal impairment but also broader functional consequences of voice change. Findings should be interpreted in light of the cross-sectional design, modest sample size, and reliance on self-report.

Keywords: *Head and neck cancer, radiotherapy, voice disorders, vocal congruence, voice-related quality of life*

NOSE RESONANCE AND VOICE

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Background: Some singing teachers argue that nasalization should be avoided while other teachers recommend a slight degree of nasalization. This raises the question of what the associated timbral effects may be. The acoustic properties of the nose are determined by its shape, which vary within wide limits between people. We have documented the acoustic properties of nasal tracts, analyzed how they are affected by the paranasal sinuses and also to what extent they can be reliably analyzed in 3D-replicas of anatomical specimens.
Methods: Resonance properties of nasal tracts were analyzed in 9 ex-vivo specimens as well as in 3-D replicas by sending a sinewave sweep from an earphone, airtightly sealed into the velopharyngeal port. Responses were recorded at a nostril. The acoustical influence of the sinuses was reversibly eliminated by occlusion of their ostia.
Results: Two main resonances were found in all nasal tracts as well in replicas, one in the 600-750 Hz range and the other in the 2500 – 3500 Hz range. The paranasal cavities complicated the response curves considerably by introducing V-shaped valleys at their respective resonance frequencies and also peaks.
Conclusions: In the absence of paranasal cavities, nasal tracts possess two main resonances mainly determined by their anatomical length. The resonances of the paranasal cavities introduce minima and maxima in the frequency response curves with substantial inter-individual variation. Replicas of anatomical specimens provide reliable data for acoustic analysis. Timbral effects of a narrow velopharyngeal opening will be described.

Keywords: *sinuses, transfer function, velopharyngeal port*

THE INFLUENCE OF VENTRICULAR FOLD POSITION ON VOCAL FOLD OSCILLATION: INITIAL FINDINGS FROM DYNAMIC 3D MAGNETIC RESONANCE IMAGING OF PHONATION

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Ventricular fold (VenF) placement has been linked to glottal jet stability, impedance matching, and vocal tract acoustics, and is clinically observed in conditions like ventricular phonation and muscle tension dysphonia, where it may interfere with VF oscillation. Estill Voice Training® (EVT®) describes isolated VenF positioning combined with different VF configurations.

Whether VenF positioning directly affects VF oscillation, e.g. via changes in VF thickness, has remained unclear, as simultaneous in-vivo quantification of VenF position and VF vibration was not previously possible. Recent advances in dynamic 3D MRI enable simultaneous sub-millimeter imaging of VF vibration and supralaryngeal structures. This exploratory study therefore investigated the effect of VenF positioning on VF configuration and oscillatory behavior.

Dynamic 3D VF MRI (Fischer et al. 2026) was performed in four professionally trained singers (2♂, 2♀) under nine phonatory conditions combining three VF configurations (Thick, Thin, Stiff) with three VenF positions (retract, mid, constrict) as defined in EVT®. Phase-binned 3D-datasets were reconstructed to quantify laryngeal volumes, VF thickness, contact area, and displacement.

VenF retraction was associated with larger volumes, reduced VF thickness, and smaller contact area, whereas the mid position showed increased thickness, larger contact area, and smaller volumes. Constriction further increased those trends. These effects occurred across all VF configurations. Absolute measures reflected sex-related anatomical size differences, while oscillatory patterns showed comparable trends across participants.

Given the small sample and restriction to trained singers, generalizability to untrained or clinical populations is limited. VF–VenF covariation indicates shared muscular control. Beyond modulation of VF thickness via the M. vocalis, VenF configuration appears to influence vibratory behavior and may be partially adjustable independently of surrounding laryngeal and pharyngeal adduction. By elucidating supraglottic–glottic interactions, this study refines in-vivo concepts of phonatory control and positions dynamic 3D MRI as a complementary research modality with prospective clinical and pedagogical relevance.

Keywords: *vocal fold oscillation, vocal fold thickness, ventricular fold positioning, dynamic 3D MRI*

MULTIPHONICS – WORKSHOP FOR EXPERIMENTAL VOCAL TECHNIQUES

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The term Extended Vocal Techniques (EVT) refers to vocal practices that go beyond what is expected or considered "normal" singing technique. Often, the classical belcanto tradition serves as a reference norm, from which other vocal expressions are understood as "extended" (Noble, C. J., 2019). At the same time, such terminology also reflects the fact that vocal phenomena cannot yet be fully explained in physiological or acoustic terms, which makes it difficult to assign precise and unambiguous labels to vocal practices. EVT is therefore not a fixed or objective term, but highly context-dependent: techniques such as throat singing, phonatory processes during inhalation, and the resulting multiphonics may be considered "extended" in a classical concert context, while they are established in other musical or cultural settings – for example, in indigenous traditional music or popular music styles. Against this background, this workshop deliberately focuses on the experimental exploration and the breadth of these vocal techniques, in order to enable a deeper understanding of the versatility of the human voice.
Experimental vocal techniques open up diverse possibilities for extensive vocal exploration and artistic expression. Participants will have the opportunity for practical exploration of selected vocal techniques and to investigate their safe application in terms of vocal health. In addition, these techniques will be explored as effective preparatory and warming-up practices that can also support "normal" singing techniques. Furthermore, some underlying physiological processes of selected techniques will be explained.
The event is aimed at singers, singing teachers, speech therapists, and anyone interested in the intersection of voice science and creative expression. Prior experience with experimental vocal techniques is not required.

Noble, C. J. (2019) Extended From What?: Tracing the Construction, Flexible Meaning, and Cultural Discourses of "Extended Vocal Techniques", University of California Santa Cruz, California Digital Library

Keywords: *Workshop, Experimental Vocal Techniques, Multiphonics, practical vocal exploration, artistic expression*

"IT REMINDS ME – AH, RIGHT, YOU'RE SUPPOSED TO DO IT THIS WAY": PATIENTS' EXPERIENCES OF A VOICE THERAPY APP

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Background:
Adherence to home practice is a key factor in successful voice therapy, yet many patients report difficulties remembering and performing exercises correctly between sessions. Digital tools, such as mobile health applications, may support self-directed practice, but patient experiences of app-supported vocal practice between sessions remain underexplored, particularly in a Swedish context.
Aim:
To investigate, analyse, and describe patients' experiences of self-supervised home training using a voice therapy app, The Voice Assistant (Swedish: Rösthjälpen).
Methods:
Semi-structured interviews were conducted with twelve adults who had completed voice therapy for functional or structural voice disorders and used The Voice Assistant to support continued home practice. Interviews were audio-recorded, transcribed verbatim, and analysed using systematic text condensation, a qualitative inductive method for thematic analysis.
Results:
Three main themes were identified. The App as a Companion described how the app provided structure, calmness, auditory guidance, and a sense of support between therapy sessions, facilitating focus and adherence. To Keep/To Develop reflected participants' views on preserving the app's simplicity and core function of audio-guided exercises, alongside suggestions for future development such as feedback, self-recording, or communication with their speech and language therapist. Repetition and Continuity highlighted the app's role in reinforcing learning, supporting motivation, and enabling long-term, self-directed practice beyond the formal therapy period. Overall, the app was perceived as easy to use, flexible, and well-integrated into everyday life.
Conclusions:
Participants experienced The Voice Assistant as a helpful companion in home-based voice therapy. Several app features appeared to promote self-regulation; a factor previously associated with successful voice therapy outcomes. The findings suggest that audio-guided mobile applications may reduce barriers to home practice and support sustained voice training. Further studies are needed to evaluate clinical outcomes and long-term effects.

Keywords: *Voice Disorders, Voice Therapy, mHealth, Mobile Applications, Qualitative Research*

RECLAIMING THE WOMEN'S VOICE

Elizabeth Ebbink
Vocal communication training Elizabeth Ebbink

RECLAIMING THE WOMEN'S VOICE
Workshop Elizabeth Ebbink, Voice Trainer, Psychologist, Operasinger Amsterdam

Summary: For 5000 years of patriarchy, women's speaking voices have been confined to an impossible choice: be acceptable (high, soft, breathy) but powerless, or be powerful (loud, low, commanding) but hated and feared. How can voice professionals can help women reclaim their full vocal freedom.

The Impossible Choice: Women seek voice therapy to make their voice lower. Female voices are judged as "too high" (childlike, stupid), "too soft" (weak), "too loud" (aggressive), "too low" (fake, manipulative), "too fast" (nervous). Women face a double bind: sound feminine and be dismissed, or sound authoritative and be despised.

What Voice Professionals Can Do:
Examine Our Own Beliefs - Do we unconsciously reinforce the warrior/victim dichotomy?
Teach Vocal Dimensions - vocal tools for influence
Teach Melodic Travel - insight in expertise, presence, connection and boundaries.
Change Labels - Reframe negative labels for big female voice
Develop Full Vocal Range

With these steps we develop The Free Women's Voice. Beautiful, powerful voices require not so much muscle strength, but rather vibration, relaxation. The courage to let go and be vulnerable is precisely what makes the voice big commanding and joyful.
About the presenter: Voice Trainer Elizabeth Ebbink has worked for 40 years as a voice trainer/coach with speakers in business, politics, and media. She was trained as a psychologist and opera singer. She specializes in the intersection of voice, identity, and personal power.
Pevoc 2019, she gave a workshop about the voices of Obama, Trump, Merkel and Thatcher as vocal icons for different views of power.
Pevoc 2022, she presented ‘intimacy, power, connection and courage in business voices’. About the vocal tools for influencing.
Pevoc 2024 she presented ‘fashion in Voices’. About social change and the change in voice behavior.

Keywords: *women's voice, voice as social construct, vocal double bind, vocal range*

reclaiming the women's voice

How societal roles make it hard for women to speak

OPENING THE 'BLACK BOX' OF VOICE THERAPY: INVESTIGATING CVT-VOICE THERAPY IN PMTD USING THEMATIC ANALYSIS AND THE REHABILITATION TREATMENT SPECIFICATION SYSTEM

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Aim and Objectives: Voice therapy is often described as a "black box," with insufficient detail on the active therapeutic components driving change. This study aimed to qualitatively analyze the structure, techniques, and pedagogical features of Complete Vocal Technique–Voice Therapy (CVT-VT) for the treatment of primary Muscle Tension Dysphonia (pMTD), using thematic analysis and the Rehabilitation Treatment Specification System (RTSS).

Methods: Fourteen adults with pMTD were recruited at a National Health Service voice clinic; eleven completed the CVT-VT protocol (average 4.2 sessions) and attended the follow-up research clinic. 54 recorded therapy sessions were transcribed and analyzed through reflexive thematic analysis, followed by consensus classification according to the RTSS framework. Triangulation was achieved using session transcripts, practitioner patient journal notes, and multi-investigator analysis incorporating perspectives of SLP, singing voice rehabilitation, and vocal pedagogy.

Results: Thematic analysis identified five overarching themes: demystifying voice physiology, (re)coordinating breath and phonation, working toward a clear sound, avoiding uncontrolled constrictions, and designing one's own sound. RTSS consensus analysis specified 10 treatment targets (e.g., increased clear voice, improved stamina, patient empowerment, and achieving healthy loudness) and their ingredients, highlighting functional exercises (e.g., voiced fricatives, SOVTEs, epilaryngeal narrowing, and metallic voice) and pedagogical strategies (e.g., structured feedback, motivational scaffolding, Growth Mindset, and self-efficacy). CVT-VT emphasized coordinated control of respiratory, phonatory, and resonatory subsystems, with deliberate progression from therapist guidance to patient independence.

Conclusion: CVT-VT represents a functionally oriented, patient-centered intervention for pMTD that integrates explicit pedagogy with deliberate therapeutic practice. Findings highlight the value of qualitative inquiry to examine not only what therapy is delivered, but how it is pedagogically delivered. The findings participates in opening the "black box"of therapy, detailing active components and mechanisms of action, suggesting potential for reduced treatment duration compared to traditional voice therapy. Further evaluation in randomized controlled trials with extended follow-up is warranted.

Keywords: *Voice Therapy, Muscle tension Dysphonia, Singing Voice Rehabilitation Specialist, Complete Vocal Technique-Voice Therapy*

GOING BEYOND THE REGISTER - VOCAL MODE CATEGORISATION ACROSS FOUR OCTAVES IN PROFESSIONAL MALE AND FEMALE SINGING VOICE USING VOICE RANGE PROFILE, EGG, ACOUSTIC, AND VIBROACOUSTIC MEASUREMENTS: DOUBLE CASE STUDY

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Introduction: Registers are considered a fundamental yet controversial topic in relation to the lack of generally accepted definitions and pedagogical application. Recent discoveries suggest that singers are able to use specific vocal tract configurations across upward of three octaves without register changes. Previous research has shown differences between registers at the glottal level as well as in perceptual, acoustic, physiological, and aerodynamic dimensions. This study investigates loudness and vocal quality conditions across 3-4 octaves.

Methods: Double-case study of two professional singers (F1—AFAB, M1—AMAB) performing vocal tasks based on Complete Vocal Technique modes, sustained vowels, at varying intensities across their vocal range. 572 (F1) and 516 (M1) samples were analyzed, focusing on SPL, fo, formants, spectral parameters (SPR, L1-L2, and SCO-2.5), jitter, shimmer, CPPS, NHR, and EGG. Statistical methods included t tests, Wilcoxon tests, Bonferroni correction, linear regression, and factor analysis.

Results: Both singers produced samples in M1 and M2-type vibratory mechanisms extending beyond typically observed pitch regions for traditional registers, with the male covering a total of four octaves (C2-C6) with all conditions represented in three octaves, while the female covered three octaves (D3-D6) with all conditions represented in two octaves. Metal and density parameters systematically and linearly varied with fo and influenced SPL, acoustic spectra, and EGG measures. Metallic conditions exhibited higher SPL and Qx, while non-metallic conditions showed lower SPL and EGG-waveform magnitude. Factorial analysis revealed statistical differentiation for metal and density. Classical samples showed restricted use of vocal modes throughout the range, whereas CCM samples did not.

Conclusion: Metal and density parameters offer a stable, measurable, and statistically significant nuancing beyond traditional register classifications. Participants produced vocal configurations across more than three octaves. Register boundaries are fluid and singers can manipulate vocal fold vibratory patterns and vocal tract setup to maintain timbral consistency across an extended range.

Keywords: *Register, Vocal mode, CVT, Metal, Density*

SOVTE EFFECTS ON LARYNGEAL GESTURES IN SINGING OBSERVED DURING AND AFTER 4 INTERVENTIONS USING STROBOSCOPY AND EGG: (MIS)MATCH BETWEEN SOVTE AND VOCAL TECHNIQUE

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Background
SOVTEs are widely used in by pathological and healthy professional voice users. SOVTEs have been shown particularly useful in the treatment of hypo/hyper-functional dysphonia. However, potential contraindications for SOVTEs are sparsely studied, with some clinical results suggesting fatigue and tiredness from SOVTEs in both patients and singers, at least short-term. Recent studies document epilaryngeal expansion during and after SOVTEs, which may be counterproductive for learning sounds requiring such narrowing.

Objective:
To study the effects of four common SOVTEs in healthy professional singers producing different voice conditions at various loudness levels and qualities.

Methods:
Double-case nasostroboscopic study (male and female) of sustained vowels for 8 conditions (vowel EH for all conditions, except one produced on UH) varying in loudness and quality with four SOVTEs (3mm straw, 10cmH20 WRT, Shaker Deluxe at 5cmH20, and voiced vvvf-fricative). Stroboscopy, EGG, and audio were obtained before, during, and after SOVTEs. Expert ENTs assessed endoscopic materials. Baseline SVHI and VTDS prior to interventions and an adapted VTDS for each intervention was collected.

Results:
SOVTEs resulted in epilaryngeal expansion for both participants, particularly visible during phonations with prior marked epilaryngeal narrowing. For the female, 3mm, 10cmH20 WRT, and Shake Deluxe interventions destabilised the voice source and changed vocal fold vibratory pattern as observed by EGG wavegram -not the voiced fricative. For the male, 3/4 SOVTEs caused marked epilaryngeal expansion and pronounced vocal fatigue. For both participants, samples requiring more initial epilaryngeal narrowing and firmer adduction coupled with SOVTEs were associated with increased VTDS symptom severity.

Conclusions:
Epilaryngeal expansion from SOVTE interventions were visible for different vocal coordinations. Sounds requiring epilaryngeal narrowing seem mismatched with high resistance SOVTEs, whereas sounds less reliant on epilaryngeal narrowing may benefit from the increase flow and adduction control provided by SOVTEs. Research into alignment between target output and SOVT is warranted.

Keywords: *Semi-Occluded Vocal Tract Exercises (SOVTe), Epilaryngeal Narrowing, Metal, habilitation, rehabilitation*

DYNAMIC REAL-TIME MRI OF VOCAL TRACT CONFIGURATIONS DURING ESTILL VOICE FIGURES

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Professional singing and speaking depend on finely coordinated muscular control throughout the vocal tract to generate a wide range of vocal qualities. The vocal tract is highly dynamic, and even subtle configurational changes can substantially influence timbre, loudness, pitch, and vocal color. While endoscopy and high-speed imaging allow visualization of selected structures, they provide only a partial view of the complex, coordinated internal adjustments underlying voice production.

Real-time two-dimensional magnetic resonance imaging (2D MRI) offers a complementary approach by enabling simultaneous visualization of movements across the entire vocal tract during phonation. In this study, a professionally trained singer produces selected Estill Voice Training® Figures, which are designed to isolate and train specific anatomical components of the vocal tract. Dynamic 2D MRI data were acquired with a temporal resolution of 24 frames per second, allowing detailed observation of time-dependent vocal tract adjustments during sustained phonation tasks.

The presentation focuses on key structures involved in shaping vocal output, including the tongue, velum, larynx, aryepiglottic sphincter, and the coordinated movements of the thyroid and cricoid cartilages. By examining these regions using a dynamic approach, the study highlights their adaptability and the complex spatial and functional interactions associated with distinct vocal qualities.

By visualizing vocal tract configurations in motion, 2D MRI provides a more comprehensive understanding of internal vocal dynamics than auditory or endoscopic observation alone. The findings demonstrate how MRI-based visualization can bridge voice science and vocal pedagogy, offering valuable insights for evidence-informed voice training, teaching, and interdisciplinary collaboration between researchers and voice professionals.

Keywords: *Voice, MRI, vocalstyles, voicecontrol, vocaltract*

VOICE TRAINING WORKSHOP & DYNAMIC REAL-TIME MRI OF VOCAL TRACT MOVEMENTS USING ESTILL VOICE FIGURES

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Professional singing and speaking depend on highly refined and precisely coordinated muscular control throughout the vocal tract, enabling the production of a broad spectrum of vocal qualities. Even minimal adjustments in vocal tract configuration can substantially affect timbre, efficiency, loudness, pitch, and vocal color.

The workshop explicitly bridges voice science and voice pedagogy by translating dynamic real-time MRI findings of vocal tract movements into pedagogically relevant concepts and practices. Participants will engage in guided experiential exploration of selected vocal tract adjustments while observing corresponding 2D MRI imagery, acoustic measures, and spectrographic feedback.

Drawing on research conducted at the Institute of Musicians' Medicine in Freiburg, the workshop presents 2D MRI data from a single, highly trained singer performing the Estill Voice Training® Figures—systematic exercises designed to isolate and train specific anatomical components of the vocal tract.

Particular emphasis is placed on the dynamic interactions of the tongue, velum, larynx, aryepiglottic sphincter, and the coordinated movements of the thyroid and cricoid cartilages. Analysis of these structures highlights their adaptability and the complex spatial and functional relationships that contribute to variations in vocal quality across singing and speaking tasks.

This interdisciplinary approach demonstrates the potential of MRI-based voice research to enhance conscious control of vocal tract shaping, may support efficient and healthy voice use, and deepen anatomical and acoustic understanding across diverse vocal styles. The workshop aims to foster meaningful collaboration between voice scientists and voice professionals, contributing to evidence-informed voice training, teaching, and clinical practice.

Keywords: *voicetraining, voiceresearch, 2DMRI, training&science, vocalcontrol*

LONGITUDINAL ANALYSIS OF ANAMNESTIC DATA AND EXAMINATION RESULTS ON ANATOMICAL PRECONDITIONS AND VOCAL CHARACTERISTICS OF PROSPECTIVE VOCAL STUDENTS BETWEEN 1981 AND 2025

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Objective
The anatomical and physiological conditions of the vocal system and the body are closely linked to a classical singer's vocal abilities, speaking voice, range and register. A healthy and resilient voice therefore requires a precise assessment of its potentials and limitations, as incorrect strain may lead to irreversible vocal damage.
The aim of this study is therefore to investigate anatomical preconditions and vocal characteristics of singing students, collected for over four decades in the context of their singing studies.

Method
At the beginning of their studies, singing students at the Conservatory of Music Carl Maria von Weber Dresden undergo an initial examination in which anamnestic data, laryngoscopic findings, general physical conditions (including body size and weight), vocal anatomy (including length and width of the vocal folds) and various vocal parameters such as range, habitual speaking pitch, and voice type are recorded and now analyzed.
In this study, N=603 students from the academic years 1981 - 2025 were included.

Results
The results show typical correlations for body size, weight as well as the length and width of the vocal folds when compared to range, habitual speaking pitch, and voice type. Moreover, they reveal an asymmetrical distribution of the voice profiles in this cohort of prospective professional singers, changes in physiological conditions over the four decades and significant changes in assessed vocal ranges.

Conclusions
This cohort of voice students is consistent with respect to previous literature in their general physical attributes and vocal characteristics. The distribution of voice profiles at the beginning of conservatory studies does not seem to align with demands of the music market. A considerable change in the assessments of the students physiological and musical vocal range over the four decades needs further attention.

Keywords: *Vocal students, Longitudinal analysis, Laryngoscopic examination, Vocal range, Vocal folds*

CONTROLLABLE VOCAL TRACT SHAPES FOR THE VOCAL TRACT ORGAN

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The vocal tract organ is a musical instrument that uses 3-D printed fixed shape vocal tracts. These are acoustically excited with a digitally generated larynx excitation signal that is played via a music keyboard or a slider. This paper describes the incorporation of a physically deformable synthetic vocal tract to replace the fixed shape hard (non-flexible) 3-D printed plastic tracts used in the existing Vocal Tract Organ. This will enable new paradigms for musical performance and composition as the tract shape and therefore the Vocal Tract Organ output spectrum will be modifiable in real time. The main aim of this work is to extend the capability of the existing Vocal Tract Organ and specifically, to provide a novel musical instrument for Shout at Cancer's alaryngeal choir. It would also offer a much wider timbral palate for composers and players alike.

The deformable vocal tract models the human vocal tract as a soft, compliant acoustic filter whose internal shape can be actively modified to produce recognisable vowel sounds and dynamic vowel transitions. The tract is moulded and cast in silicone rubber to ensure flexibility and airtightness and is driven by an electronically synthesised larynx source delivered via a loudspeaker. The modelled tract shape is controllable in real-time enabling a systematic reshaping of the tract including the mouth opening thereby facilitating controllable modifications of the resonant characteristics of the tract. Fixed actuator configurations correspond to target steady vowels, while time-varying configurations allow repeatable dynamic transitions between vowel shapes.

When incorporated into the keyboard-controlled and polyphonically playable Vocal Tract Organ, the deformable vocal tract offers enhanced expressive control and a much closer approximation to human vocal behaviour. This development will extend the instrument's potential both as a tool for research and pedagogy in voice acoustics and as a basis for new musical instruments.

Keywords: *voice, performance, alaryngeal, vocal tract organ*

DIAGNOSTIC PERFORMANCE OF ACOUSTIC VOICE PARAMETERS IN LARYNGEAL MASS LESIONS: EMPHASIS ON SHIMMER ANALYSIS

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Objective
To compare acoustic voice parameters among individuals with normal vocal folds, benign vocal fold lesions, and laryngeal mass lesions, and to evaluate the diagnostic performance of selected acoustic measures in discriminating laryngeal mass lesions.

Methods
This retrospective observational study included 117 patients who underwent acoustic voice analysis at a single tertiary center. Patients were classified as normal vocal folds (n = 13), benign vocal fold lesions (n = 47), or laryngeal mass lesions (n = 57).The laryngeal mass group consisted of mass-forming lesions that were clinically and endoscopically defined and confirmed as malignant by histopathological analysis. Acoustic parameters included fundamental frequency (F0), jitter (%), shimmer (%), and harmonics-to-noise ratio (HNR). Intergroup comparisons were performed using the Kruskal–Wallis test with Dunn–Bonferroni post hoc analysis. Effect sizes (r) and receiver operating characteristic (ROC) analyses were calculated.

Results
Significant overall differences were observed among groups for F0, jitter, shimmer, and HNR ($p < 0.05$). Shimmer differed significantly between the laryngeal mass group and both comparison groups, with moderate to large effect sizes. ROC analysis showed that shimmer demonstrated acceptable discriminative performance for identifying laryngeal mass lesions (AUC = 0.701, 95% CI: 0.605–0.796; $p < 0.001$), with a sensitivity of 78.9% and a specificity of 40.0%. Jitter showed statistically significant but weaker discrimination (AUC = 0.650, 95% CI: 0.549–0.751; $p = 0.005$).

Conclusion
Among the evaluated acoustic parameters, shimmer demonstrated the strongest discriminative performance for laryngeal mass lesions; however, its low specificity limits its use as a standalone diagnostic marker. These findings should be interpreted considering the retrospective single-center design, small normal control group, imbalanced group sizes, and heterogeneity of lesion types. Shimmer may serve as an adjunctive acoustic parameter when combined with clinical and endoscopic evaluation.

Keywords: *Voice analysis, Shimmer, Laryngeal mass lesions, Acoustic parameters, Receiver operating characteristic analysis*

VOCAL FATIGUE IN MULTIPLE SCLEROSIS: PATIENT-REPORTED VS PERCEPTUAL AND OBJECTIVE MEASURES

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Aim:
To determine whether vocal fatigue in multiple sclerosis (MS) is more strongly associated with patient-reported voice impact and phonatory endurance measures than with objective dysphonia severity defined by the Dysphonia Severity Index (DSI).

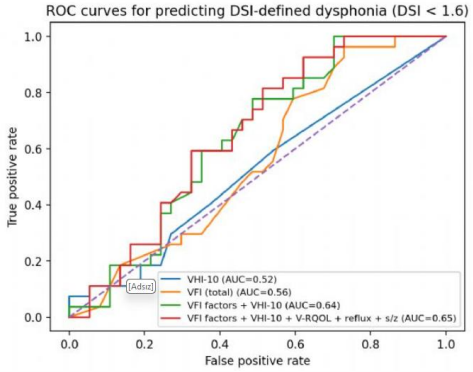
Materials-Methods:
This cross-sectional study included 64 patients with MS. The predictive ability of patient-reported outcome measures—the Vocal Fatigue Index (VFI), Voice Handicap Index-10 (VHI-10), and Voice-Related Quality of Life (V-RQOL)—for DSI-defined dysphonia was evaluated. Voice recordings were analyzed using Praat software. Maximum phonation time (MPT, s) was obtained from sustained /a/. Highest fundamental frequency (F0_high, Hz), lowest intensity (I_low, dB), and jitter (%) were extracted from pitch, intensity, and periodicity analyses.
The Dysphonia Severity Index was calculated as:
DSI = 0.13×MPT + 0.0053×F0_high - 0.26×I_low - 1.18×Jitter(%) + 12.4.
Dysphonia was defined using a commonly applied cutoff (DSI < 1.6). Logistic regression models were constructed using VHI-10, VFI (total and factor scores), and V-RQOL, with reflux status (yes/no) and s/z ratio included as clinical covariates.

Results:
Patient-reported scales demonstrated weak discrimination for DSI-defined dysphonia. The area under the curve (AUC) was 0.52 for VHI-10, 0.56 for VFI total score, and 0.64 for combined VFI factor scores and VHI-10. Inclusion of V-RQOL, reflux status, and s/z ratio modestly increased the AUC to 0.65. Lower V-RQOL scores and shorter MPT showed trend-level associations with greater vocal fatigue. These findings are consistent with MS-related central fatigue mechanisms, in which perceived vocal fatigue may not directly correspond to acoustic dysphonia severity.

Conclusion:
In MS, vocal fatigue appears to be more closely related to patient-perceived voice impact and reduced phonatory endurance than to objective dysphonia severity as measured by the DSI. The modest discriminative performance of patient-reported scales, underscore the need for fatigue-specific outcome measures in the MS patients.

Keywords: multiple sclerosis, vocal fatigue, Dysphonia Severity Index, Voice Handicap Index

Figure 1.



Receiver operating characteristic (ROC) curves for predicting DSI-defined dysphonia (DSI < 1.6) in patients with multiple sclerosis using VHI-10, VFI (total and factor scores), and combined patient-reported models (with and without V-RQOL, reflux status, and s/z ratio).

VIBRATIONAL MODES OF THE VOCAL FOLDS IN SUBHARMONIC PHONATION

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Subharmonic phonation occurs when one or more fractional components of fundamental frequency (fo) appear in the voice signal. Most commonly, the second subharmonic (fo/2) is observed; however, higher-order subharmonics, i.e., third (fo/3), fourth (fo/4), etc., can also be produced. Subharmonic phonation can result from interaction between vocal folds and other laryngeal structures (e.g., ventricular folds or aryepiglottic tissues), but it can also be produced solely by the vocal folds. Particularly in the latter case, the biomechanical behavior of the vocal folds has not been fully understood. This study aimed to identify the vibrational vocal fold modes responsible for subharmonic oscillations using high-speed laryngeal videoendoscopy, focusing on detecting and comparing the mode shapes (topos) and eigenfrequencies (chronos) forming successive subharmonics.
We examined a contemporary experimental singer capable of producing subharmonic series (fo -> fo/2 -> fo /3 -> fo /4) by vocal fold oscillations without interaction with other laryngeal tissues. The oscillations were recorded at the rate of 7200 frames per second using a high-speed camera with a 90° laryngoscope. Glottal contour was extracted using Glottal Analysis Tools (Kist et al. 2021). Modal decomposition was performed in a self-made script in MATLAB based on Neubauer et al. (2001).
During subharmonic phonation, higher-order modes were observed, splitting the glottis anterior-posteriorly into two, three, and four oscillatory half-wavelengths. These modes contributed differently to individual subharmonic regimes. The primary differences among the second and higher-order subharmonics were found in the chronos (temporary behavior) rather than topos (shapes) of the respective modes.
The results show that the approach based on vocal fold modes is an insightful tool for understanding complex vocal fold vibratory patterns and can be applied to other problems, such as register transitions.

Keywords: *vocal fold oscillations, subharmonic phonation, vibrational modes, high-speed videolaryngoscopy*

FORMANT TUNING IN THE PERSIAN SINGING STYLE OF AVAZ

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The once courtly heritage of Persian avaz is a living solo singing tradition in Iran, and is mostly sung in free rhythm in the higher part of the vocal range with quick quasi-improvised melodic ornamentation. Following upon the authors' earlier case study on the timbral and melodic characteristics of avaz, this study is focusing on the lowest formant frequencies in relation to the harmonics. Audio and electroglottograph (EGG) signals were recorded from stylistically representative male and female singers singing typical avaz excerpts as well as scales. Formant frequencies (F1 & F2) were measured from inverse filtering of the audio signal, using the custom made Sopran (Svante Granqvist) software.
The new study clearly confirms and extends the findings suggested by the earlier case study. The singers, ranging from internationally awarded avaz master to amateur/pupil, clearly applied formant tuning on various vowels: the female singers had F1 tuned in the proximity of H2, as did the male singers in the upper part of their F0.
The formant tuning of the most professional male singers encompassed the F0 range of 17-19 semitones, as they tuned F1 to H3/ H4 in their lowest F0 range in order to switch to H2 in their highest F0 octave. And the same singers also showed a tendency to tune their F2 to a higher harmonic on the few tones where F1 was not being tuned to a harmonic.

Keywords: *Formant tuning, Persian avaz, inverse filtering*

THE EFFECT OF RESONANT VOICE THERAPY ON REDUCING MIDDLE EAR EFFUSION: PRELIMINARY RESULTS

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In children, middle ear effusion following acute non-suppurative otitis media resolves spontaneously in approximately 85% of cases within three months. Surgical intervention is generally considered when effusion persists beyond this period. The Eustachian tube, which connects the nasopharynx to the middle ear cavity, is composed of relatively static anatomical structures, including bone and cartilage. Based on the hypothesis that vibration of the surrounding structures may facilitate the drainage of middle ear effusion, this study was designed to investigate the potential therapeutic effect of resonant voice therapy.

Children aged 7–12 years (18 patients enrolled to date) diagnosed with acute non-suppurative otitis media were instructed to perform resonant voice therapy exercises for 15 minutes per day over a one-month period, beginning at their second-month follow-up visit. All participants were re-evaluated at the third month following the onset of otitis media. Otoscopic examination, audiometric assessment, and tympanometric evaluation were used to compare the persistence of middle ear effusion and the need for surgical intervention between patients who received resonant voice therapy and those who did not.

Patients who participated in resonant voice therapy exercises demonstrated a reduced requirement for surgical intervention and showed superior mean hearing outcomes compared with patients who did not undergo rehabilitation therapy. These findings should be interpreted as preliminary results, as patient recruitment is ongoing and the final analysis will be conducted upon completion of enrollment.

Keywords: *Resonant voice therapy, Otitis media with effusion, Eustachian tube function*

SHORT-TERM EFFECTS OF VOCAL THERAPY TECHNIQUES: PERCEIVED VOCAL EFFORT AND CEPSTRAL CHANGES FOLLOWING ACAPELLA AND LAX VOX EXERCISES

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Objective:
The aim of this study was to investigate changes in perceptual and acoustic voice parameters during the day in teachers with high vocal demand and to examine the protective effects of semi-occluded vocal tract (SOVT) exercises, including Acapella and Lax Vox.

Methods:
Twenty-four high school teachers participated in this repeated-measures study. Each participant completed three sessions at one-week intervals: a control day without therapy, a day with Acapella exercises, and a day with Lax Vox exercises. Exercises were performed for 10 minutes in the morning, at noon, and in the evening. Voice assessments were conducted in the morning and evening. Perceptual vocal effort was assessed using the Borg CR-10 scale, and acoustic voice quality was evaluated using cepstral analysis (CPP/a/). Morning–evening comparisons were analyzed using paired-samples t-tests or Wilcoxon signed-rank tests, while within-day changes (ΔDay = evening - morning) were compared across sessions using repeated-measures ANOVA or the Friedman test, with Bonferroni-corrected post-hoc analyses.

Results:
Borg CR-10 scores increased significantly from morning to evening on the control day ($p < .001$), though no significant changes were observed on Acapella or Lax Vox days. There was no significant change in CPP/a/ on the control day. However, evening CPP/a/ values were significantly higher on the Acapella and Lax Vox days ($p = .004$ and $p = .030$, respectively). ΔDay Borg CR-10 scores differed significantly across session types ($p < .001$), indicating higher vocal effort on the control day. ΔDay CPP/a/ scores also differed significantly across sessions ($p = .020$), showing higher values on therapy days.

Conclusion:
These findings suggest that Acapella and Lax Vox exercises may attenuate short-term within-day increases in perceptual vocal effort and support acoustic voice quality in teachers, with both SOVT techniques demonstrating comparable preventive and supportive effects.

Keywords: *Acapella, Lax-Vox, Borg CR-10, CPP, Vocal demand*

INFLUENCE OF WATER RESISTANCE EXERCISE ON VOCAL VIBRATO IN CLASSICALLY TRAINED SINGERS

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Vocal Vibrato is an element in many singing styles which is not fully understood in biomechanical terms but is often referred to as sign of a free and relaxed voice.
As water resistance exercises are a common tool which aim to relax and free the voice by pressure resistance, and the massage effects and pressure modulations of low-frequency bubbles, it has been hypothesized that such exercises could have a direct effect on vocal vibrato. To investigate this topic, the phonations of eight western-classically trained singers (3 male, 5 female) with intended vocal vibrato were recorded through simultaneous high-speed videolaryngoscopy at 20,000 fps, electroglottography (EGG), audio recordings and a Rothenberg mask. The task of sustained phonations on vowel *was performed before and after a 10 minute water resistance exercise, as well as 10 minutes later. Outcome parameters were Vibrato Extent (VE), Vibrato Rate, Sound Pressure Level, and Cepstral Peak Prominence (CPP). CPP was found to be significantly raised (p=0.008) directly after the exercise and VE decreased 10 min after the intervention (p=0.04), however within very small ranges. The other parameters did not show systematic effects. Independent from measurement time point, the nasalance varied together with the vibrato's fo undulation in several subjects.*

Keywords: *Water resistance exercise, vocal vibrato, high-speed videolaryngoscopy, nasalance*

VOICE HEALTH IN TEACHERS: THE RELATIONSHIP BETWEEN QUALITY OF LIFE, ACOUSTIC PARAMETERS, AND OCCUPATIONAL VARIABLES

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Objective:
This study aimed to examine the relationships between objective acoustic voice parameters, demographic variables related to vocal hygiene and voice use, and voice-related quality of life in teachers.

Methods:
A total of 37 teachers without any organic voice disorders participated in the study. Perceptual, acoustic, and voice-use–related demographic data were collected from all participants. Acoustic voice measurements included fundamental frequency (F0), jitter, shimmer, and noise-to-harmonics ratio (NHR). Perceptual outcomes were assessed using the Voice-Related Quality of Life (VRQOL) scale, including total score as well as physical and emotional subscale scores. Based on data distribution characteristics, Spearman correlation analysis, the Kruskal–Wallis test, and the Mann–Whitney U test were used for statistical analyses. The significance level was set at $p < .05$.

Results:
No statistically significant relationships were found between acoustic voice parameters and VRQOL scores ($p > .05$). In addition, no significant differences were observed in VRQOL total or subscale scores with respect to occupational experience, weekly teaching hours, grade level taught, or daily water consumption ($p > .05$). In contrast, significant differences were found in VRQOL total and physical subscale scores according to tea and coffee consumption levels ($p < .05$). Post-hoc Dunn–Bonferroni analyses indicated that participants with tea–coffee consumption of >= 8 cups per day had higher physical subscale and total VRQOL scores compared to the other groups.

Conclusions:
These findings suggest that voice-related quality of life in teachers cannot be explained solely by objective acoustic measurements and that subjective experiences and lifestyle-related factors play a significant role. Accordingly, evaluation and intervention processes for teachers' voice health should adopt a holistic approach that considers not only acoustic parameters but also subjective voice perception, voice hygiene, and voice use habits.

Anahtar Kelimeler: *Teachers, VRQOL, Acoustic Analysis, Vocal Hygiene*

WHEN THE JAW SETS THE TONE: EXPLORING THE IMPACT OF TMD ON THE SPEAKING AND SINGING VOICE

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Temporomandibular disorders (TMD) are increasingly recognized as an influential yet often overlooked factor in both speaking and singing voice problems. This workshop explores the relationship between jaw function and vocal performance, integrating current theoretical insights with clinical observations. Participants will gain a deeper understanding of how altered mandibular alignment, muscular imbalance, and joint dysfunction can contribute to phonatory tension, reduced vocal efficiency, and limitations in resonance, articulation and even respiration.
Through a combination of lecture, case-based demonstration, and guided exercises, we will illustrate how TMD manifests in diverse vocal profiles and discuss assessment cues that help clinicians identify when the jaw is a contributing factor to voice problems. Several intervention strategies and exercises for the therapeutic or pedagogical setting will be practiced.

Keywords: *Temporomandibular Disorder, voice, MTD, professional voice*

PANEL: PROFESSIONAL VOICE TRAINING: A MULTIDISCIPLINARY APPROACH

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Professional voice users such as singers, actors, and public speakers, face complex demands that require efficiency, artistic freedom, and long-term vocal health. In practice, ENT and phoniatric specialists, voice therapists, and vocal coaches often work in isolation from one another, with limited exchange and sometimes unclear boundaries of responsibility.
This panel will explore the benefits of multidisciplinary collaboration: How can clinicians, therapists, and teachers combine their perspectives, define roles, and develop common strategies to support vocal well-being, artistic expression, and sustainable professional voice use?
The session will provide a platform for sharing experiences, discussing practical case studies, and identifying concrete approaches for closer collaboration in the care and training of professional voices.

Keywords: *Professional Voice Users, Multidisciplinary Collaboration, Vocal Health & Sustainability, Interprofessional Communication, Voice Care and Training*

ESTONIAN SWIMMING COACHES' VOICE QUALITY AND FACTORS AFFECTING IT

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Objectives
Swimming coaches are occupational voice users, who have received limited scientific attention. Indoor pool environment involves several unique vocal risk factors, including air temperature, humidity, exposure to chemicals (NCL 3), and elevated background noise, which may increase the risk for dysphonia. The aim of this study was to describe the voice quality of Estonian swimming coaches, to examine factors influencing vocal function, and to identify potential causes for dysphonia.

Methods
Fifty-nine swimming coaches completed a questionnaire and the VHI-30_EST. Coaches reporting voice-related complaints (n=34; 58%) were invited for further clinical assessment; 21 of them participated in it. Further assessment included transnasal fiberoptic laryngoscopy and voice analysis. Acoustic analyses were performed using PRAAT software and included the Acoustic Voice Quality Index, Cepstral Peak Prominence Smoothed, and Maximum Phonation Time.

Results
Work experience and the number of weekly training hours were not significantly associated with the occurrence of voice problems, although coaches with voice complaints tended to report slightly longer work experience and higher training loads. Coaching qualification and training group sizes were not significantly associated with voice fatigue or pain and hoarseness; pool size showed a marginal but non-significant trend towards an association with voice fatigue. Statistically significant difference was revealed with composite voice load indices. Those reporting complaints had higher physical, emotional, functional, and total voice load ($U = 789.0$, $p < 0.001$). Acoustic analyses demonstrated mild to moderate alterations in voice quality (AVQI, HNR, MFK). Laryngoscopic findings predominantly indicated functional voice disorders characterized by supraglottic hyperfunction (A-P=13; M-L=7), with complete glottal closure (n=11) and generally preserved regular mucosal wave (n=20); mild inflammatory (n=9) findings were observed.

Conclusion
Estonian swimming coaches show a high prevalence of voice problems primarily associated with increased voice load and functional laryngeal findings, while workload and environmental factors were not significantly associated with dysphonia.

Keywords: *Voice, occupational voice users, swimming coaches*

DO PARENTS, TEACHERS AND VOICE THERAPISTS PERCEIVE CHILDREN'S VOICES DIFFERENTLY?

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Usually, parents take the initiative to have their child's voice examined, sometimes after a comment from the teacher. While in daily practise children with moderate or severe hoarseness often present for voice examination, children with mild hoarseness rarely seek therapeutical attention. This could be explained by the difference between the perceptual evaluation of children's voices by parents, teachers and voice therapists. In this study, the authors investigate whether this difference actually exists.
Voice samples of 207 Belgian Dutch speaking primary school children, about 50 children per level, were gathered and evaluated by 4 speech language therapists after informed consent. Each of the 3 voice samples, a sustained vowel /aa/, a reading passage and (semi-)spontaneous speech, were assigned a degree of hoarseness ranging from 0 (no hoarseness) to 3 (serious hoarseness). After perceptual evaluation of the spontaneous speech, the voice therapist was asked whether she would refer the child for further voice assessment.
Parents and teachers were also asked to evaluate the voice of the children responding with yes, no or sometimes, to the question whether the child was hoarse. The question regarding referral was also put to them.
The voice therapists evaluated the quality of all voices significantly worse than parents and teachers according to the Mc Nemartest ($p<0.05$). There was no significant difference between the perceptual evaluation of the children's voices by parents and by teachers.
Significantly more children of 3 levels were referred for further voice assessment by voice therapists than by their parents. The difference between voice therapists and teachers was more clear with 5 levels yielding a significant difference between them for referral.
More results as well as consequences for daily practice will be discussed during the presentation.

Keywords: *voices, children, perceptual*

PUTTING LOUDNESS ON THE VOICE MAP

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The human voice's capabilities are conventionally documented through achievable combinations of fundamental frequency (f_0) and sound pressure level (SPL), establishing voice range profiles (VRPs) or voice maps. However, perceptual loudness may serve as a superior descriptor of voice's communicative potential. To address this consideration, loudness-augmented voice maps were developed for thirty-five participants phonating in chest (M1) and falsetto (M2) registers. For each voice map cell—representing individual combinations of f_0 and SPL—loudness levels (L_n) were estimated employing the ISO 532 loudness model. The isoparametric differential between L_n and corresponding SPL within each voice map cell was calculated as "excess loudness over SPL" (ELOS), quantified in units of [phon-dB]. ELOS values were predominantly positive yet non-uniformly distributed throughout participants' voice maps, indicating elevated loudness levels relative to respective SPL measurements. Comparatively larger ELOS values were observed for trained versus untrained singers and for M1 versus M2 phonation modes. Loudness-augmentation of voice maps constitutes a valuable analytical tool, elucidating how SPL variations translate into loudness gains independently of maximum loudness levels achieved. This methodology reveals that training may enhance both efficiency and control of vocal mechanisms across the complete voice range. The approach demonstrates that perceptual loudness provides additional insights beyond traditional SPL measurements, potentially offering more comprehensive characterization of vocal performance capabilities. Our findings suggest that vocal training influences not merely maximum output capacity but also the effectiveness of vocal production throughout the performer's entire phonatory range, highlighting the importance of considering perceptual parameters in voice assessment protocols.

Keywords: *voice range profile (VRP), voice map, loudness perception, singing voice registers*

VIBRATO DEVELOPMENT DURING CONSERVATORY TRAINING: A RETROSPECTIVE LONGITUDINAL STUDY

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Objective

The goal of this retrospective study was to examine the longitudinal vibrato development of classical singers during undergraduate conservatory training, testing the following research questions:

Does Vibrato Rate regress toward the group mean over time?

Does Vibrato Extent increase over the course of studies?

Method

Since 2002, bachelor students at the Hochschule für Musik Carl Maria von Weber Dresden have recorded a series of exercises during each year of their studies, including an ascending triad on an /a/ vowel with a sustained fifth.

Of the 275 students recorded between 2002-2021, 200 (122 F, 78 M) had more than one recording session within a four-year time frame and were included in the analysis.

From the ascending triad, the middle 50% was extracted from the sustained fifth. Vibrato-Rate (VR) and Vibrato-Extent (VE) were calculated for the observed frequency and amplitude modulations. Sustained segments likely to have been classified as non-vibrato in prior perceptual studies were automatically excluded from the analysis.

To investigate whether Vibrato Rate regresses to the mean, each measurement of VR was regressed against the subject's value in the following year.

To show the longitudinal development of Vibrato Extent, a linear regression was performed for VE for both frequency and amplitude deviations.

Results

VR regressed moderately toward the mean over time. VE increased over time. Observed increases in VE occurred primarily in students exhibiting VRs between 4.5 Hz-6.5 Hz.

Conclusion

Classical singing development is characterized by an increase in vibrato extent over the course of study. Vibrato rates outside of a normative range are less likely to be measured in the following year of study.

Keywords: *singing, longitudinal, vibrato, acoustics*

OUTCOME OF NEUROTIZATION OF THYROARYTENOID MUSCLE IN UNILATERAL VOCAL FOLD PALSY WITH ANTERIOR PHONATORY GAP- OUR EXPERIENCE

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Background
Unilateral vocal fold immobility(UVFI) is one of the common causes for dysphonia with diverse aetiology. The varied involvement of the intrinsic muscles like the thyroarytenoid, lateral cricoarytenoid and inter-arytenoid can result in phonatory gap at different positions of vocal fold and so is the surgical intervention required.

Objectives
The objective of this study is to assess the outcome of neurotization of the thyroarytenoid muscle in cases of symptomatic unilateral vocal fold immobility with anterior phonatory gap in a tertiary care centre.

Method
In our study 12 patients who presented with dysphonia following unilateral vocal fold palsy were included after obtaining an informed consent.

Inclusion criteria
symptomatic UVFI with the phonatory gap at the anterior 2/3rd of vocal fold.

Exclusion criteria
1.Those UVFI with gap at the level of vocal process and posteriorly in the inter-arytenoid area.
2.Age >70.

Methodology
The VFI was diagnosed, evaluated and followed post op (3 months)with endoscopy, VHI and MPD. These patients underwent thyroarytenoid neurotization where the ansa cervicalis was anastomosed to distal branch of recurrent laryngeal nerve to thyroarytenoid.The statistical significance was studied using paired t test with SPSS software.

Results
The VHI preoperatively had an average of 21.3 which was moderate in severity, while postoperatively it improved to 8 which was significant(p=0.003). While the MPT preoperatively was 7.56 seconds, post-operatively it had improved to 17.67 seconds which was also significant (p value- 0.001). The results of our study show that neurotization of the thyroarytenoid muscle is a very useful surgical option in correcting phonatory gap in isolated thyroarytenoid weakness.

Conclusion
There was significant improvement in parameters like VHI and MPT. An improvement in tone and bulk of vocal fold was noted rather than the actual observed movement of vocal fold. Hence it may be considered more physiologically sound than static procedures.

Keywords: *UVFI, Neurotization of thyroarytenoid, HSR*

CAN CRYOTHERAPY HELP TO ACCELERATE HEALING OF VOCAL FOLD TISSUES?

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Whole-body cryotherapy is a physiotherapeutic method that has been used to accelerate the healing of microtraumatic injuries in sports medicine.
The therapy consists of short-term exposure of an unclothed body to temperatures of 100–140 degrees Celsius below zero. It evokes a systemic reaction causing vasoconstriction with anti-edematous and anti-inflammatory effects and leads to accelerated healing of submucosal and muscular lesions. The procedure leads to a decrease in pain, reduction of inflammation, regulation of muscle tension, an increase in hyperemia, and improvement of tissue metabolism.
The aim of our non-randomized comparative study was to investigate whether cryotherapy can be used to accelerate the healing of vocal fold tissues in voice professionals.
Thirty-five voice professionals (33 females and 2 males) suffering from dilated vocal fold vessels (34%), venectasias or small hemorrhages (38%), or hematoma (28%) served as subjects in this study. Twenty-one of these subjects underwent cryotherapy, while the rest served as controls. All subjects were asked to maintain voice rest and were treated with medication (venotonic drugs, anti-edematous therapy). Vocal fold status was evaluated daily or every two days using strobovideolaryngoscopy. Subjects were considered healed when tissue pathologies disappeared and the patients simultaneously self-evaluated their vocal function as having returned to normal.
The average healing time was 8 ± 2 days in subjects who underwent cryotherapy, compared to 17 ± 4 days in the control group. It is a statistically significant association. (p value = 0,00000448).
Cryotherapy could be used to accelerate healing of vocal fold tissues, with the healing time shortened by more than half compared to the control group.
Vocal use in voice professionals can be considered analogous to physical activity in athletes, as it leads to significant loading of soft body tissues.
We therefore recommend including whole-body cryotherapy as an additional therapeutic method for traumatic vocal fold injuries.

Keywords: *cryotherapy, voice proffesionals, vocal fold injury*

PSYCHOLOGICAL DISTRESS IN A SAMPLE OF ADULT ITALIAN VOICE PROFESSIONALS AFFECTED BY VOCAL NODULES AND MUSCLE-TENSION DYSPHONIA

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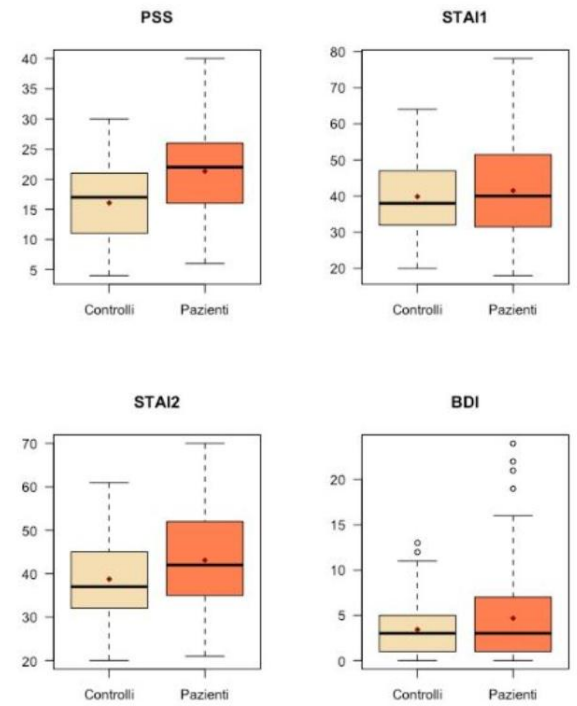
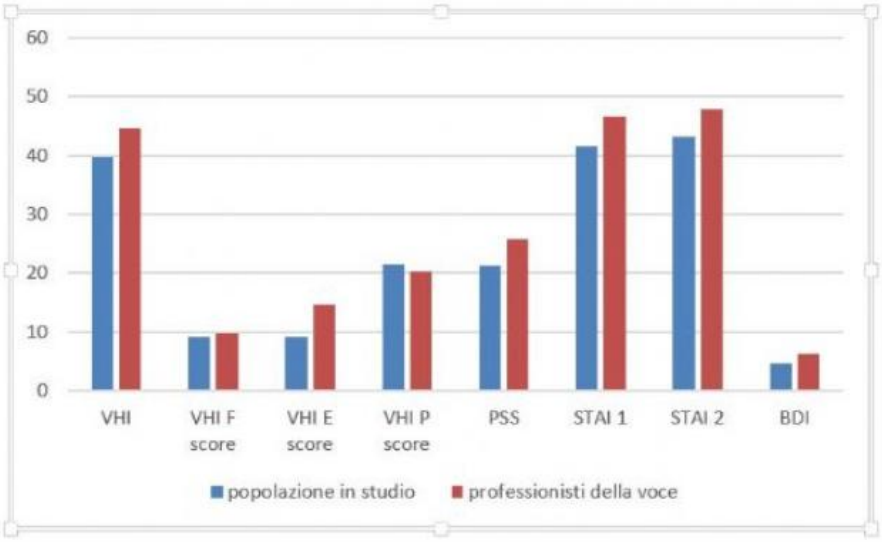
Objectives
To evaluate the correlation between voice disorders and psychological distress, in terms of anxiety and stress, in a sample of adult Italian Voice Professionals (singers, actors) and to compare our results with those obtained in a group of adult healthy controls matched by age, sex, geographic distribution, and occupation and with a Non-Voice Professional population of dysphonic patients.
Methods
This prospective-controlled study included 100 adults with Vocal nodules (VN) and Muscle Tension Dysphonia (MTD1), aged between 18 and 65 years, as Experimental Group (EG) and 100 age-matched subjects without any voice disorders as a Control Group (CG). All patients in the EG underwent a phoniatric evaluation, including the administration of the Voice Handicap Index (VHI) and laryngeal examination. Both patients of EG and CG underwent a Psychological evaluation by means of standardized tests;
State Anxiety Inventory (STAI 1-State Anxiety), Trait Anxiety Inventory (STAI 2- Trait Anxiety), and Perceived Stress Scale (PSS-10) were completed by patients. Patient were than subgrouped by their occupation. Results. In the study group, the Physical domain (P score) of the VHI was more affected than the Emotional (E score) and Functional ones (F score) both in patients with MTD1 and VN. Scores related to psychological distress in the EG were far superior to those obtained by the healthy CG, with markedly significant values especially for PSS-10 ($P < 0.0001$) and STAI 2 ($P < 0.01$). All the scores had higher results in voice professionals compared with non-voice professionals dysphonic patients.
Conclusion the present study identified a high prevalence of psychological distress among patients with vocal disorders without any prior specific psychiatric diagnosis, especially in terms of anxiety and perceived stress compared with the healthy population. Professional voice users are more concerned with an higher impact on the QoL. This might also negatively affect treatment compliance.

Keywords: *voice professionals, actors, singers, psychological distress, dysphonia*

Cases vs Controls results



non voice professionals vs voice professionals scores



SWALLOWING OUTCOMES AFTER TOTAL LARYNGECTOMY: SUBJECTIVE COMPLAINTS, OBJECTIVE FINDINGS AND SURGICAL DETERMINANTS

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Background: Swallowing difficulties are common after total laryngectomy and may significantly affect quality of life. The relationship between patient-reported complaints, objective swallowing findings, and surgical determinants remains incompletely characterised, particularly in long-term follow-up.

Methods: We conducted a cross-sectional study of 54 patients after total laryngectomy treated at the University Hospital Centre Zagreb. Median age was 67 years (IQR 8.8), and median time from surgery to assessment was 29.5 months (IQR 46.3). Swallowing was evaluated using patient-reported dietary intake and standardized clinical assessment across liquid, semi-solid, and solid consistencies. Fibreoptic endoscopic evaluation of swallowing (FEES) was performed, and pharyngeal residue was assessed descriptively based on structured endoscopic evaluation rather than graded using a formal residue severity scale. Surgical variables and adjuvant treatment were analysed using descriptive statistics, correlation analysis, and contingency testing.

Results: Normal oral intake was reported by 66.7% of patients, while 33.3% experienced dysphagia, including 9.3% with severe impairment requiring liquid or non-oral nutrition. Objective impairment was rare for liquids (3.7%) and semi-solids (5.6%), but more frequent for solids (24.1%). Pharyngeal residue was observed in 29.6% and increased with bolus consistency. Difficulty swallowing solids correlated with the presence of residue (Spearman's $\rho = 0.30$, $p = 0.028$). The extent of pharyngeal resection was significantly associated with solid bolus impairment (14.3% after laryngectomy alone vs 50% after partial pharyngectomy and 100% after flap reconstruction; Fisher's exact test, $p = 0.002$). No significant associations were found with adjuvant treatment, dentition status, salivary complaints, neck dissection extent, or patient-reported swallowing complaints.

Conclusions: Post-laryngectomy dysphagia predominantly affects solid bolus transit and is strongly associated with the extent of pharyngeal resection. The observed discordance between subjective complaints and objective findings underscores the need for structured objective evaluation to guide patient counselling, dietary recommendations, and long-term follow-up.

Keywords: *Dysphagia, Total laryngectomy, Fibreoptic endoscopic evaluation of swallowing, Swallowing outcomes*

PHONIATRIC TREATMENT OF PSYCHOSOMATIC VOICE, SPEECH, AND FLUENCY DISORDERS

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Objectives: Psychosomatic (psychogenic, dissociative) voice, speech, and fluency disorders (PSVSFD) are occasionally occurring, clinically striking conditions, characterized by a sudden aphonia or abrupt changes in voice, speech, or fluency without an identifiable organic cause. Affected individuals often experience limited access to effective treatment. Here we present an effective behavioral phoniatric intensive intervention aimed (PII) at rapid symptom resolution through resetting and functional readjustment. In a retrospective study, we compared time to symptom remission following PII with conventional therapy or spontaneous recovery. In addition, a randomized controlled trial (RCT) explores cerebral correlates of PSVSFD using neuroimaging.

Methods: The therapeutic approach is demonstrated in detail. The retrospective study included 35 patients (33 female; mean age 47.54 ± 16.10 years) with available voice or speech recordings from the symptomatic phase. Twenty patients received PII (intervention group); 15 patients underwent conventional therapy or experienced spontaneous recovery (control groups). Follow-up voice recordings and structured telephone interviews assessed symptom and treatment experience, and recovery time [1].

Results: The intervention combines clinical, pharmacological, suggestive, and instrumental components. In the retrospective analysis, voice-speech re-establishment occurred on average after 106.3 ± 71 minutes in the PII group. In contrast, control group patients reported symptom persistence for a mean of 8.4 ± 4 months before gradual recovery [2]. Preliminary findings from the prospective RCT are presented.

Conclusion: Although final vocal and speech outcomes were comparable between groups, PII showed a marked advantage in time efficiency, cost savings, resource utilization, and reduction of patient distress [1]. Phoniatric intensive intervention should be considered a clinical standard for PSVSFD to enable rapid restoration of social participation and improvement in quality of life.

Reference: [1] Hoffmann S, Neumann K, Gietmann C, Ramm M, Conrad R, Brix T, Mathmann P. Phoniatric intensive intervention in psychosomatic voice disorders – findings of a structured, modified therapeutic approach. Submitted

Keywords: *psychogenic, psychosomatic, voice disorder, intervention, treatment*

CAN ARTIFICIAL INTELLIGENCE SING BEL CANTO?

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The aim of this study was to evaluate whether contemporary artificial intelligence (AI) tools are capable of improving selected aspects of classical singing in the bel canto technique, including vocal quality, articulation, reduction of hard attacs, and resonance balance. The research focused on the applicability of AI-based voice processing to a highly specialized vocal aesthetic – Bel Canto.
The study used recorded samples of singing voice, including excerpts from operatic arias performed in the bel canto technique as well as glissando exercises. The recordings were processed using SoundID VoiceAI software (Sonarworks), employing four AI voice models: MAYA, FIONA, REBECCA, and SAMUEL. In the case of the aria Dido's Lament by Henry Purcell, the AI models significantly altered the vocal output, adapting it toward popular music aesthetics rather than preserving the parameters such as tempo, dynamics, and vibrato. When processing a Polish aria by Stanisław Moniuszko, the AI tools were unable to accurately reproduce Polish consonants, resulting in noticeable pronunciation errors. Furthermore, during the modification of bel canto glissandi, the AI systems were unable to faithfully reproduce the highest pitches and subsequently struggled with the lowest frequencies of the classical vocal range.
The findings indicate that bel canto represents a niche vocal aesthetic that current AI technologies are unable to genuinely enhance or stylistically refine. Instead, AI-based voice processing tends to replace classical vocal characteristics with dominant contemporary popular vocal styles. At present, AI functions more as a tool for stylistic substitution than as a means of improving or supporting authentic bel canto performance practice.

Keywords: *Bel canto, Artificial intelligence, Voice processing, Classical singing*

ADDRESSING COGNITIVE AND EMOTIONAL FACTORS IN PEDIATRIC VOICE THERAPY

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Muscle tension often plays a central role in pediatric voice disorders. A variety of techniques to reduce physical tension are commonly used by speech-language pathologists (SLPs). While these approaches are valuable, the mental aspect of tension is often insufficiently incorporated into treatment. The ICF framework describes mental functions that directly influence muscle tension and voice use. If these functions are not addressed in therapy, there is a risk of physical tension being repeatedly rebuilt. The objective of this workshop is to explore how cognitions and emotions influence voice production. The application of this concept in pediatric voice therapy will be illustrated through clinical examples.

Keywords: *voice therapy, pediatrics, mental functions, tension*

RECURRENCE PLOTS OF VIBRATO SIGNALS

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Introduction

Vibrato in the singing voice has been described as fundamental frequency fluctuations over time [1]. Its regularity and periodicity have been studied recently using recurrence plots, a method from nonlinear dynamics [2]. The aim of this study is to assess the accuracy / robustness of recurrence analysis applied to vibrato waves and present a set of parameter recommendations.

Methods

A set of vibrato tones were (a) created through synthesis using sine waves and (b) recorded audio signals of different lengths and sample size from voice and electric guitar. Fundamental frequency estimation was performed in MATLAB, along with estimation of false nearest neighbour and recurrence analysis conducted using the CRP toolbox [3]. Different parameters for embedding dimension and epsilon threshold were used and compared for all the different vibrato signals.

Results

The findings of this study show that recurrence analysis applied to vibrato signals can provide different results depending on various parameters. Our results suggest that the number of vibrato oscillations within time series is of higher relevance than its sample size. From a statistical point of view, the vibrato vectors should have enough samples and variability for the method to find sufficient recurrences.

Conclusion: Recurrence plots and recurrence quantification analysis are powerful tools for visualisation and characterisation of vocal and instrumental vibrato. This research provides further insights into acoustic approaches to investigate vocal features, which can be supplemented in the future by correlation analysis with psychoacoustic and perceptual effects.

Keywords: *Voice, Singing, Music, Vibrato, Analysis*

BREATHINESS SEVERITY IN COMMON DYSPHONIA DIAGNOSES: VOCAL FOLD NODULES, MUSCLE TENSION DYSPHONIA AND VOCAL FOLD PARALYSIS

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Objective
To compare breathiness severity across vocal fold nodules (n=48), muscle tension dysphonia (MTD; n=28), and vocal fold paralysis (VFP; n=24), and to examine the discriminative patterns of breathiness-related acoustic measures across diagnoses and breathiness severity levels.

Methods
In this cross-sectional study, participants produced a 3-second sustained /a/ and read the Pinocchio passage. Diagnoses were established by a multidisciplinary team during a voice board meeting. Breathiness was rated using the GRBAS (Grade, Roughness, Breathiness, Asthenia, Strain) "B" scale by three raters. The Acoustic Breathiness Index (ABI), cepstral peak prominence (CPP), glottal-to-noise excitation ratio maximum (GNE max), and perturbation measures (jitter local, shimmer local) were computed using a voice-chain approach constructed from the sustained /a/ and the Pinocchio passage. Group comparisons and breathiness-level analyses were performed using appropriate tests followed by Bonferroni-adjusted post-hoc procedures. To evaluate the impact of unequal group sizes, sensitivity analyses were repeated after down-sampling the nodules and MTD groups to n=24 (matching VFP).

Results
Inter-rater reliability for GRBAS-B ratings was Krippendorff's α=0.848. Across the three diagnoses, we compared (i) GRBAS-B severity distributions (B0–B3) and (ii) acoustic measures. Breathiness severity differed across diagnoses, with higher breathiness levels more frequently observed in the VFP group. In ROC-based comparisons, ABI showed the strongest overall discriminative pattern, while CPP and GNE max also provided meaningful discrimination. Perturbation measures (jitter local and shimmer local) demonstrated comparatively weaker discrimination. Across breathiness severity categories, the acoustic measures changed in a direction consistent with clinical expectations, with differences observed particularly between neighboring categories. Sensitivity analyses supported robustness.

Conclusion
Breathiness profiles differ among nodules, MTD, and VFP. The superior overall discrimination of ABI supports the value of a breathiness-focused multiparametric summary measure; CPP and GNE max provide additional discriminative information, whereas perturbation measures appear less informative for differentiating breathiness severity in this context.

Keywords: *breathiness, Acoustic Breathiness Index, acoustic analysis, auditory-perceptual analysis, dysphonia*

TREATMENT RESPONSE OF PRIMARY VERSUS SECONDARY MUSCLE TENSION DYSPHONIA - A PROSPECTIVE OBSERVATIONAL STUDY

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Introduction

Muscle Tension Dysphonia(MTD) is a functional voice disorder characterized by excessive and inappropriate activation of intrinsic and extrinsic laryngeal musculature, resulting in altered voice quality, pain and discomfort. MTD is broadly classified into Primary MTD(PMTD), in which no underlying structural or neurological pathology is present, and Secondary MTD(SMTD), where muscle tension develops as a compensatory response to an underlying vocal fold pathology. Voice therapy for MTD consists of vocal relaxation, vocal function exercises and circumlaryngeal massage aiming to normalise phonatory patterns and improve vocal efficiency.

Objectives

To compare vocal outcomes in PMTD and SMTD using clinical, perceptual, and patient-reported outcome measures.

Methodology

A prospective observational study was conducted at a tertiary voice care centre. Patients presenting with voice complaints and diagnosed as having PMTD or SMTD by a Laryngologist were divided into two groups. Diagnosis was based on history, clinical examination including laryngeal palpation, stroboscopy, and voice analysis. All participants underwent voice therapy for MTD, for 1 month. The SMTD group was treated surgically for the primary pathology prior to voice therapy. Outcome measures recorded pre- and post-treatment were pain perception scores, GRBAS, Voice Handicap Index (VHI), Maximum Phonation Time (MPT), and stroboscopic parameters such as mucosal wave amplitude, phonatory gap, and squeeze pattern.

Results

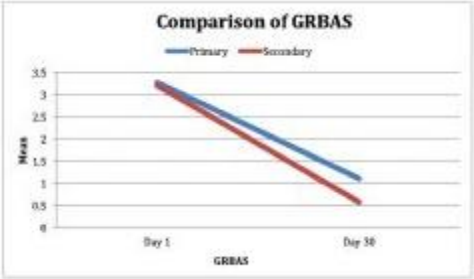
Pain perception showed a significant reduction in both groups (PMTD:5.72±1.44 to 1.94±1.16; SMTD:5.79±1.47 to 0.42±0.60). MPT improved significantly in PMTD (10.06±1.79 to 12.11±1.81 seconds) and in SMTD (11.84±2.85 to 17.37±4.56 seconds). GRBAS and VHI scores demonstrated significant post-treatment reductions in both groups. Stroboscopic findings revealed significant improvement in mucosal wave amplitude, phonatory gap, and squeeze pattern in the SMTD group. Between group comparisons; revealed that the SMTD group had statistically better outcomes than PMTD.

Conclusion

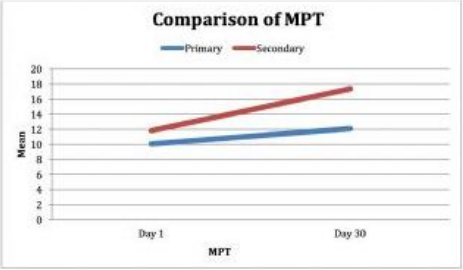
MTD management leads to significant improvement in vocal outcomes in both groups, with better therapeutic response in SMTD.

Keywords: *Muscle Tension Dysphonia, Primary MTD, Secondary MTD, Voice therapy, Vocal Outcomes*

Comparison of GRBAS



Comparison of MPT



Comparison of VHI

Comparison of Pain Perception between Study Groups

Pain Perception	Primary (n=18) Mean (SD)	Secondary (n=19) Mean (SD)	P Value
Day 0	5.72 (1.44)	5.79 (1.47)	0.890
Day 30	1.94 (1.16)	0.42 (0.60)	<0.001*
Mean Change	3.78	4.32	
Percentage Change	66.08	74.61	
P Value	<0.001**	<0.001**	
Unpaired t Test, P Value * Significant Paired t Test, P Value **Significant			

Comparison of Squeeze Pattern between Study Groups

Squeeze	Primary (n=18) n (%)	Secondary (n=19) n (%)
Day 0		
AP	2 (11.1)	4 (21.1)
Lateral	3 (16.7)	4 (21.1)
No	14 (78.8)	13 (68.4)
Chi- Square Test, P Value =0.687, Not Significant		
Day 30		
AP	1 (5.6)	-
Lateral	1 (5.6)	-
No	16 (88.9)	19 (100.0)
Chi- Square Test, P Value =0.327, Not Significant		
Day 0 v/s Day 30, Primary P Value = 0.486, Not Significant		
Day 0 v/s Day 30, Secondary P Value = 0.010, Significant		

VOICE PRODUCTION AND OCCUPATIONAL VOICE DISORDERS IN MANASCHY

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Background
A Manaschy is a traditional performer of the Kyrgyz epic Manas, whose professional activity involves prolonged and intensive vocal use. Their performance style is characterized by high vocal intensity, performing for a very long duration, wide pitch range, and emotionally expressive recitative, all of which may cause considerable strain on the vocal apparatus. As there are only 23 officially recognized manaschys in the Kyrgyz Republic and one of them already has vocal dysphonia. The window to continue this research is very narrow.

Objective
To analyze the characteristics of voice production in manaschy and to identify the main functional and clinical voice problems associated with their occupational vocal load.

Materials-Methods
Clinical observations of manaschy presenting with voice-related complaints were systematically analyzed. Assessment methods such as indirect and fiber optic laryngoscopy, structured evaluation of vocal load, performance conditions, and professional history were used.

Results
Voice production in manaschy demonstrated increased involvement and tension across the respiratory, phonatory, and articulatory subsystems. Common clinical findings included functional dysphonia, hyperfunctional voice use, chronic laryngeal inflammation, vocal fold nodules, and decreased phonatory endurance. Contributing risk factors identified were absence of formal voice training, insufficient vocal hygiene, prolonged performances without adequate recovery periods, and unfavorable acoustic and environmental conditions.

Conclusion
The traditional epic performance practice of manaschy is associated with a high risk of occupational voice disorders. Early phoniatric assessment, preventive voice care strategies, and targeted voice training programs designed according to the ethnocultural context are essential for maintaining vocal health in this population.

Keywords: *manaschy, voice production, occupational voice disorders, dysphonia, phoniatrics*

THE BODY&VOICE PROTOCOL EXERCISE FOR VOICE PROFESSIONALS

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Objectives
Body&Voice is an exercise program inspired by Body Technique's philosophy and principles, specially made for voice professionals in order to prepare their body and mind for vocal activity. It is a 15-minute set of exercises that should be performed prior to vocal activity and it is not a substitute for vocal technique or vocal practice. We conducted the pilot study to objectify the effect of Body&Voice exercise on voice quality and vitality self–perception.

Materials and methods
The study included 14 healthy participants at the Clinical department of ENT and Head and Neck Surgery, University Hospital Center Zagreb. The median age was 25.5 years (range 21-66). Participants performed individually conducted Body&Voice protocol exercises for the first time, mentored by an official Body Technique instructor. Results from the self-evaluation questionnaire Vitality Quotient and Subjective Vitality Scale, the chest and pelvic expansion and the LingWAVES Voice Protocol (s/z ratio, maximum phonation time, fundamental frequency, voice range, minimal loudness, jitter, shimmer, irregularity, noise, and Dysphonia Severity Index) were compared before and after the exercise.

Results
Results showed a significant increase in mean chest and pelvic expansion and vitality self assessment questionnaires, Vitality Quotient and Subjective Vitality Scale, showed significantly better results after 15 minutes of Body&Voice exercise. The acoustic voice analysis showed improvement in almost all tested parameters after the exercise, and significant change was observed in higher maximum frequency and increased voice range. Furthermore, voice irregularity showed a significant decrease after exercise. **Conclusion**: The results of the Body&Voice pilot study showed significant improvement in most variables in only 15 minutes of the participant's first trial experience. The application of Body&Voice exercise can become additional science-based training for voice professionals.

Keywords: *Voice, body, exercise*

REAL-TIME VISUAL FEEDBACK IN SINGING LESSONS: LEARNING PROCESSES, STUDENT PERSPECTIVES, AND PEDAGOGICAL IMPLICATIONS

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The use of real-time visual feedback technologies (RVFTs) in singing education has increased considerably in recent years, in line with the broader expansion of technology-supported learning models within the arts. Tools such as spectrographic visualization, electroglottography, and subglottal pressure measurement, among others, provide singers with immediate acoustic and physiological information, supporting processes of self-evaluation, technical adjustment, and enhanced bodily awareness.

This communication adopts a dual approach. First, it presents a synthesis of a scoping review that systematically maps existing evidence on the use of RVFTs in singing pedagogy, conducted in accordance with established methodological guidelines of the Joanna Briggs Institute and the PRISMA-ScR framework. The review reveals that most published interventions are short-term, involve small sample sizes, and offer limited descriptions of both pedagogical strategies and instructors' specific training. Despite these constraints, existing studies consistently report improvements in selected technical parameters, while other contributions approach RVFTs from conceptual or theoretical perspectives.

Second, the paper reports on a pedagogical intervention conducted at the University of Girona, in which RVFTs were integrated into a structured modern singing program with undergraduate music education students. Particular emphasis is placed on discussing the pedagogical implications of incorporating visual feedback into one-to-one singing lessons, as well as on foregrounding students' lived experiences of learning with these technologies. The study examines technical development, self-efficacy, proprioception, and theoretical understanding, combining quantitative outcomes with qualitative data drawn from students' reflective accounts.

Findings indicate that the use of RVFTs supports measurable technical improvements while also reshaping how students perceive, understand, and regulate their vocal production. Students report increased clarity, confidence, and autonomy in their practice, and the pedagogical discussion foregrounds learners' experiences and the role of visual feedback in supporting reflective and embodied singing training. The paper concludes by discussing the relevance of RVFTs for contemporary vocal pedagogy.

Keywords: *Real-time visual feedback, singing pedagogy, scoping review, reflective practice, learner experience*

WHEN LISTENING BECOMES FEELING: LINKING NEURAL PATTERNS IN VOCAL EMOTION PERCEPTION TO SUBJECTIVE EXPERIENCE

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As with music, emotional responses to the human voice extend beyond auditory perceptual processing to involve psychophysiological processes and subjective feelings. These processes appear to be highly individual-dependent: the same vocal sounds can evoke different emotional responses across listeners, while a single listener may respond similarly to different emotionally expressive voices. Examining the neural mechanisms underlying emotional voice perception in relation to subjective experience may therefore help clarify how the voice facilitates emotional synchronization and the sharing of meaning.

In this study, we conducted an exploratory investigation of potential correspondences between patterns of brain activity elicited while participants listened to short, non-verbal vocalizations expressing five different emotions and their ratings of subjective emotional experience. Neural activity was measured using functional magnetic resonance imaging (fMRI), and subjective emotional experience was rated during the experiment using a three-point Likert-type button-press scale.

Neural activity was estimated using a general linear model (GLM). A searchlight multivoxel pattern analysis was then applied to the GLM-derived images, yielding whole brain decoding accuracy maps in which each voxel reflects the extent to which local patterns of neural activity are informative for discriminating perceived vocal emotions. These whole-brain maps were subsequently compared with participants' subjective ratings of their emotional experience while listening to others' voices.

Similarities in neural patterns were observed across participants, with brain regions associated with auditory processing and general emotional processing showing greater informative power for discriminating perceived vocal emotions, as expected. In addition, preliminary results suggest an increased emotion-discriminative contribution of specific brain regions at the intersection of perception, action, and emotion when subjective emotional ratings were higher. The involvement of these regions may reflect embodied components of emotional experience, consistent with previous work implicating these regions in the processing of emotional content in music and in emotion-related responses in listeners.

Keywords: *Voice perception, Emotions, fMRI, Multivariate Pattern Analysis, Subjective ratings*

DİL VE LARENKS POZİSYONLARININ SES ÜRETİMİ VE VOKAL PERFORMANSA ETKİLERİ

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Bu bildiri, ses üretiminde dil ve larenksin anatomik ve fonksiyonel konumlarının vokal performansa etkilerini incelemektedir. Ses kalitesi, yalnızca akciğerlerden çıkan hava akışının değil; dilin yatay ve dikey konumu, larenksin yüksekliği, farenks boşluğunun genişliği ve bu yapıların koordinasyonunun bir sonucudur. Güncel ses bilimi araştırmaları, dil ve larenks pozisyonlarının vokal rezonans, formant frekansları ve vokal yorgunluk üzerinde belirleyici etkiler oluşturduğunu göstermektedir. Özellikle profesyonel ses kullanıcılarında, düşük larenks ve nötr/ileri dil konumu; rezonansın dengelenmesi, sesin sürdürülebilirliği ve doğal tını elde edilmesinde kritik rol oynamaktadır. Bu çalışmada fonksiyonel ses eğitimi (Functional Voice Training), Estill Voice Training (EVT) ve Complete Vocal Technique (CVT) yaklaşımlarından elde edilen gözlemler ve literatür verileri değerlendirilmiştir. Bulgular, dil ve larenks koordinasyonunun hem sanatsal performans hem de vokal sağlık açısından temel bir belirleyici olduğunu ortaya koymaktadır. Larenks (gırtlak) ve dilin farklı kombinasyonları, vokal icracının temel ses kalitesini ve çeşitli şarkı söyleme stillerini elde etmesini sağlar. Bu yapılar üzerinde icracının sağladığı yüksek kontrol, sesinin tınısını ve stilistik ifadesini belirler. Şarkı söyleme esnasında, konuşur gibi (speech), falsetto (sesin hafif kullanımı), sobbing (hıçkırarak ağlama/ağıt) gibi vokal icra çeşitliliği ve teknik kullanımlarla belt, twang, legit, pop, caz, opera v.b. gibi stiller ortaya çıkar. Bu çalışmada kaynak tarama yöntemi uygulanmış ve elde edilen bulgularda, speech ve falsetto uygulandığında larenksin orta pozisyonda, sobbing ve mix (operatik ses) kullanıldığında larenksin düşük pozisyonda, twang ve belt icrada lareksin yüksek pozisyonda konumlandığı görülmektedir. Dilin pozisyonu ise speech ve falsetto ses kullanımında orta, sobbing, opera, twang ve belt icrada yüksek pozisyonda konumlandığı sonucu elde edilmiştir.

Anahtar Kelimeler: *Dil pozisyonu, larenks yüksekliği, vokal rezonans, vokal teknik*

MANAGEMENT OF PSYCHOGENIC APHONIA: A CASE - BASED APPROACH

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Background. Psychogenic aphonia is a challenging condition for voice specialists, as it occurs without structural laryngeal pathology and can present very differently depending on the trigger.

Objective. To demonstrate distinct clinical scenarios of psychogenic aphonia and highlight how the trigger influences the course and management.

Methods. Clinical observations included cases triggered by acute psycho-emotional stress and by medical intervention. All patients underwent phoniatric assessment, including evaluation of voluntary and involuntary phonation and laryngoscopy.

Results. In both scenarios, no organic laryngeal pathology was found, and vocal fold mobility was preserved. Stress-induced aphonia showed sudden onset and rapid response to phoniatric tests. Post-intervention aphonia developed more gradually, with pronounced muscular tension and fear of phonation, requiring a tailored therapeutic approach.

Conclusions. Psychogenic aphonia can look very different depending on the trigger, even when the underlying mechanism is the same. Sudden stress-related cases often improve quickly, while post-intervention cases may develop more slowly and involve tension or fear of speaking. Knowing the trigger helps specialists choose the best management approach and support the patient effectively.

Keywords: *Psychogenic aphonia, Functional dysphonia, Etiology, Stress, Phoniatric evaluation*

GENDER PERCEPTİON OF TRANS AND CİS SPEAKERS: A COMPARİSON ACROSS LİSTENER GROUPS

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Introduction

Voice plays a critical role in gender perception, and listener-related factors may influence how a speaker's gender is perceived. While previous studies have primarily focused on acoustic correlates of gender perception, evidence regarding differences across listener groups remains limited. The present study aimed to compare gender perception responses across three listener groups—cisgender individuals, transgender and gender-diverse (TGD) individuals, and expert clinicians—using speech samples from transgender and cisgender speakers.

Methods

Sustained vowel and connected speech samples from trans women, trans men, cis women, and cis men were presented to cis, TGD, and expert clinician listeners via the Gorilla online platform. After each stimulus, listeners provided (1) categorical gender attributions and (2) 0–100 visual analogue scale (VAS) ratings of perceived femininity and masculinity. Gender perception responses were compared across listener groups for each speaker group using percentage distributions of categorical gender attributions and mean femininity and masculinity ratings.

Results

Gender perception responses differed across listener groups by speaker group and speech task. For cisgender speakers, expert listeners gave higher femininity scores for cis women, whereas TGD listeners rated cis men as more feminine than expert listeners ($p<0.01$). For transgender speakers, expert listeners generally gave higher femininity scores and lower masculinity scores than cis and TGD listeners ($p<0.01$), whereas TGD listeners more frequently used mid-range femininity/masculinity ratings. By comparison, in sustained vowel phonation, expert listeners more frequently assigned transgender speakers to the female category and less frequently to the male category than other listeners ($p<0.05$).

Discussion

The findings highlight the role of listener characteristics in shaping gender perception beyond acoustic cues. By directly comparing cis, TGD, and expert listeners' responses for diverse speaker groups, this study extends existing evidence on listener-related influences on gender perception and contributes comparative data that remain limited in the current literature.

Keywords: *gender perception, voice, transgender, gender diversity*

EFFECTIVENESS OF BEHAVIORAL VOICE THERAPY APPROACHES IN ADULTS WITH VOCAL FOLD NODULES: A SYSTEMATIC REVIEW

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Vocal fold nodules are among the most common causes of dysphonia in adults, and behavioral voice therapy is widely recognized as the first-line treatment. However, variability in therapeutic techniques, treatment intensity, and outcome measures makes it difficult to determine which therapy approaches provide the most consistent clinical benefit. This study presents the protocol of a systematic review aiming to compare the effectiveness of commonly used behavioral voice therapy approaches in adults with vocal fold nodules.

The review will include randomized controlled trials evaluating behavioral or exercise-based voice therapy interventions in adults (>=18 years) with laryngeal visualization–confirmed vocal fold nodules. Eligible interventions include direct and indirect approaches such as Resonant Voice Therapy, Vocal Function Exercises, semi-occluded vocal tract exercises, Accent Method, and structured behavioral voice therapy programs delivered in clinical or telepractice settings. Comparator conditions may include usual care or waiting-list controls. Primary outcomes include acoustic parameters, aerodynamic measures, perceptual voice evaluations, patient-reported outcomes, and videostroboscopic findings reflecting structural and functional improvement.

Due to expected heterogeneity across therapy protocols and outcome measures, findings will be synthesized descriptively. The review aims to identify therapy approaches associated with greater improvements in voice quality and patient-reported outcomes and to highlight methodological limitations in the existing literature.

The findings are expected to support evidence-based clinical decision-making and guide future research toward more standardized and effective voice therapy protocols.

Keywords: *dysphonia, vocal fold nodules, evidence-based voice therapy*

THE EFFECT OF FOOT ARCH MORPHOLOGY IN DIFFERENT POSTURES ON CRANIOVERTEBRAL ANGLE AND ACOUSTIC VOICE PARAMETERS: A PILOT STUDY

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Purpose
Human voice is a holistic phenomenon influenced by whole-body biomechanics and the kinetic chain. The aim of this pilot study is to investigate the effect of foot arch morphology (neutral and pes planus) on craniovertebral angle (CVA) and acoustic voice parameters across four different body postures: neutral, kyphotic, upright, and anterior sway.

Method
Twenty non-professional voice users (mean age: 21.05 ± 1.63 years) were included in the study. Foot arch morphology was assessed using a three-dimensional optical laser scanning system (3DOeTech), and participants were divided into neutral and pes planus groups. Data were collected from each participant in four postures: neutral, kyphotic, upright, and anterior sway. In each posture, CVA measurement via lateral photogrammetry, sustained /a/ phonation, and standard text reading recordings were obtained. Acoustic parameters (jitter, shimmer, F_0, HNR, F_1, F_2, and CPPS) were analyzed using PRAAT software. Since data were not normally distributed, differences between groups were tested using the Mann-Whitney U test.

Results
Posturographic analyses revealed that CVA measurements in the pes planus group were significantly lower than the neutral group in neutral and anterior sway postures, indicating forward head posture ($p<.05$). Spectral measures proved significant in acoustic analyses. Specifically, in mechanically challenging postures (anterior and kyphotic), the pes planus group exhibited a significant decrease in Cepstral Peak Prominence Smoothed (CPPS) values during connected speech ($p<.05$) and deviations in formant frequencies (F_1, F_2) indicating vocal tract resonance changes.

Conclusion
The findings suggest that pes planus disrupts cervical stability via the ascending kinetic chain and negatively affects the laryngeal mechanism. Participants with collapsed arches had difficulty maintaining voice quality and resonance, especially under dynamic postural loads. These results highlight that the approach to voice should not be limited to laryngeal structures but must holistically consider the entire kinetic chain "from the ground up."

Keywords: *Foot arch morphology, Acoustic voice analysis, Craniovertebral angle, Myofascial chain*

Comparison of Acoustic Parameters and Craniovertebral Angle Between Neutral and Pes Planus Groups Across Four Postures (Mann-Whitney U Test Results).

Parameters	Neutral Posture (p value)	Kyphotic Posture (p value)	Upright Posture (p value)	Anterior Sway (p value)
CVA (Angle)	.023*	.165	.297	.025*
F_0	.143	.076	.031*	.037*
Jitter (%)	.643	.440	.143	.280
Shimmer (dB)	.847	.375	.280	.217
HNR (dB)	.1000	.316	.316	.247
Formant 1 (F_1)	.143	.014*	.031*	.037*
Formant 2 (F_2)	.025*	.045*	.355	.003*
CPPS (Sustained /a/)	.700	.165	.189	.105
CPPS (Text Reading)	-	.014*	.037*	.005*

**Statistical significance (p<.05). Note: In all parameters with significant differences, the Pes Planus group exhibited lower Mean Rank scores compared to the Neutral group.*

THE CHALLENGES OF MAINTAINING A PERFORMANCE VOICE IN IDIOPATHIC STENOSIS

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Idiopathic subglottic stenosis (iSGS) is a rare condition of unknown aetiology with a population incidence of approximately two per million. It predominantly affects women between 30-50 years who often present with exertional dyspnoea, effort intolerance and chronic stridor due to progressive fibromatosis of the subglottis and proximal cervical trachea. In approximately 30% of patients progression of the fibrotic changes to involve the vocal folds can cause hoarseness and glottic airway narrowing from vocal fold tethering or cricoarytenoid joint fixation 1. This can have significant effects on the speaking voice and particularly on the performing voice. Although proximal progression of the fibrosis may be a natural history of some individual's pattern of fibromatosis, the use of diffuse energy sources such as Coblation and KTP lasers and surgical trauma to the glottis from serial endoscopic treatment can exacerbate the process. Early identification of iSGS and evolving proximal stenosis, avoidance where possible of more aggressive and traumatic resection procedures and adopting more conservative newer endoscopic laryngo-tracheoplasty techniques with biological inhibition using in-office intralesional steroids 2 may provide optimal treatment until the disease process is better understood and new biological modulation techniques are developed. A Case of a 39-year-old amateur dramatic singer is presented illustrating some of the points in technique and challenges in the management.

Keywords: *Idiopathic Subglottic Stenosis, Singing voice, In-office procedures*

ASSESSING THE PERFORMER'S VOICE: A WILD-GOOSE CHASE FOR ACOUSTIC EQUIVALENCE, OR REDEFINING THE GOAL?

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The objective assessment of artistic voice has traditionally relied on airborne microphones—the "gold standard" for radiated acoustic signals. However, in ecologically valid performance contexts, the signal-to-noise ratio (SNR) is frequently compromised by environmental noise and instrumentation. While contact sensors have emerged as a robust alternative, scientific focus remains largely fixed on their ability to replicate the airborne signal.
This session challenges the necessity of acoustic equivalence, proposing instead that contact-based sensors offer a distinct, complementary potential. Evidence suggests these technologies are not directly interchangeable: while airborne signals capture the glottal source filtered by the vocal tract, contact sensors provide a direct proxy of glottal tissue vibration. Consequently, frequency-based parameters show strong correlations between sensors, while amplitude-based parameters and noise components diverge.
We propose a paradigm redefinition: contact sensors should be viewed not as secondary acoustic tools, but as primary instruments for measuring physiological sources—representing an entirely different measurement construct. This approach allows performers to quantify underlying mechanisms independently of the radiated sound, even in high-noise environments.
We invite researchers and pedagogues to reflect on a dual-measurement model: utilizing contact-based sensors to robustly quantify the "physiological engine" and airborne sensors to capture the "artistic-acoustic result." This distinction facilitates a clearer analysis of cause (glottal mechanism) versus effect (radiated sound) in vocal pedagogy and science.

Keywords: *Performer's Voice, Contact Sensors, Acoustic Analysis, Airborne Microphones, Glottal Source*

EFFECTS OF THE HYPERTONIC SALINE NEBULIZATION ON VOICE QUALITY

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Voice disorders are highly prevalent, particularly among professional voice users, and are associated with significant functional and psychosocial consequences. Vocal hygiene strategies aimed at optimizing vocal fold surface hydration are therefore central to both prevention and management of voice problems. Nebulization is widely used to deliver aerosolized solutions to the upper airway and laryngeal mucosa, yet its specific effects on voice quality remain insufficiently defined. Existing voice-related research has focused predominantly on isotonic saline, with generally positive effects on perceived vocal comfort and phonatory ease, while objective acoustic and perceptual outcomes have been inconsistent.

In contrast, evidence regarding hypertonic saline nebulization and voice is scarce. Most data originate from pulmonology and rhinology, where hypertonic saline is known for its osmotic properties and ability to modify mucus rheology and enhance mucociliary clearance. In voice science, higher concentrations of hypertonic saline have been associated with transient mucosal irritation or dryness, whereas potential benefits related to vocal fold surface hydration remain unclear. Importantly, medium-concentration hypertonic saline solutions, commonly used in clinical practice, have not been systematically evaluated with respect to voice outcomes.

This contribution combines a focused narrative review of the available literature with the presentation of a pilot study designed to explore the short-term effects of nebulization with 2.3% sodium chloride on voice in vocally healthy individuals. The study applies a multidimensional assessment framework, including acoustic analysis, auditory-perceptual evaluation, laryngeal visualization, and self-reported phonatory discomfort, conducted before and after a single nebulization session.

By integrating current evidence with preliminary empirical observations, this work aims to advance understanding of the potential role of medium-concentration hypertonic saline nebulization in vocal fold surface hydration and voice function. The findings are intended to inform future controlled studies, including dysphonic populations, and to support evidence-based clinical decision-making in voice assessment and therapy.

Keywords: *voice quality, nebulization, hypertonic saline*

POSTER
Presentation

SEVERE LARYNGEAL INVOLVEMENT İN CHARCOT–MARİE–TOOTH DİSEASE: A RARE CASE OF BİLATERAL VOCAL CORD IMMOBİLİTY

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Background
Charcot–Marie–Tooth (CMT) disease is a hereditary motor and sensory neuropathy predominantly affecting distal peripheral nerves. Laryngeal involvement is exceptionally rare but may result in severe voice, swallowing, and airway compromise. Reports describing bilateral vocal cord immobility in CMT are scarce.

Case Presentation
We report a 22-year-old wheelchair-dependent female patient with a known diagnosis of Charcot–Marie–Tooth disease and comorbid asthma who presented with a six-month history of progressive hoarseness, near aphonia, impaired communication, dysphagia, and dyspnea. Flexible laryngoscopic examination revealed bilateral vocal cords fixed in a cadaveric position, consistent with paralysis, and anterior dislocation of the left arytenoid cartilage. Voice assessment demonstrated a GRBAS score of 12 and a maximum phonation time of 3 seconds. Polysomnography showed mild sleep-disordered breathing with an apnea–hypopnea index of 3.4 events/hour. Given the coexistence of asthma and upper airway symptoms, laryngeal pathology was considered a contributing factor to respiratory complaints. Under local anesthesia, a 1-cc injection augmentation was performed to the left vocal cord via a transthyroid approach, followed by initiation of structured voice therapy.

Conclusion
Laryngeal neuropathy resulting in vocal cord paralysis is an extremely rare manifestation of Charcot–Marie–Tooth disease. This case emphasizes that laryngeal involvement should be considered in CMT patients presenting with respiratory symptoms, particularly when comorbid conditions such as asthma are present. Early recognition and a multidisciplinary approach are essential for optimizing communication, swallowing, and airway safety.

Keywords: *Charcot–Marie–Tooth disease, laryngeal neuropathy, bilateral vocal cord paralysis, injection laryngoplasty, voice therapy*

post injection vocal cord phonation position

Post-injection laryngoscopic view demonstrating improved glottic closure following left vocal fold injection augmentation.

preop vocal cord position

“Preoperative rigid laryngoscopic view demonstrating bilateral vocal fold immobility in a cadaveric position.””

FOCAL LARYNGEAL DYSTONIA. THERAPEUTIC APPROACH WITH BOTULINUM TOXIN INJECTION

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Laryngeal dystonia (LD), also known spasmodic dysphonia, is a focal, chronic, and task-specific neurological disorder that affects the larynx, interfering with phonation and speech function, significantly reducing patients' ability to communicate effectively, and profoundly impacting their quality of life.
LD is classified according to the intrinsic laryngeal muscle groups affected (adductor LD, affecting lateral thyroarytenoid muscles; abductor LD, affecting posterior cricoarytenoid muscles; mixed, respiratory, and singer's dystonia). Patients present specific clinical profiles according to the dystonic pattern. Injection of botulinum neurotoxin (BoNT) into the laryngeal muscles has become the treatment of choice.

STUDY OBJETIVE

To evaluate efficacy and safety of EMG-guided percutaneous botulinum toxin injection for laryngeal dystonia over 20 years of institutional experience

RESULTS

This is a retrospective case serie of 43 patients (76% women, mean age: 64 years), classified as focal dystonia 76%, segmental 13.96%, multifocal 2.33%, generalized 6.98%. Associated tremor in 76%. The time to first injection averaged 7 years. The therapeutic approach was botulinum toxin injection with unilateral pattern (37.2%), bilateral (44.1%), and mixed (18%). The mean dose was 4.57 units (2.50–8 units). The response was good/very good in 84% (patient global impression) with mild side effects (breathiness less than 2 weeks) in 76%, and the duration of effect was 7.55 months. We present videos of the injection technique and of patients before and after injection affected by different types of dystonia.

CONCLUSIONS

Botulinum toxin is an effective treatment for addressing laryngeal dystonia, especially if tremor is not associated. The percutaneous approach technique through the cricothyroid membrane with unilateral/bilateral infiltration is well tolerated and without complications, showing efficacy in over 80% of patients and mild, tolerable side effects in over 90%.
Limitations in this study (retrospective design, non standardized outcome measures, subjective response assessment, single-centre experience)

Keywords: *Laryngeal, dystonia, treatment, botulinum, injection*

THE HEALING POWER OF THE VOICE

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The healing power of the voice explores the human voice as a transformative instrument for well-being, emotional balance, and inner integration. This presentation examines how vocal expression can positively influence the nervous system, reduce stress, and support personal healing processes. It highlights how many ancient cultures understood healing as a holistic practice involving body, mind, and spirit, and used vocal techniques such as chanting, ritual singing, and sacred sound to restore harmony on all these levels. Drawing from both traditional knowledge and contemporary scientific perspectives, the session illustrates how practices like humming, mantra recitation, and overtone singing can induce states of deep relaxation, inner clarity, and expanded awareness. The presentation concludes with a collective experience in which all participants are invited to sing a mantra together, followed by a guided relaxation using overtone singing, offering everyone a direct experience of the integrative and healing potential of vocal vibration.

Keywords: *Healing voice, overtone singing, mantra singing, holistic well-being, ancient healing practices*

VOICE CARE STRATEGIES FOR ACTORS AND SINGERS: METHODS OF MANAGING VOCAL PROBLEMS

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Voice health is a key aspect of vocalists and actors work but many of them experience problems related to sound production. The aim of the study was to analyse the occurance of voice disorders, determine their symptoms and methods of prevention and treatment used by people working with their voice. The study group consisted of 90 vocalists and actors from musical and dramatic theatres, as well as students and graduates of artistic schools. An online survey including closed and open-ended questions allowed for the collection of data on factors affecting voice condition, frequency of complaints and used methods of prevention and treatment. The most common voice problems were related to making high-pitched sounds and symptoms included hoarseness, voice fatigue and loss of tone scale. A significant number of number of respondents did not use specialist help and coping methods included rest, throat moisturising and home treatment. Only 30% of the respondents used phoniatric or laryngological consultations. Only 40% of respondents had access to voice hygiene education as part of their artistic education. The results of the study suggest that the lack of systematic education on vocal hygiene in art schools and insufficient awareness of the importance of prevention may contribute to the development of vocal problems. Mandatory classes on voice production and regular phoniatric examinations could help reducing the risk of occupational voice disorders and improve the vocal health of singers and actors.

Keywords: *vocal hygiene, voice production, voice disorders, vocal fatigue*

“SHE HAD TO WAIT FOR SOME OTHER TO SPEAK”: A PERFORMING ARTS MEDICINE CASE STUDY ON NARCISSISM AND VOICELESSNESS

Stephen King
Voice Care Centre

Myths, legends, and folk stories have all been used to help us navigate our world, life, and trying times, and hold rich and important observations of the human condition. The quote in the title comes from Ovid’s tale of Echo and Narcissus, where Echo has been cursed to only repeat the last words of another. This single performing arts medicine case study aims to illuminate how this myth applies to certain types of psychogenic voice loss, whereby the victim (Echo) is left voiceless in relation to the narcissistic persecutor (Narcissus).

Narcissistic abuse constitutes a pattern of interpersonal violence characterised by grandiosity, entitlement, and a calculated dismantling of the victim’s autonomy. Contemporary scholarship locates these dynamics within broader structures of gendered power, where tactics such as gaslighting and coerced loyalty render women increasingly silent. How often are we left without the use of our own words, simply repeating others’ in order to fit into the hierarchical systems which harm us, particularly in the performing arts?

After completing a successful piece of work with a client around her voice problem, I came to retrospectively understand that she occupied a very similar thematic association to Echo and had lost the use of her singing voice due to the demands put on her in narcissistically led work environments, thus developing an acute functional psychogenic voice disorder which resolved across our work.

Keywords: *voice, psychology, psychotherapy, narcissism, functional voice disorder*

LARENGOLOJİ VE FONİATRİ OKULU'NUN KBB UZMANLIK PRATİĞİNE KATKISI: İKİNCİ BASAMAK DEVLET HASTANESİNDE İKİ YILLIK DENEYİM

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Manisa Merkez Efendi State Hospital,Deparment of Otolaryngology, Manisa

Giriş
Türk KBB-BBC Derneği bünyesindeki Larengoloji ve Foniatri Okulu (LFO) eğitimi; ikinci basamak sağlık kurumlarında larengoloji vizyonu için temel bir dönüm noktasıdır. Bu çalışma, eğitimin ardından geçen iki yıllık süreçte ikinci basamak bir devlet hastanesinde yaşanan mesleki gelişim ve klinik faaliyet raporudur.

Gelişme
Eğitimin sağladığı vizyon, 5 KBB uzmanının görev yaptığı kliniğimizde, malignite dışı ses ve konuşma bozukluklarının yönetiminde belirgin bir "ilgi alanı özelleşmesi" ve verimli bir iş bölümü sağlamıştır:

• Klinik ve Cerrahi Veriler: İki yıllık süreçte kliniğimize başvuran malignite dışı ses, konuşma ve yutma bozukluğu tanılı toplam 2903 hastanın 960'ı (%33) ve bu grubun içindeki 188 pediatrik olgu, oluşan klinik içi sevk mekanizmasıyla tarafımca değerlendirilmiştir. Benzer şekilde, benign ses patolojilerine yönelik yapılan toplam 43 spesifik cerrahi girişimin 27'si (%63) bu vizyon çerçevesinde tarafımca gerçekleştirilmiştir.

• Uygulamalı ve Terapötik İlerleme: Vokal kord enjeksiyon laringoplasti ofis prosedürü ve mukoza koruyucu cerrahi, endoskopi ile yutma değerlendirmesi standardize edilmiştir. Tanı ve cerrahi süreçler, bizzat yürütülen ses terapisi uygulamaları ile bütüncül bir rehabilitasyon zeminine taşınmıştır.

• Kurumsal ve Akademik Etki: İdari girişimlerle endoskopi ünite sayısı arttırılmış ve hastaneye ilk kez bir Dil ve Konuşma Terapisti (DKT) kazandırılmıştır.LFO sonrası kurulan akademik ağ sayesinde, takip edilen benign olguların yanı sıra, tanı konulan kompleks onkolojik vakaların doğru merkezlere yönlendirilmesinde yetkinlik sağlanmıştır. Ayrıca Güzel sanatlar fakültesi müzik bölümünde ses sağlığı dersi verilmektedir.

• Koruyucu ve Multidisipliner Yaklaşım: İlahiyat fakültesi, diyanet akademisi ve güzel sanatlar ve imam hatip liseleri ile şehir korolarına verilen "Ses Hijyeni" seminerleri verilmiş olup "Koruyucu Müzik Hekimliği" temelleri atılmıştır.

Sonuç
İkinci basamakta sağlanan bu dönüşüm, üçüncü basamak sevk yükünü azaltmış; profesyonel ses kullanıcıları ve sanatçılar için nitelikli bir referans merkezi oluşturmuştur. LFO eğitimi ile edinilen tanıdan rehabilitasyona bütüncül yaklaşım misyonu yeni öğrenim hedefleri ile devam etmektedir.

Anahtar Kelimeler: *Larengoloji, Foniatri, İkinci Basamak, Fonocerrahi, Ses Bozuklukları*

EFFECTS OF FERROSTATIN-1 ON VOCAL FOLDS IN AGING RATS

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Objectives
Age-related vocal fold degeneration is characterized by alterations in the lamina propria, extracellular matrix remodeling, and reduced tissue viscoelasticity, all of which contribute to presbyphonia. Ferroptosis, an iron-dependent form of regulated cell death driven by lipid peroxidation, is increasingly implicated in tissue aging. In this study, we investigated the association between ferroptosis and vocal-fold aging using ferrostatin-1 (Fer-1) in a rat model.

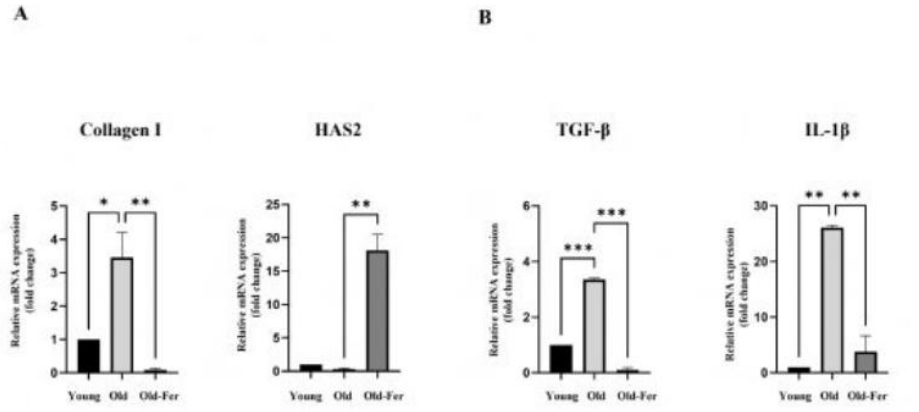
Methods
Thirty-six male Sprague–Dawley rats were assigned to three groups: Young, Old, and Old–Fer, followed by a 1-week acclimatization period prior to experimentation. Fer-1 (2.5 μmol/kg, 20 μL) was injected unilaterally into the left vocal fold at weeks 0 and 2. At week 3, the vocal folds were harvested for histological, immunohistochemical, and biochemical analyses. Outcome measures included ferroptosis-related markers (reactive oxygen species, malondialdehyde, malondialdehyde/4-hydroxyalkenals, iron, and glutathione peroxidase 4), lamina propria thickness, extracellular matrix morphology, collagen and hyaluronic acid, and inflammatory cytokines (transforming growth factor-β and interleukin-1β).

Results
Compared with the Young group, the Old group demonstrated increased lipid peroxidation, reactive oxygen species, and iron accumulation, accompanied by reduced glutathione peroxidase 4 activity; these changes were attenuated in the Old–Fer group. The Old group also exhibited increased lamina propria thickness, enhanced collagen deposition, and reduced hyaluronic acid distribution. In comparison, the Old–Fer group showed reduced collagen accumulation and preserved hyaluronic acid distribution. Expression levels of transforming growth factor-β and interleukin-1β were elevated in the Old group relative to the Young group and were reduced in the Old–Fer group.

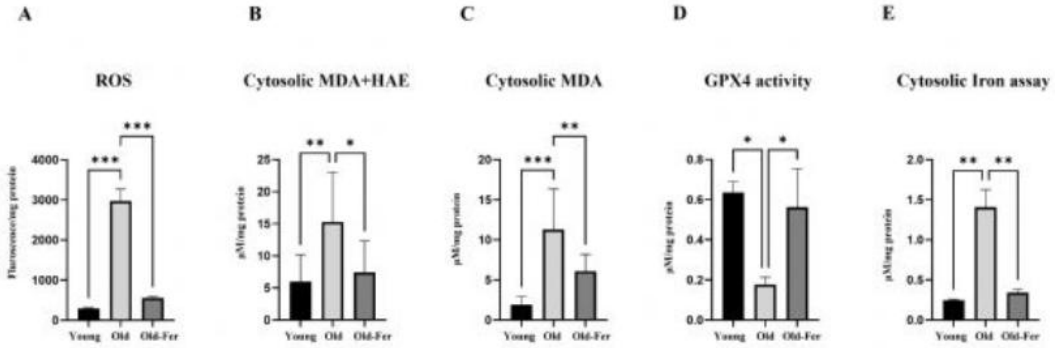
Conclusion
The results indicate that ferroptosis is involved in vocal fold aging. In addition, Fer-1 effectively suppressed ferroptotic pathways, which may be associated with the attenuation of aging-related extracellular matrix alterations in the vocal folds.

Keywords: *ferrostatin-1, ferroptosis, vocal fold aging, extracellular matrix, rat model*

ECM gene expression



Ferroptosis markers



TISSUE MOBILIZATION DURING DOUBLE SOURCE OF VIBRATION SEMIOCCLUDED VOCAL TRACT EXERCISES: A NECK AND FACE SURFACE ACCELERATION STUDY

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Purpose
This study primarily aimed at observing the possible tissue mobilization on facial, neck, and chest tissues caused by different double source of vibration semioccluded vocal tract exercises (DSV-SOVTEs). Another goal was to inspect the degree of self-perceived sensation of a massage-like sensation. Method: Fifty-five participants engaged in a set of several DSV-SOVTEs: (a) phonation with a silicone tube submerged 2 and 8 cm below water surface, (b) Acapella Choice device, (c) lip trills, and (d) tongue trills. A self-perceived massage- like sensation was also assessed. All exercises were performed at three loudness levels. Tissue mobilization signal was captured by four accelerometers placed in four different body regions: (a) over the cheek, (b) over the neck, (c) over the thyroid cartilage, and (d) over the suprasternal notch. Results: There is a differential effect of all DSV-SOVTEs on tissue mobilization. All four observed dependent variables from tissue oscillation modulation (frequency, amplitude, jitter, and shimmer) showed significant three-way interactions. In general, amplitude and frequency of tissue oscillation modulation increases with loudness. A self-perceived massage-like sensation showed highly significant differences between DSV-SOVTEs. Conclusions: All DSV-SOVTEs do mobilize tissues. Type of exercise, loudness level, and body region produce an effect on all tissue oscillation variables. Acapella device produces the largest amplitude of vibration, lowest frequency, and more regular oscillation of tissue. Water resistance therapy showed the most irregular tissue oscillation. Control of these variables is likely to be relevant to obtain the best outcomes in patients. The work offers a meaningful and clinically relevant contribution. A key component of voice training and voice therapy is sensory input: vibrations generated by different vocal exercises are an important source of somatosensory stimulation, not only because of their massage-like effect, but also because they may support appropriate sensorimotor learning.

Keywords: *Semioccluded vocal tract exercises, Water resistance therapy, voice therapy, voice training*

THE ROLE OF LOGOPEDIC VOICE TREATMENT WITHIN TRANSDISCIPLINARY VOICE CARE TEAMS FOR PROFESSIONAL SINGERS

Alba Rodríguez Piñeiroa
Alba Rodríguez Piñeiroa. A Coruña. Galicia. España

Singers are a high-risk group for vocal problems due to the complex interaction between anatomical, physiological, technical, psychological and contextual factors associated with the high demands placed on the singing voice. Intensive and prolonged use of the voice increases the risk of strain, vocal fatigue, laryngeal injuries and other associated pathologies. In this context, the assessment, prevention and treatment of vocal difficulties is particularly important. The integration of voice therapy into transdisciplinary teams made up of otolaryngologists, singing teachers and other health professionals allows for a more comprehensive approach to the singer's vocal function, technique and artistic performance.

The objective is to analyse the scientific literature on voice therapy interventions in singers, with special attention to their contribution within transdisciplinary models of vocal care and optimization.

A narrative search for information was conducted in databases such as the “Journal of Voice”, “Web of Science” and “PubMed”. The terms “logopedic voice treatment”, “voice therapy”, “singer training” and “singer” were used. Articles published in the last ten years that addressed logopedic interventions, voice therapies, or vocal care programmes for singers were included.

The evidence reviewed indicates that voice therapy intervention is associated with significant improvements in vocal quality, phonatory efficiency, vocal load management, motor control, and vocal self-awareness in singers. The most commonly described interventions include vocal hygiene education, evidence-based vocal exercises, and individualised vocal therapy programmes, often coordinated with medical assessment and pedagogical vocal training, as well as with other health professionals.

The results reinforce the need to approach singers from a integrative perspective. Within this framework, logopedic voice therapy plays a key role in prevention, vocal education, performance optimisation, and rehabilitation of the singing voice, contributing to long-term professional sustainability. The need for greater methodological consensus and structured transdisciplinary models that optimise vocal health and artistic performance in professional singers.

Keywords: *Logopedic voice treatment, Voice therapy, Singer training, Singer*

NEW VOICE, NEW SOUND - VOICE THERAPY AFTER GLOTTOPLASTY FOR TRANS WOMEN

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Medical Voice Center, Hamburg, Germany

This presentation focuses on the procedure of voice feminization for trans women, with particular emphasis on the clinical pathway followed by glottoplasty. A structured overview illustrates the sequential steps a patient undergoes at our center, from initial assessment to postoperative voice therapy. The interdisciplinary collaboration between ENT doctors and speech-language pathologists (SLPs) is highlighted as a key factor in achieving optimal outcomes. The presentation demonstrates therapeutic results using before-and-after video recordings, showing changes in vocal quality and communicative expression. This integrated approach underscores the importance of coordinated medical and therapeutic care in supporting sustainable and functional voice feminization.

Keywords: *Interdisciplinary collaboration, voice feminization, trans women, Glottoplasty, Gender-affirming voice surgery*

RESPIRATORY AEROSOL GENERATION DURING VOICE PRODUCTION: PHONATORY TASK DEPENDENCE AND AIRWAY TRANSPORT

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Background
Voice production is a relevant source of respiratory aerosol emission with implications for infection transmission. While louder voice has been consistently linked to increased aerosol emission, the independent effects of different phones on particle generation remain unclear.

Objectives
To investigate how selected phones influence respiratory particle emission, and to model particle transport in the upper airway during phonation.

Methods
Controlled experimental measurements were conducted in 41 infection-free singers. Particle number concentration and size distributions (0.004–10 µm) were measured during production of the phones [a], [o], and [r], as well as breathing and coughing, using a condensation particle counter and an aerodynamic particle sizer. Sound pressure levels (SPL) were recorded concurrently, and data were analyzed using generalized mixed-effects models. In addition, large-eddy simulations (LES) were used to model airflow and particle transport (1–100 µm) through the vocal tract during phonation of [o].

Results
Particle emission varied systematically between the phones. The vowel [o] produced higher particle counts than [a], and the alveolar trill [r] generated a disproportionate number of submicron particles. SPL showed a consistent positive association with particle emission but did not completely explain differences between phones. Computational modeling demonstrated that the upper airway effectively filters larger particles originating from the larynx and below, allowing predominantly <5–10 µm particles to exit the mouth, depending on airflow velocity.

Conclusions
The results confirm previous findings that higher sound pressure levels are associated with increased respiratory particle emission, while also demonstrating that different phones independently influence emission characteristics. Differences between vowel phonations and the alveolar trill [r], together with computational modeling, suggest that small particles may originate from multiple regions of the respiratory tract and the emitted size distribution can be further shaped by airway transport. The findings provide mechanistic insight into respiratory aerosol generation during voice production.

Keywords: *Voice production, Respiratory aerosols, Phonation, Particle emission, Upper airway transport*

VOICE AND BIOSOMATIC MEDICINE: SOMATIC MEMORY AND DYSPHONIA

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The voice is a complex neuromotor function resulting from the integration of respiratory, phonatory, postural, and emotional systems, and it represents one of the earliest forms of interaction between the individual and the environment. From the very first moments of life, vocal activity emerges as an expression of profound neurophysiological adaptations.

Biosomatic Medicine investigates the interaction between bodily, psychological, and emotional dimensions, aiming to identify the links between individual lived experiences and somatic manifestations. From this perspective, symptoms are not considered isolated events, but rather expressions of adaptive strategies involving the entire organism, including components of bodily memory.

In the vocal domain, particular relevance is attributed to the newborn's first respiratory and phonatory experience, a crucial moment for the organization of pneumo-phonatory patterns and the autonomic nervous system. Critical perinatal events, such as the presence of a nuchal cord, may lead to hypoxic conditions, increased defensive muscle tone, and alterations in respiratory coordination. These conditions can interfere with the establishment of a physiological neuromotor organization, promoting the development of early compensatory patterns.

Such adaptations may be stored as somatic memory, understood as a set of neuromuscular and neurovegetative traces that persist over time and influence motor and vocal behavior into adulthood. From this viewpoint, functional dysphonia can be interpreted not only as a technical or muscular alteration, but as the expression of a primary adaptive response to stress.

Clinical experience as a speech-language pathologist specialized in artistic vocology highlights how exclusively technical and hyper-controlled approaches may reinforce these compensatory patterns. Conversely, an integrated model that takes into account somatic memory and the individual's bodily history allows for a more effective functional reorganization, promoting a physiological, economical, and expressive vocal emission. This approach opens new perspectives in the prevention and treatment of functional dysphonias.

Keywords: *Biosomatic Medicine, Dysphonia, Critical perinatal events, Voice*

SELECTIVE LARYNGEAL ADDUCTOR DENERVATION- REINNERVATION SURGERY FOR ADDUCTOR SPASMODIC DYSPHONIA- A PRELIMINARY REPORT

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Background
Adductor spasmodic dysphonia (AdSD) is a focal laryngeal dystonia characterized by involuntary, intermittent spasms of the adductor laryngeal muscles, leading to strained voice breaks during speech. Treatment options include Botox, Thyroplasty Type II, Endoscopic Thyroarytenoid Myoneurectomy, and Selective Laryngeal Adductor Denervation–Reinnervation (SLAD-R).

Aim
To assess the effectiveness of SLAD-R surgery in treatment of Adductor spasmodic dysphonia.

Methods
This is a prospective study on the efficacy of SLAD-R surgery in 7 patients over a period of 18 months done in a tertiary care laryngology referral unit.

Patient selection – All patients diagnosed to have adductor spasmodic dysphonia based on perceptual voice analysis, videolaryngostroboscopy findings and positive response to at least one dose of botox were included in the study. Perceptual voice analysis were done by 3 voice pathologist blinded to the method of treatment offered. Only those patient who opted for a long lasting solution were given the option of SLAD-R surgery.

Exclusion criteria-Patients above 60yrs of age and with history of long standing Diabetes mellitus were not included in the study
Videolaryngostroboscopy, perceptual voice assessment, and VHI score were done preoperatively and postoperatively at 3 months, 6 months, and 1 year.

Statistical method used was Wilcoxon signed rank test.

Results
All patients had an improvement in postoperative VHI scores.
One patient had recurrence of spasm after 9 months, however his VHI score was significantly less at 1 year compared to preoperative. All other patients remained spasm-free at follow-up. Postoperative morbidity included transient breathy voice and subclinical aspiration. Breathy voice improved gradually and resolved completely by 3 months.

The limitations of the study include small sample size, lack of control group, relatively short follow-up period, single centre study.

Conclusion
SLAD-R provides long lasting control of symptoms, with good patient satisfaction. However it needs further validation with more number of patients.

Keywords: *Adductor spasmodic dysphonia, selective laryngeal adductor deinnervation reinnervation surgery, voice handicap index, laryngeal dystonia*

Comparison of preoperative and postoperative Voice handicap index

Pre-operative VHI	Post operative VHI at the end of 1 year
18	3
26	3
16	7
22	10
19	8
21	5
25	2

BEYOND THE LARYNX: THE ROLE OF AUDITORY BIOFEEDBACK IN THE REVERSIBILITY OF ORGANIC VOCAL FOLD LESIONS. CASE REPORT WITH 8-YEAR FOLLOW-UP

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Introduction

Professional voice users with hearing loss often develop laryngeal hyperkinetic compensatory mechanisms. Superficial siderosis (SS) of the central nervous system (CNS) is a rare neurological condition involving progressive sensorineural hearing loss. The absence of auditory biofeedback triggers a chronic Lombard effect, with involuntary increase in vocal intensity and phonotraumatic load which can induce organic vocal fold lesions. This case describes vocal fold lesions' evolution in a teacher with SS following a cochlear implant (CI).

Case

A 45-year-old female teacher, diagnosed with SS at age 17, presented with progressive hearing loss resulting in left anacusis and severe right hearing loss. Concurrently, she developed worsening dysphonia related to work activity. Pre-CI evaluation (2018) revealed: intracordal cystic lesion in the middle third of the left vocal fold with contralateral reactive nodule on videolaryngostroboscopy (VLSS); GRBAS G2 I2 R1 B0 A1 S2 and multiple pathological acoustic parameters exceeding normative thresholds (Jitter 1.231%, RAP 0.724%, ATRI 8.414%, DSH 0.833%, DUV 0.826%) on Multi-Dimensional Voice Program (MDVP). Given limited benefit obtained from hearing aids, the patient underwent a right CI.

Results

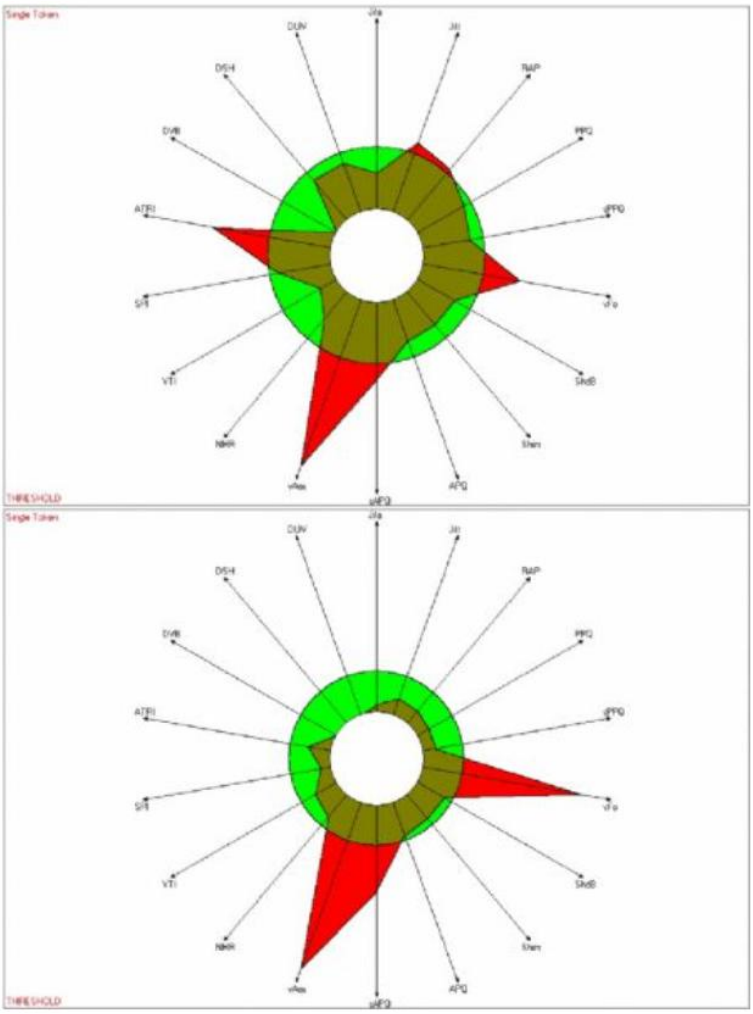
Post-CI evaluation (2026) showed significant improvement: GRBAS G1 I1 R0 B0 A1 S1; marked reduction in perturbation parameters (Jitter 0.438%, RAP 0.272%), tremor amplitude (ATRI 2.516%), and complete elimination of subharmonic and unvoiced segments (DSH and DUV both 0%) on MDVP. Spectrographic analysis revealed transformation from irregular, fragmented harmonic structure with high-frequency noise to regular, continuous harmonic patterns. VLSS confirmed complete resolution of the reactive nodule and regression of the cystic lesion to an asymptomatic micro-cyst.

Conclusions

Despite a discontinuous follow-up, this case report demonstrates that auditory biofeedback restoration can attenuate/resolve organic vocal fold lesions secondary to phonatory load. Furthermore, teaching load remained unchanged and speech therapy was provided exclusively for auditory rehabilitation, emphasising the importance of sensory integrity in professional voice users.

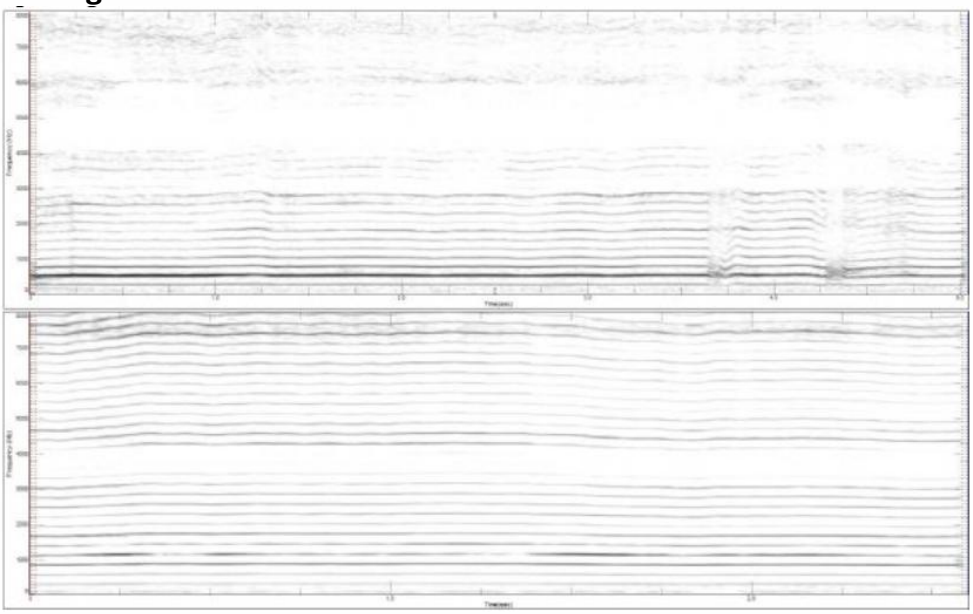
Keywords: *Vocal fold lesions, auditory biofeedback, cochlear implant, professional voice, superficial siderosis*

MDPV



MDVP acoustic analysis - Pre-CI (2018, top) vs Post-CI (2026, bottom) comparison. Pre-CI (2018): Multiple pathological parameters (red zones) reflecting organic vocal fold lesions: frequency perturbation (Jitter, RAP), amplitude variability (vAm), and tremor (ATRI) exceeding thresholds. Presence of subharmonic (DSH) and unvoiced segments (DUV) indicates vibratory irregularity secondary to intracordal cyst and reactive nodule. Post-CI (2026): Significant improvement in perturbation parameters (Jitter -64%, RAP -62%, ATRI -70%) and complete elimination of DSH/DUV, consistent with lesion regression. Increased vFo and vAm variability likely represents sensorimotor recalibration phenomenon: restoration of auditory biofeedback enables recovery of physiological prosodic dynamics after years of rigid hyperfunctional compensation. This transitional adaptation phase is supported by concurrent GRBAS improvement and spectrographic regularization. Alternative hypothesis: possible vocal strain during adaptation phase or age-related physiological changes (8-year interval: from 45 to 53 years) warrant consideration and longer-term follow-up. Color coding: Green = normal; Yellow = borderline; Red = pathological exceeding threshold.

Spectrogram



Comparative spectrograms of vocal production. Top panel (2018, pre-implant): Spectrogram showing harmonic structure visible up to approximately 3000 Hz, with significant high-frequency aperiodic noise (4000-8000 Hz range), poor harmonic definition and unstable fundamental frequency due to severely compromised auditory feedback. Bottom panel (2026, post-cochlear implant): Marked improvement with clear, well-defined harmonics now recognizable up to 8000 Hz, substantial reduction in high-frequency noise, improved harmonic organization, enhanced spectral clarity, and better fundamental frequency stability. The restoration of auditory feedback through cochlear implantation resulted in significant improvement in voice quality and phonatory control.

MEASURING THE IMPACT OF MONITORING DEVICES ON SINGERS

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Different types of monitoring are commonly used in Contemporary Commercial Music, from personal in-ear monitors (IEMs) to wedge monitors distributed across a stage. However, as technology for networked performances in virtual acoustics is developed, all performers, including classical singers, are sometimes required to perform with monitoring over personal monitoring devices (MDs). For singers, this is a complex issue that can impact their performance in multiple ways. Often singers want to remove one of the earpieces when performing in personal MDs. The reasons for this are not well understood but are likely related to proprioception and the occlusion effect.

Previous work piloted a study in which contact microphones were used to measure the impact of personal MDs on vibrations at the cheekbone and mastoid bone positions during singing. The results suggested that MDs impact the spectral content of sung vowels, and results vary across pitch, phoneme and device.

Building on this previous pilot, a modified protocol has been developed to include a new measurement tool consisting of an IEM type device, which contains microphones, enabling the capture of signals inside and outside the ear. The protocol now utilises contact microphones, airborne microphones and in-ear microphones (via the IEM devices) to measure the influence of personal MDs on singers. The personal reflections of the singers are also captured as part of the protocol. Alongside the protocol, validation of the methodology will be shown utilising a KEMAR dummy head.

Findings suggest that this is a robust protocol for investigating the impact of MDs on singers, with implications for future development of MD technologies and voice science research.

Keywords: *Singing, Monitoring, Protocol, Headphones, In-Ear Monitors*

MUCOUS VERSUS EPİDERMOİD VOCAL FOLD CYSTS: CLİNİCAL, SURGİCAL AND PHONİATRİC OUTCOMES

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Introduction

Vocal fold cysts are a frequent cause of dysphonia and mainly include epidermoid and mucous types, which differ histopathologically and may present distinct clinical and postoperative outcomes. Comparative data on their functional evolution after phonomicrosurgery remain limited. This study compares clinical features, surgical outcomes, and short- and long-term voice results between epidermoid and mucous vocal fold cysts.

Methods

A retrospective cohort study including 69 patients who underwent a mini-microflap excision (last author) of vocal cyst between 2014 and 2024.
Data collected include demographic characteristics, histological type, recurrence, contralateral involvement, follow-up duration, and voice evaluations performed preoperatively, postoperatively, and at last follow-up. Voice assessment comprise perceptual (GRBAS), aerodynamic (TMP), patient-reported (VHI), and acoustic parameters (jitter, DSI). Statistical analyses used nonparametric tests with significance set at $p <= 0.05$.

Results

The cohort is mainly female (88%), with a median age of 39.5 years. Thirty-five patients had epidermoid cysts and 34 had mucous cysts. Recurrence (11.1%) and contralateral vocal fold lesions (18.5%) occurred only in epidermoid cysts, which also had longer follow-up. Preoperative findings were similar between groups. Postoperatively, perceptual grade, VHI, and DSI favored mucous cysts. At last follow-up, GRBAS scores and VHI remained significantly worse in epidermoid cysts.

Conclusion

Epidermoid cysts are associated with higher recurrence, contralateral involvement, and poorer long-term voice outcomes, supporting histology-based management and extended follow-up.

Keywords: *mucous vocal cyst, epidermoid vocal cyst, cysts minimicroflap procedure*

KEY ROLES IN OPERA PRODUCTION REGARDING ACHIEVING SINGERS' SUNG TEXT INTELLIGIBILITY

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The sung text in opera is difficult for listeners to understand, even when sung in a language they know. Various explanations have been found for this, for example in the case of very high notes. However, opera texts remain incomprehensible in other cases as well. The goal of this research was to collect first-hand insights from singers regarding textual clarity, an aspect often overlooked in previous systematic studies. The study conducted 30 semi-structured interviews with professional opera singers from Europe and North America, conducted in Estonian (n = 11) and English (n = 19). As the problem concerns all voice types, all the singers who agreed to participate in the study and gave interviews were included in the work. Among the singers were three basses, three baritones, six tenors, one countertenor, six mezzo-sopranos, and eleven sopranos. This article focuses specifically on their reflections regarding the role of other professionals in supporting textual clarity. Although no direct questions were asked about these roles, the topic emerged spontaneously in several interviews. The findings suggest that improving text intelligibility in opera requires collaborative effort among singers, teachers, directors, conductors, production organizers, and even audiences.

Keywords: *opera, singers, text intelligibility, interviews, pronunciation*

ENCOURAGING AUTONOMY IN SINGING INSTRUCTION – ADVANCES FROM MOTOR LEARNING

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The collegiate voice studio is steeped in the tradition of the master-apprentice model. As outdated as that system may seem, teaching practices in the modern voice studio are very similar. Many modern voice teachers are flipping this paradigm, using science-informed pedagogy and modern learning theories. Because singing is a complex motor task, motor learning theory has emerged as a useful tool for encouraging student independence in voice pedagogy. Motor learning theory offers a clear framework to examine teacher feedback and gauge how that feedback does or does not encourage student autonomy.
The purpose of this study was to use the Motor Learning Classification Framework to analyze how teachers' teaching activities contribute to students' autonomy. I recruited three collegiate voice teachers. I then selected five of their students and recorded one lesson with each student. After the lessons were recorded, I interviewed the teachers regarding their beliefs and practices in promoting voice student autonomy in their studios. How do the voice teachers give their students feedback during the lesson?
Research questions included: How does the teacher give feedback during different phases of the lesson (i.e. technique, repertoire)? How is autonomy encouraged by the feedback given to the voice students by their teacher? How do the voice teachers view student autonomy? How do the voice teachers actively encourage autonomy in their students?
I used an embedded multiple case study to study the research questions. The data sources for this study were the recorded lessons and semi-structured interviews. Analytical memos were also taken while the lessons were being recorded. These memos described any physical movements from the teacher or the student that was part of the learning process.
Results are pending data collection and analysis to be completed in late winter 2026.

Keywords: *voice, teaching, music, motor learning, autonomy*

COMPARISON OF ARTIFICIAL INTELLIGENCE ASSESSMENT AND CLINICIAN ASSESSMENT IN PERCEPTUAL ASSESSMENT OF VOICE DISORDERS

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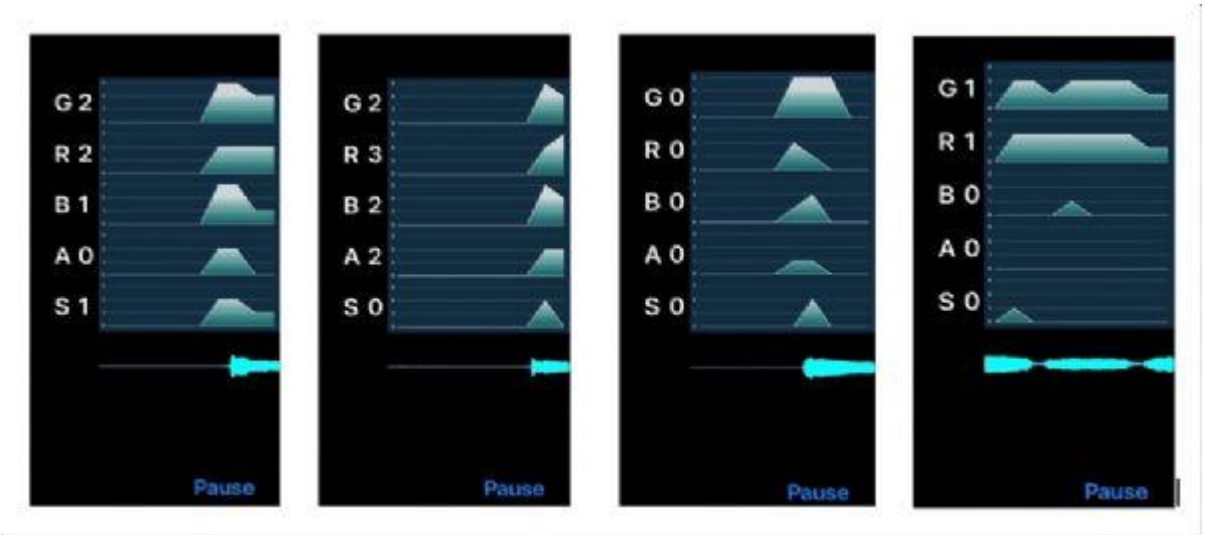
Introduction

Combined acoustic, aerodynamic, and perceptual analyses in evaluating voice disorders are important for accurate diagnosis and effective treatment planning. Advancements in artificial intelligence (AI) aim to standardize diagnostic processes. The AI-powered GRBASZero application provides scoring for the GRBAS scale in perceptual voice evaluation. This study compares GRBAS scores of Turkish-speaking individuals with voice disorders, assessed by Turkish Speech and Language Therapists, with scores from the GRBASZero application. Method: The study included 60 dysphonic and 15 healthy individuals. Since GRBASZero and clinicians consistently scored healthy individuals as '0', a zero-variance situation occurred. Because correlation tests cannot be calculated for constant variables, healthy controls were excluded. Participants were scored using GRBASZero and completed the Voice Handicap Index-10, Voice-Related Quality of Life Scale, Turkish Vocal Fatigue Index and Vocal Tract Discomfort Scales. Maximum /a/, /i/, /s/, /z/ phonations and reading passages were analyzed using Praat software. Recordings were evaluated by 13 Speech and Language Therapists using the GRBAS scale. Results: Reliability values among the clinicians' GRBAS scores (ICC=.97,95,94,94,93) indicate a high level of consistency. A moderately significant relationship was found between clinician and GRBASZero evaluations for G, R, B, and S parameters. A low-correlation significant relationship was found for the A parameter. Mean GRBAS scores were higher in clinical assessments (Mean=1.32) compared to GRBASZero (Mean=0.92). Comparing acoustic and aerodynamic analyses with GRBAS parameters revealed no significant differences. Self-perception scales generally showed a significant relationship with clinician evaluations, but rarely with GRBASZero. Conclusion: The near-moderate correlation between clinician and GRBASZero assessments offers hope for AI integration into diagnosis, but indicates AI-assisted applications should currently be used as an auxiliary tool. The difference between AI and self-perception scales suggests the application may not fully capture the patient-perceived psychosocial impact of voice disorders. Further studies are needed.

Keywords: *Artificial intelligence, voice disorders, perceptual evaluation, voice analysis, GRBAS*

GRBASZero Application Usage Screenshots



The GRBASZero iOS application, installed on an iPhone 15 Pro, was used to obtain AI-generated GRBAS scores for the audio recordings.

Comparison of Clinician GRBAS Scores and GRBASZero Scores in 60 Dysphonic Individuals

Comparison of Clinician GRBAS Scores and GRBASZero Scores in 60 Dysphonic Individuals

	G (SLP)	R (SLP)	B (SLP)	A (SLP)	S (SLP)
G (AI)	0.569***	0.531***	0.479***	0.413**	0.483***
R (AI)	0.556***	0.571***	0.354**	0.330**	0.533***
B (AI)	0.447***	0.499***	0.479***	0.304*	0.462***
A (AI)	0.423***	0.537***	0.399**	0.293*	0.463***
S (AI)	0.327*	0.372**	0.393**	0.303*	0.323*

** p <.05, ** p <.01, *** p <.001 AI: Artificial Intelligence, SLP: Speech and Language Pathologist, G: Grade, R: Roughness, B: Breathiness, A: Asthenia, S: Strain*

Comparison of Acoustic and Aerodynamic Parameters with GRBASZero Scoring in Dysphonic Individuals

	F0	Jitter	Shimmer	HNR	Maximum /a/ Phonation	Maximum /i/ Phonation	s/z ratio
G (SLP)	0.130	0.444***	0.373**	-0.365**	0.063	0.075	-0.184
R (SLP)	0.118	0.467***	0.334**	-0.409**	0.033	0.107	-0.152
B (SLP)	0.344**	0.393**	0.422***	-0.383**	-0.098	-0.060	-0.165
A (SLP)	0.297*	0.332**	0.290*	-0.230	0.029	0.081	-0.066
S (SLP)	0.122	0.478***	0.359**	-0.371**	0.183	0.176	-0.267*
G (AI)	-0.014	0.562***	0.426***	-0.486***	0.042	-0.014	-0.151
R (AI)	-0.168	0.457***	0.351**	-0.406**	0.196	0.159	-0.121
B (AI)	0.178	0.519***	0.430***	-0.465***	-0.107	-0.100	-0.238
A (AI)	0.193	0.463***	0.353**	-0.436***	-0.115	-0.062	-0.226
S (AI)	0.171	0.305*	0.198	-0.224	-0.045	-0.008	-0.153

** p <.05, ** p <.01, *** p <.001 AI: Artificial Intelligence, SLP: Speech and Language Pathologist, F0: Fundamental Frequency, HNR: Harmonic Noise Ratio, G: Grade, R: Roughness, B: Breathiness, A: Asthenia, S: Strain*

Comparison of Clinician GRBAS Scores and Self-Perceptual Scales in Dysphonic Individuals

	Voice Handicap Index-10	Voice-Related Quality of Life Scale	Turkish Vocal Fatigue Index	Vocal Tract Discomfort Scales
G (SLP)	0.401**	-0.396**	0.368**	0.268*
R (SLP)	0.391**	-0.367**	0.359**	0.278*
B (SLP)	0.457***	-0.461***	0.397**	0.397**
A (SLP)	0.468***	-0.505***	0.441***	0.281*
S (SLP)	0.288*	-0.291*	0.274*	0.273*
G (AI)	0.197	-0.213	0.202	0.277*
R (AI)	0.131	-0.181	0.126	0.249
B (AI)	0.227	-0.205	0.277*	0.283*
A (AI)	0.217	-0.123	0.219	0.205
S (AI)	0.179	-0.241	0.258*	0.134

** p <.05, ** p <.01, *** p <.001 AI: Artificial Intelligence, SLP: Speech and Language Pathologist, G: Grade, R: Roughness, B: Breathiness, A: Asthenia, S: Strain*

VOCAL AND PROSODIC VARIABILITY IN CHILDREN WITH AUTISM SPECTRUM DISORDER

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Communication impairments represent one of the core diagnostic criteria of autism spectrum disorder (ASD), with atypical prosody being a frequent yet clinically difficult-to-objectify symptom. In clinical practice, the assessment of prosodic features largely relies on the examiner's subjective judgment, while reliable and sensitive acoustic indicators have not yet been clearly established. The aim of this study was to acoustically describe and analyze vocal and prosodic speech characteristics in children with ASD.
The study included 15 verbal children with ASD aged 7;08 to 14;02 years. The control group consisted of 15 typically developing children without voice disorders. Prosodic features were assessed through spontaneous speech in a picture description task, while vocal characteristics were evaluated through sustained phonation of the vowel /a/. Acoustic analysis included macrovariability parameters (fundamental frequency and voice intensity – mean values, standard deviations, and range) and microvariability parameters of phonation (jitter, shimmer, and harmonics-to-noise ratio – HNR). The obtained values were compared with those of the control group and with reference norms reported in the literature.
The results indicate increased variability of fundamental frequency and voice intensity, suggesting reduced control of prosodic parameters, while basic phonatory abilities were largely preserved, with occasional amplitude oscillations reflected in shimmer measures. In conclusion, children with ASD demonstrate relatively stable phonation but impaired prosodic regulation, with the combined variability of fundamental frequency and voice intensity emerging as a potential acoustic biomarker of ASD.

Keywords: *autism spectrum disorder, acoustic analysis, vocal microvariations and macrovariations*

CONSERVATIVE MANAGEMENT OF SELECTED SCHAEFER-FUHRMAN GROUP III BLUNT LARYNGEAL TRAUMA

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Introduction

Blunt laryngeal trauma can be life-threatening, with risks for long-term morbidity. The Schaefer–Fuhrman classification has traditionally been used to grade severity and guide management; with definitive surgical intervention being the recommendation for group III injuries. Data regarding conservative management remain limited. Herein, through 2 cases, we report the feasibility and outcomes of conservative management in selected Schaefer-Fuhrman Group III blunt laryngeal trauma.

Case Series

We present 2 patients with Schaefer–Fuhrman group III blunt laryngeal trauma. One had displaced left thyroid cartilage fracture with ipsilateral supraglottic edema, supraglottic and true cord hematoma. The other had exposed cartilage with arytenoid and true cord hematoma on nasendoscopy. The former declined surgical fixation while the latter was advised on conservative management in view of age and comorbidities.

Results/Discussion

Both patients maintained a stable patent airway on serial scopes and were managed conservatively (airway monitoring, voice rest, dexamethasone, anti-reflux medication). They were discharged on day 4 and 3 respectively on oral diet with subjective voice and objective nasoendoscopic improvement. While both patients defaulted follow-ups; on phone recall, both had no further voice/swallowing complaints (first patient recovered fully, second patient had mild residual dysphonia with satisfactory functional voicing). These cases provide preliminary evidence that conservative management may be feasible in selected injury patterns traditionally considered for surgical repair – specifically in clinically stable patients without airway or swallowing compromise with displaced fractures that do not impair vocal fold mobility/mucosal wave or limited mucosal disruption/exposed cartilage with low adhesion risk; particularly in elderly individuals with significant comorbidities. Interpretation is limited by small sample size, lack of formal follow-up, objective voice/swallowing measures, and longer-term outcomes.

Conclusion

Conservative management may be feasible in carefully selected patients with Schaefer–Fuhrman Group III blunt laryngeal trauma. Further studies with standardized functional outcome assessments are required to better define selection criteria.

Keywords: *blunt laryngeal trauma, laryngeal injury, laryngeal fracture*

Figure 1. Patient 1. (A, B) Flexible nasoendoscopy on admission demonstrating left supraglottic edema, false and true cord and aryepiglottic fold hematoma with normal cord mobility; (C) Axial CT scan showing left displaced thyroid cartilage fracture.

Figure 2. Flexible nasoendoscopic findings of Patient 2 on admission. (A) left arytenoid, aryepiglottic fold and right true cord hematoma; (B) Exposed cartilage on the medial surface of the left arytenoid; (C) normal vocal vord mobility bilaterally

CLINICAL VALIDATION OF THE CROATIAN VOICE HANDICAP INDEX-10 AND ITS RELATIONSHIP WITH ACOUSTIC VOICE MEASURES

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Introduction
Contemporary voice assessment relies on the integration of instrumental, perceptual, and patient-reported outcome measures. Self-assessment questionnaires play a crucial role in capturing patients' perceptions of vocal difficulties and their impact on everyday communication and quality of life. The Voice Handicap Index-10 (VHI-10) is a brief and widely adopted tool for the clinical assessment and monitoring of voice disorders. This study aimed to validate the Croatian version of the VHI-10 and to examine its relationship with objective acoustic voice measures.

Methods
The study included 33 women with diagnosed dysphonia (functional and structural voice disorders) and 57 vocally healthy women. All participants completed the Croatian VHI-10. Objective acoustic voice analysis was performed using Praat software. Clinical validity was evaluated by comparing VHI-10 scores between groups. Internal consistency and factor structure were analysed to assess reliability and construct validity. Associations between VHI-10 scores and selected acoustic parameters were examined using correlation analysis.

Results
Participants with dysphonia reported significantly higher VHI-10 scores compared to vocally healthy controls ($p < 0.001$), confirming strong clinical validity. The Croatian VHI-10 demonstrated excellent internal consistency (Cronbach's $\alpha = 0.927$) and a stable one-factor structure. Correlation analysis revealed no significant associations between VHI-10 scores and most acoustic parameters, with the exception of a weak negative correlation between the total VHI-10 score and jitter.

Conclusion
The Croatian version of the VHI-10 is a reliable, valid, and clinically applicable instrument for assessing perceived vocal handicap. The limited correspondence between subjective self-assessment and acoustic measures underscores the importance of incorporating patient-reported outcomes within a multidimensional framework for comprehensive voice evaluation.

Keywords: *Voice Handicap Index-10, dysphonia, clinical voice assessment, acoustic analysis*

SURGICAL TREATMENT OF SUPRAGLOTTIC CYSTS USING A 445-NM "BLUE" LASER

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Introduction

Laryngeal cysts are classified as tumor-like lesions and are most commonly localized in the supraglottic region, predominantly on the epiglottis. The main treatment method for this pathology remains surgical excision.

Objective.

To evaluate the efficacy of 445 nm laser surgery in the management of laryngeal supraglottic cysts.

Materials and Methods

This prospective single-center study included 42 patients (21–72 years old, mean 44 ± 12) with supraglottic laryngeal cysts treated by 445 nm laser microsurgery between May 2025 and November 2025. Outcomes included endoscopic resolution of mucosal inflammation, postoperative pain (VAS 0–10), wound re-epithelialization time, and cyst recurrence. A study-specific 4-point scale (0–3) for edema, hyperemia, and fibrin (maximum total score 9) was used to grade the inflammatory response.

Results

The epiglottis was the most common cyst location (62%), followed by the valleculae and aryepiglottic fold. Cyst diameter ranged from 0.7 to 1.5 cm. All cysts were completely excised with no intraoperative complications. No recurrences were observed over a median follow-up of 3 months. The mean inflammation score was 5 on postoperative day 1 and 6 on day 3 (reflecting fibrin deposition), then decreased, with near-normal endoscopic appearance by day 12. Mean pain VAS was 4.5 on day 1, 2–3 by day 3, and 0 by day 7. Wounds re-epithelialized within two weeks in all cases.

Conclusions

The 445 nm laser demonstrated high efficacy and safety, providing precise tissue dissection with effective hemostasis and minimal thermal damage. Its use was associated with favorable postoperative outcomes and rapid re-epithelialization, supporting its feasibility for surgical management of supraglottic laryngeal cysts. Short-term outcomes were comparable to those reported for CO_2 laser or cold instrument excision. Limitations include the small, single-center sample, lack of a control group, and short follow-up; further comparative studies are warranted.

Keywords: *supraglottic cysts, surgical treatment, blue laser, 445 nm laser*

STIGMA AMONG LARYNGECTOMIZED INDIVIDUALS DESPITE SUCCESSFUL ACQUISITION OF ESOPHAGEAL OR TRACHEOESOPHAGEAL SPEECH

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The surgical procedure involving complete removal of the larynx is known as total laryngectomy. This mutilating procedure entails numerous consequences, which significantly alter a person's quality of life after surgery. When an individual is confronted with a severe cancer diagnosis resulting in the loss of the organ responsible for the most important form of communication—speech—many of their social roles and opportunities change. Two of the three possible methods of voice restoration are tracheoesophageal voice/speech and esophageal voice/speech.
Loss of voice/speech can also lead to the loss of a previously established social identity across different social domains. One of the consequences of losing social identity may be self-stigmatization, as well as social stigma, in which the environment—often unintentionally, due to lack of knowledge or information—changes its attitude toward the individual, isolates them, avoids them, or treats them differently than before the loss.
The aim of this study was to investigate whether stigma is present in laryngectomized individuals despite successful acquisition of substitute speech (esophageal or tracheoesophageal).
In accordance with the research questions, a qualitative approach to data collection and analysis was applied using thematic analysis.
A total of 22 participants who had undergone laryngectomy took part in the study. All participants met five predefined criteria, one of which was successful mastery of esophageal or tracheoesophageal voice/speech.
The presentation of the research results shows that person with laryngectomy, despite successful voice and speech rehabilitation, regularly experience environmental stigma, self-stigmatization, and psychological consequences of stigma. After laryngectomy, participants reported experiences of avoidance by the environment, friends, and colleagues, as well as various unpleasant interactions with others. The greatest difficulty they reported was speaking in social situations, which often leads to social withdrawal. Most participants socialize less and speak less in social settings.

Keywords: *Total laryngectomy, esophageal or tracheoesophageal voice, stigma*

RESULTS OF SURGICAL TREATMENT OF SUBGLOTTIC STENOSIS IN CHILDREN

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Subglottic stenosis (SGS) in children results from congenital anomalies and acquired causes. Congenital anomalies are relatively rare. Acquired subglottic stenosis is more common, occurring in approximately 1-2% of children treated in intensive care units (Schweiger C et al., 2013; Choi SS, Zalzal GH. 2000). The aim of this study was to compare the results of endoscopic and open one-stage surgeries.

Materials and Methods

The study was conducted 2016, a total of 36 children with subglottic stenosis, aged 2 months to 12 years, were examined. Three children had congenital subglottic stenosis, while the remaining 33 had acquired subglottic stenosis. Eleven children were admitted without a tracheostomy with severe stridor and the remaining 25 had a tracheostomy.

Surgeries were performed in 35 cases: 11 open and 24 endoscopic. Endoscopic surgeries included laser scar excision and T-tube dilation for 3-6 months. Open surgeries included one-stage laryngotracheal reconstruction with expansion tne cricoid cartilage and placement of costal cartilages anteriorly and posteriorly. The posterior implant was formed laterally in a "boat" shape, while the anterior implant was shaped as a step. A stent was placed in the expanded space and secured sutures for 4-5 weeks. After 4-5 weeks, the stent was removed.

Study results

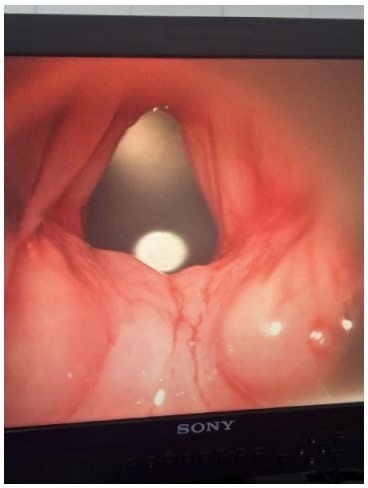
Endoscopic procedures were performed in 24 cases. After surgery 6 months, decannulation with spontaneous oral breathing was possible in 13 cases (54.2%). Endoscopy revealed Mayer-Cotton grade 1 stenosis in 9 cases. Eleven patients developed recurrent stenosis, worsening the severity and making decannulation impossible.

One-stage laryngotracheal reconstruction with expansion using costal cartilage was performed in 11 patients - 4-5 weeks after the operation, the stents were removed, decannulation was performed after 3 weeks. Decannulation was effective in all patients, recurrence of grade 1 stenosis according to Mayer-Cotton was observed in 3 patients without the presence of respiratory failure.

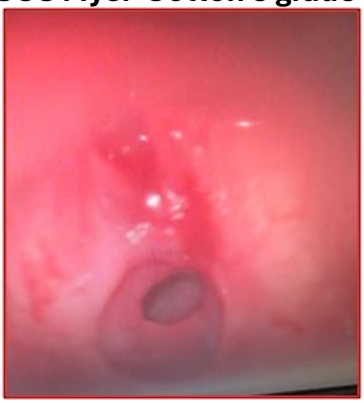
Keywords: *subglottic stenosis, children, laryngotracheal reconstruction*

costal cartilage grafts

endoscopy after 3 month LTR with costal cartilage



SGS Myer-Cotton 3 grade



Characteristics of patients with SGS

Symptom	abs	%
Congenital	3	8,3
Acquired	33	91,7
Age		
Newborns	11	30,6
Young children 3 months-3 years	9	25,0
Preschool age	10	27,7
School age	6	16,7
Causes of long intubation		
Intensive care unit for newborns	8	24,2
Congenital heart defects	6	18,2
Traumatic brain injury	7	21,2
Lung infection	12	36,4
Duration of intubation, day	6,33±0,59	
By Mayer-Cotton stenosis grade		
III	24	66,7
IV	12	33,3
With tracheostomy	25	69,4
Surgical Therapy		
Endoscopic procedures/result decannulation	24/13	54,2
Open reconstruction of subglottic stenosis Single-stage laryngotracheal reconstruction with cartilage expansion/ result decannulation	11/11	100,0

INVESTIGATING POSTURE EFFECTS ON SPEECH AND VOICE PRODUCTION

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Producing speech across different body postures requires humans to constantly adapt to the Earth's gravitational pull. However, body posture effects on voice production remain largely uncharted. Classically trained singers were reported to maintain unchanged subglottal pressure levels in the supine position [1], but little is known about the effects in untrained voices and in other positions.

In two pilot studies [2, 3], we studied compensatory patterns in speech breathing and voice characteristics across the upright, supine and inverted positions. The results showed greater abdominal movement in the supine position compared to upright, with mixed patterns observed in the inverted position. Additionally, systematic voice quality changes across the positions were found at specific fundamental frequency and sound pressure level ranges. However, individual variation was substantial, possibly related to body type and divergent compensatory strategies.

In our ongoing project, we investigate the effects of posture on speech and voice production using a novel coregistration protocol for simultaneous acquisition of breathing, phonation, and articulation. We are interested in adjustments speakers employ in the upright, supine and inverted positions, their individual variability and their impact on perceptual characteristics of the voice. We also study the effect of vocal training on consistency of the observed patterns. The findings will inform biomechanical models of speech production and movement control in humans.

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Keywords: *Body posture, speech production, speech breathing, phonation*

MUTATIONAL DYSPHONIA-OUR EXPERIENCE

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Objective
Mutational dysphonia is the most common mutation disturbance. The aim of the study is to demonstrate the effectiveness of complex phonitary therapy and the significance of this clinical phenomenon, often ignored in the clinical practice of an otolaryngologist in the Republic of Kazakhstan.

Methods
Over 3 years, we treated 1,189 patients (955 boys, 234 girls) aged 15 to 25. Comprehensive treatment includes a detailed medical history, clinical ENT and phoniatric examinations, endovideolaryngostroboscopy, and multidimensional computerized voice and speech analysis. The correction program was based on individualized DoctorVox Voice Therapy with elements of psycho-emotional correction.

Results
At the initial examination stage, patients showed persistent elevated fundamental frequency that did not correspond to age-sex norms, in combination with signs of hyperfunctional voice formation. Videolaryngostroboscopy revealed symmetrical vocal fold vibration and a preserved mucous wave in the presence of pronounced supraglottic tension. Acoustic analysis demonstrated a limited dynamic range and decreased vocal signal stability. A phoniatric team (phoniatrists, speech therapists, and a psychologist) is involved in voice rehabilitation. After completing a course of therapy, 1,181 patients (964 boys, 227 girls) demonstrated a reduction in their fundamental frequency to physiological values, a reduction in hyperfunction, and the development of a more economical phonation pattern. Acoustic parameters and subjective voice assessment improved, and vocal fatigue decreased. Eight patients (one boy, seven girls) did not experience any effect, and rehabilitation is still ongoing, primarily due to a lack of motivation to improve their voice.

Conclusions
Mutational dysphonia is a multifactorial functional disorder requiring a comprehensive phoniatric approach. The obtained data confirm the effectiveness of treatment for mutational dysphonia with individualized DoctorVox Voice Therapy and emphasize the need for its widespread implementation in the clinical practice of ENT doctors in the Republic of Kazakhstan.

Keywords: *mutational dysphonia, DoctorVox Voice Therapy, Kazakhstan*

MULTIPARAMETRIC VOICE ASSESSMENT OF ADDUCTOR SPASMODIC DYSPHONIA PRE- AND POST-TRETMENT WITH BOTULINUM TOXIN INJECTION: A PROPOSAL FOR IMPLEMENTATION

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Spasmodic dysphonia is a low prevalence condition (1/100000), characterized by the presence of laryngeal spasms. Two main types of laryngeal dysphonia have been described: the most common adductor spasmodic dysphonia, affecting 90% of cases and involving the overadduction of the vocal folds, and the rarer abductor spasmodic dysphonia, affecting vocal fold abductor muscles. The causes of spasmodic dysphonia are still debated, and the assessment of this condition is based on clinical and perceptual voice evaluation, even if several acoustic and aerodynamic approaches have been proposed. The aim of this study was to propose an updated voice evaluation protocol to measure the effectiveness of Botulin toxin laryngeal injections for AdSD, including the motor speech diadochokinetic assessment as an indicator of fluency and intelligibility.
Study Design. This is a case report study

Methods
Two cases diagnosed with adductor spasmodic dysphonia were evaluated at baseline, and one and three months after Botulinum toxin injection in the thyroarytenoid muscle. The voice protocol assessment included the self-assessment questionnaire, the traditional perceptual GRB Scale and the INFVo rating scale for substitution voices, the acoustic analysis of jitter%, shimmer%, glottal-to-noise excitation ratio, and the motor speech diadochokinetic parameters.

Results
In both clinical cases, the motor speech diadochokinetic parameters showed an improvement one month after the treatment compared to the baseline, and a subsequent decrease 3 months after treatment, in agreement with the trends showed by the self-assessment questionnaire. Conversely, the traditional perceptual and acoustic parameters did not demonstrate to be consistent in both cases with the self-assessment results.

Conclusions
The results suggested that motor speech diadochokinetics parameters could be relevant to assess the outcome of Botulinum toxin treatment for adductor spasmodic dysphonia, especially in terms of fluency and intelligibility

Keywords: *spasmodic dysphonia, vocal fold Botulinum toxin injection, motor speech diadochokinetics parameters*

REASSESSING THE DEGG PEAK AS A MARKER OF GLOTTAL CLOSURE INSTANT (GCI): A PRELIMINARY IN VIVO SUPER-HIGH-SPEED VIDEO INVESTIGATION AT 45000 FRAMES PER SECOND

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Electroglottography (EGG) is a non-invasive method for assessing vocal fold vibration by measuring vocal fold contact area (VFCA) changes. The maximum VFCA increase during the glottal closing phase appears as a peak in the EGG first derivative (dEGG). This dEGG peak is commonly equated with the glottal closure instant (GCI) in voice analysis, serving as a foundation for many speech-processing algorithms. Our previous excised canine larynx study (DOI: 10.1242/jeb.093203) revealed that the dEGG peak and GCI differed by up to 10% of the glottal cycle duration, questioning the dEGG peak's reliability as a GCI correlate. Notably, a verification of this finding in human phonation in vivo is still outstanding.

Here, we present findings from an exploratory study of a trained soprano singing at pitches C4 and C5. Time-synchronized acoustic and EGG recordings were obtained alongside trans-oral high-speed videoendoscopy (HSV) at 45,000 fps. In addition, phonation was documented with an accelerometer positioned at the sternal notch. Preliminary data analysis suggests approximately 5% glottal cycle duration mismatch between the strongest dEGG peak and GCI. Observed dEGG "double peaks" may reflect anterior-posterior temporal delays in vocal fold contact patterns.

The data presented here elucidate that the VFCA is a time-varying one-dimensional representation of a complex vocal fold contacting pattern occurring in three dimensions. Vocal fold contacting and de-contacting occurs over finite intervals rather than instantaneous moments, particularly influenced by anterior-posterior phase differences. While our findings require verification in a larger group of participants, they indicate that the positive dEGG peak may not accurately represent the GCI, warranting reconsideration of its use as a precise temporal marker in speech analysis algorithms. Further, yet outstanding data analysis will reveal whether features found in the accelerometer signal may be more robust predictors of GCIs.

Keywords: *elektroglottography (EGG), super-high-speed video (sHSV), glottal closure instant*

MULTIDISCIPLINARY APPROACH IN THE REHABILITATION OF PATIENTS WITH LARYNGEAL PARESIS: FROM DIAGNOSIS TO FUNCTIONAL RECOVERY

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Laryngeal paresis is a complex condition that significantly affects voice quality, swallowing, and respiratory function, thereby reducing patients' quality of life. Effective management requires not only accurate diagnosis but also a comprehensive rehabilitation strategy. This paper presents a multidisciplinary approach to the rehabilitation of patients with laryngeal paresis, integrating otolaryngology, phoniatrics, speech-language therapy and rehabilitation medicine.

Objective
To propose a comprehensive approach aimed at optimizing voice recovery, addressing psychosocial aspects of voice changes, and improving patients' quality of life.

Materials-Methods
This article discusses a multifaceted approach to voice rehabilitation, based on clinical experience in phoniatrics. From January 2024 to January 2026, 61 patients with vocal cord paresis. Diagnostic evaluation of patients before and after treatment was performed using videolaryngostroboscopy and voice recordings.

Results
50 patients underwent conservative treatment: physiotherapy using amplipulse, pharmacological therapy, inhalations with medications and voice therapy. 30 patients experienced restoration of voice function after the treatment course. 10 patients with improved voice function were advised to continue voice therapy for up to 1 month. After one month, voice function was fully restored. In 10 patients, injection laryngoplasty was performed 2–4 times within a year. Patients in follow-up reported improvement in voice function.
Key rehabilitation strategies, including both conservative and active voice therapy techniques, tailored to the individual needs of the patient, are presented. Special attention is given to the role of physiotherapy and voice therapy, the importance of early intervention, and the use of nerve stimulation with amplipulse and specialized voice exercises. The use of medical interventions, such as pharmacological treatments and, when necessary, injection laryngoplasty, is also discussed.

Conclusions
An early, individualized approach to voice rehabilitation allows for faster recovery of voice function, improves patients' quality of life, and facilitates the rapid restoration of professional working capacity.

Keywords: *Voice Rehabilitation, Laryngeal Paresis, Phoniatrics, Voice Function*

THE INTERSECTION OF VOCAL PEDAGOGY AND MUSIC THERAPY - VOICE TRAINING WITH NEURODIVERGENT SINGERS

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The growing awareness of neurodiversity and its increasingly frequent diagnosis or self-diagnosis among singers, as well as the pursuit of full inclusivity in vocal education, pose a number of important questions for singing teachers. These include distinguishing between singing instruction and music therapy, considering the possibility of adapting methods and forms of working with neuroatypical students, and, most importantly, recognizing the difficulties and "superpowers" of the people whose voices we work with. With the goal of working effectively and creating a safe and supportive environment, it is therefore necessary to develop as complete a picture as possible of students diagnosed with SA, ADHD, or AuDHD. Based on an analysis of sources on voice functioning in neurodivergent individuals (psychological, music therapy, and vocological literature) and case studies, the characteristics of neuroatypical individuals in relation to singing lessons will be presented. Pedagogical issues (time management, attention, memory, motivation, selection and goals of exercises, repeatability and durability of work effects) and vocal issues (technical precision versus interpretive freedom, expression and communication of emotions, dynamics, style, repertoire selection, improvisation) will be analyzed. Based on the objectives, the scope of educational and therapeutic activities in working with neuroatypical students and their shared area will be defined. Against this background, the role and competences of the singing teacher will be presented. Finally, the issue of the possibility of preliminary diagnosis of neurodiversity based on the characteristics of the singing voice and functioning during classes will be raised.

Keywords: *neurodiversity, neurodivergent singer, vocal pedagogy, music therapy*

SUSTAINED PHONATION AND VOCAL ENDURANCE: FUNCTIONAL INSIGHTS FROM INDIAN CLASSICAL SINGING

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Sustained phonation is a central component of training in indian classical vocal traditions, where singers regularly engage in long-duration phrases, slow tempi, and extended tonal exploration. While these practices are often associated with stylistic and aesthetic outcomes, their functional role in developing vocal endurance and efficiency is less frequently articulated within contemporary voice pedagogy. The purpose of this paper is to examine sustained phonation as a training mechanism for improving vocal endurance, stability, and economy of effort. This study is based on pedagogical observations drawn from Carnatic, Dhrupad, and Khayal vocal training contexts. Studio-based teaching experiences with trained singers were examined, focusing on long-tone exercises, slow raga-based phrasing, and extended vowel phonation. Data collection included perceptual listening assessments and qualitative feedback from singers regarding fatigue, ease of production, and tonal stability during sustained singing tasks. The findings indicate that regular engagement with sustained phonation encourages more efficient breath usage, improved tonal steadiness, and reduced compensatory muscular effort over time. Singers demonstrated increased endurance and consistency across registers, particularly when attention was directed toward resonance balance and breath–voice coordination rather than pitch force or volume. These findings suggest that sustained phonation functions as an effective endurance-training strategy that supports vocal efficiency and longevity. Framing such traditional practices through a functional lens allows them to be integrated into contemporary voice pedagogy and may offer transferable strategies for singers and voice users across genres concerned with sustainable voice use and vocal health.

Keywords: *Sustained phonation, vocal endurance, vocal efficiency, indian classical singing, voice pedagogy*

THE INFLUENCE OF TUBE MATERIAL ON TISSUE OSCILLATION AND SENSATION ON VIBRATION: AN ACCELEROMETRY STUDY

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[3]Universidad de Chile

Tube phonation is a widely used semioccluded vocal tract exercise for voice rehabilitation. Although tubes made of different materials are commonly employed in clinical and pedagogical contexts, empirical evidence regarding the influence of tube material on tissue vibration and perceived vibratory sensation remains limited. This study aimed to investigate the effect of tube material on facial, neck, and upper thoracic tissue mobilization, as well as on self-perceived vibratory sensation during tube phonation in air.

Thirty vocally healthy adults with prior experience in semioccluded vocal tract exercises produced a sustained vowel [u:] using four tubes of identical length and diameter made of glass, metal, plastic, and paper, as well as a baseline condition without a tube. Tissue vibration was simultaneously recorded using four accelerometers placed on the forehead, zygomatic bone, thyroid cartilage, and suprasternal notch. Objective measures included tissue vibration frequency, amplitude, jitter, and shimmer derived from the low-frequency amplitude modulation of the accelerometer signal were obtained. Subjective perception of vibration was assessed immediately after each condition using a 100-mm visual analog scale. Data were analyzed using repeated-measures ANOVAs with Tukey-corrected post hoc comparisons.

All tube conditions produced measurable tissue vibration compared to baseline across all anatomical regions. Objective vibration measures showed minimal differences between tube materials for most variables. In contrast, self-perceived vibratory sensation demonstrated a strong and significant effect of tube material, with glass tubes yielding the highest ratings, followed by metal, plastic, and paper. This perceptual hierarchy was further supported by a composite index derived from average self-reported vibratory sensitivity ratings.

Tube material significantly influences vibratory perception and the composite vibratory response. While objective vibration measures revealed minimal differences across materials, self-reported perceptual data consistently indicated greater vibratory sensations with more rigid tubes. In particular, glass tubes provided the strongest somatosensory feedback, followed by metal, plastic, and paper.

Keywords: *Voice Therapy, Voice Training, Tube Phonation, Tissue Oscillation, Sensation of Vibration*

COMPARATIVE ANALYSIS OF VOICE HEALTH AWARENESS AMONG UNIVERSITY STUDENTS STUDYING IN DIFFERENT PROFESSIONAL FIELDS

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This study aims to comparatively examine levels of vocal health awareness among senior university students across different disciplines (Speech and Language Therapy, Engineering, and Conservatory) and to evaluate these levels by department, professional voice requirements, and gender. The literature primarily focuses on teachers and professional voice users, and comparative studies involving university students from different academic fields remain limited. This study aims to address this gap. This research was designed as a cross-sectional comparative study within the framework of quantitative research methods. Initially, the study aimed to recruit 300 final-year university students (50 females and 50 males from each department). However, as data collection is ongoing, the target sample size has not yet been fully achieved. To date, 262 final-year students, predominantly aged 21–23 years, have participated in the study. Of the participants, 58.4% were female and 41.6% were male. In terms of departmental distribution, 38.9% are from Speech and Language Therapy, 32.1% are from Engineering, and 29% are from Conservatory programs. Data were collected using the Voice Handicap Index-10 (VHI-10), the Reflux Symptom Index (RSI), and a demographic information form. Preliminary findings indicate that speech and language therapy and conservatory students demonstrate greater awareness and sensitivity to vocal health than engineering students. Regarding gender differences, female participants scored higher on vocal health measures than male participants. After data collection, the data will be analyzed in SPSS, and interdepartmental comparisons will be conducted using the Kruskal–Wallis test. This study is expected to contribute to the development of preventive approaches to vocal hygiene by highlighting differences among students from various professional fields. The findings are anticipated to provide a scientific basis for planning educational programs on vocal health and for guiding future research.

Anahtar Kelimeler: *Ses hijyeni, Ses kullanımı, Ses sağlığı farkındalığı*

ACOUSTIC INSTABILITY AND VOCAL TREMOR PARAMETERS IN YOUNG VERSUS OLDER ADULTS

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Purpose
To compare vocal instability and tremor parameters between young and older Brazilian Portuguese speakers and investigate their correlation with chronological age.

Methods
This retrospective analysis evaluated 296 vocally healthy individuals (151 young adults, mean age 39.3 ± 11.3 years; 76 Female, 75 Male; 145 older adults, mean age 68.1 ± 5.6 years; 87 Female, 58 Male). Acoustic parameters (Stdfo, Vfo, Vam, FTRI, ATRI, Fftr, Fatr) were extracted from sustained /a/ phonation using MDVP (KayPentax). Mann-Whitney U, Spearman's Rho (rho), and Cohen's d were applied to assess differences, correlations, and effect sizes ($p<0.05$).

Results
Older adults demonstrated higher frequency/amplitude variability and frequency tremor intensity ($p<0.001$). Medians were higher for Stdfo (3.18 vs 1.92, d=0.28), Vfo (1.73 vs 1.32, d=0.23), Vam (13.70 vs 11.07, d=0.48), and FTRI (0.49 vs 0.29, d=0.21). Age correlated positively with Vfo (rho = 0.33, 95% CI [0.22, 0.43]), Stdfo (rho=0.32, [0.22, 0.42]), and FTRI (rho=0.30, [0.18, 0.40]); all $p<0.001$. No significant differences or correlations were observed for ATRI (d=0.19, p=0.217) or tremor frequencies.

Conclusion
Vocal aging in Brazilian Portuguese speakers is characterized by increased frequency instability and intensity, while amplitude tremor and rhythmic timing remain stable. These findings provide an acoustic signature for healthy aging, assisting in the early differentiation between physiological changes and pathological tremors. Limitations include the cross-sectional design and single vowel task, which prevent tracking individual trajectories or assessing connected speech. The sample features an age gap (45–60 years underrepresented) and a sex imbalance in the older group (60% female); results may not generalize to other languages.

Keywords: *Voice, Aging, Vocal Tremor, Acoustic Analysis*

PERIPHERAL MOTOR SYMPTOMS AND LARYNGEAL CONTROL: VOCAL TREMOR AND DIADOCHOKINESIS IN PARKINSON'S DISEASE

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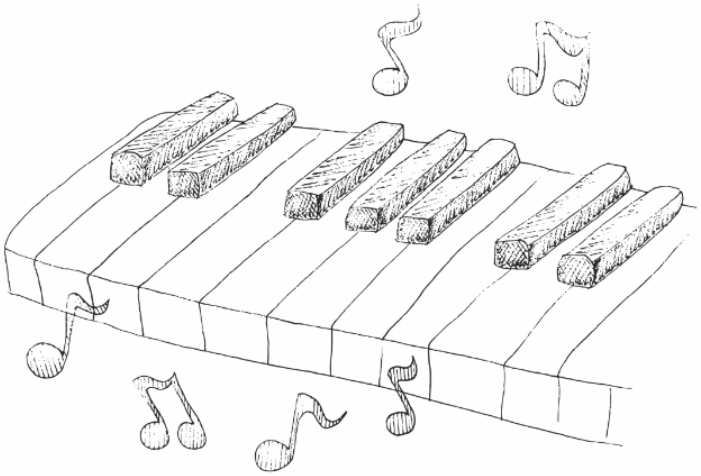
Purpose
To investigate vocal motor performance in individuals with Parkinson's Disease (PD) through visual and acoustic analysis, specifically examining the influence of concomitant body tremor on vocal stability and laryngeal diadochokinesis (LDDK).

Methods
Cross-sectional, single-center study with 54 participants: 27 in the Parkinson's Disease Group (PDG; mean age 70.3 ± 8.3 years, 12 females and 15 males) and 27 age/gender-matched healthy controls (CG). PD participants (mean H&Y 2.5) were assessed in the "ON" medication state. Assessment included nasolaryngoscopy for visual tremor inspection and acoustic analysis (Motor Speech Profile Advanced, KayPentax). Within the PDG, subgroups were compared based on the presence (n=13) or absence (n=14) of body tremor during phonation, identified via visual inspection of the limbs and the labiomandibular region. PDG was also sub-analyzed by the presence (n=11) or absence (n=16) of laryngeal tremor. Mann-Whitney U test ($p<0.05$) and Cohen's d tests were performed.

Results
Automated acoustic indices did not differentiate PDG from CG. Nasolaryngoscopy revealed higher laryngeal tremor in PDG, specifically in the arytenoids during respiration ($p=0.041$; $d=0.58$) and vertical laryngeal movements ($p=0.008$; $d=0.69$). In PDG, participants with laryngeal tremor showed greater fundamental frequency variability ($p=0.012$; $d=0.63$) and frequency tremor magnitude ($p=0.001$; $d=1.01$). Participants with concomitant body tremor exhibited higher vocal amplitude variability ($p=0.038$; $d=0.76$) and amplitude tremor periodicity ($p=0.033$; $d=0.73$). LDDK instability parameters, particularly the coefficient of variation of period and amplitude, were higher in those with body tremor ($p<0.04$; d: 0.85-1.33).

Conclusion
Laryngeal motor impairment in PD is influenced by concomitant body tremor. Peripheral tremor acts as a marker for increased laryngeal instability and reduced diadochokinetic regularity. The cross-sectional design and "ON" medication assessment preclude causal inferences. Lack of PD phenotype differentiation may limit generalizability. These findings emphasize the need for integrated motor assessments in PD clinical management.

Keywords: *Parkinson's Disease, Laryngeal Tremor, Vocal Tremor, Laryngeal Diadochokinesis*