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PROGRAM ABSTRACTS

BSc   **Basic Science**

M   **Medical**

SLP   **Speech-Language Pathology**

VP   **Voice Pedagogy**

W   **Workshop**

BSc-P1, M-P1, SLP-P1, etc = *submitted as poster

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Effects of Angle of Epiglottis on Aerodynamic and Acoustic Parameters in Excised Canine Larynges

Objective: To explore the effects of the angle of epiglottis on acoustic and aerodynamic parameters in excised canine larynges.

Methods: The natural angle of epiglottis (Aepi) was measured for 14 excised canine larynges as a control group. Then, the Aepi were manually adjusted to 60° and 90°. Aerodynamic and acoustic parameters including mean flow rate (MFR), sound pressure level (SPL), jitter, shimmer, fundamental frequency (F0), and formants (F1-F4) were measured with a subglottal pressure of 1.5kPa. Simple linear regression analysis between acoustic and aerodynamic parameters and the Aepi of the control group was performed and ANOVA comparing the acoustic and aerodynamic parameters of the three groups was carried out.

Results: 1) The larynges with larger natural Aepi had significantly lower jitter, shimmer, formant 1and formant 2;

2) PTF was significantly different for the three groups, and MFR and SPL were significantly different between the 60° and 90° groups.

Conclusion: The angle of epiglottis was proposed for the first time in this study. The angle of epiglottis plays an important role in phonation and resonance of excised canine larynges.

Key words: excised canine larynges; angle of epiglottis; aerodynamics; acoustics.

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Trends in Singing Voice Research: An Innovative Approach

Objectives: To trace and describe research patterns in singing voice; to compare the amount of published research over time; to identify journals that published most papers on "singing voice"; to establish the most frequent research topics.

Methods: The study uses qualitative and quantitative approaches through descriptive statistics, text mining and clustering. The authors conducted a search in PubMed to identify scientific papers related to the main topic. The titles and abstracts were exported and analyzed regarding word frequency and relations between them, through hierarchical cluster analysis and co-occurrence networks. Also, the frequency of journals was calculated as well as the amount of papers across time.

Results: Since 1949, 754 papers were published and an increase was noticed over the last decades. Even though 162 journals were identified by the authors, Journal of Voice holds the majority of papers, in every analyzed period. An evolution of studied topics is described. Up to 2010, the main theme was professional singers, especially classical and opera interpreters. Since then, voice quality and the effects of training gathered more attention.

Conclusion: There has been a notoriously growing interest in singing, since the first indexed paper in 1949. However it has been slightly slowing down. Until 2010, great importance was given to voice quality of singers and their occupational demands. Acoustic analysis was widely used to study the effects of training. From 2010 until now the concern with functionality is increasing, rather than the organic voice structures. Musical perception studies have been a tendency as well as the use of ellectroglotography.

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Longitudinal Mean and Overall Range Speaking Pitch Variation in English Cathedral Girl Choristers

Voice change between childhood and adulthood in terms of pitch variation is not as great in girls as it is in boys and it tends to receive less attention. As part of our regular voice recordings of the girl choristers at Wells Cathedral in Somerset UK at approximately six month intervals over the past two decades, a read passage is included. The data are stereo recordings of speech pressure (microphone) and electrolaryngograph signals. In this paper, we shall report on longitudinal mean and overall range speaking pitch variation over time for a number of girl choristers. Data analysis makes use of the eletrolaryngograph signal which indicates changing vocal fold contact area and is not prone to interference from competing acoustic signals. Summary comments are provided to snapshot voice change in this female chorister community.

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Perceptual and Quantitative Assessment of Vocal Roughness across Sustained Phonations and Connected Speech

Objective: The purpose of this study was to compare the perceived vocal roughness of sustained phonations to perceived vocal roughness of connected speech. In the laboratory, measurements of vocal roughness are often extracted from sustained vowel phonations. Alternatively, obtaining vocal roughness from continuous speech samples offers ecological validity, however, because of the multidimensional nature of continuous speech, it is unclear whether judgements will be more or less variable than for sustained phonations. Furthermore, it is unclear how well the same computational measures will compare across the two types of speech.

Methods: Ten naive listeners judged roughness from sustained /a/ phonations and one sentence from the Speech Perception in Noise (SPIN) test using a single-variable matching task. Voice samples were recorded from 5 male and 5 female talkers who varied on wide continuum of dysphonia severity. Computational measures of pitch strength, cepstral peak and autocorrelation peak were extracted from all talkers and for both stimulus types. These measures were then used to predict the perceived roughness using regression models.

Results: Perceived roughness was highly similar between sustained phonations and connected speech for most of the talkers (8/10; ~1-2dB variation in modulation depth). Similarly, there was a moderate to high correlation among the stimulus types for each of the computational measures. Pitch strength computed from the waveform produced the highest goodness of fit [$r^2 = 0.87$ (sentences) and 0.77 (vowels)] to the perceptual matching data followed by the autocorrelation peak [$r^2 = 0.85$ (sentences) and 0.70 (vowels)].

Conclusions: Despite a variety of differences among sustained phonations and connected speech, the perception of roughness and corresponding acoustic correlates were quite similar for these stimulus types. This work represents an important step in advancing studies of voice quality perception from single vowels to connected speech. Work supported by NIH-NIDCD DC009029 (DAE and RS).

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Prediction of Vocal Fatigue from Acoustical Voice Parameters in Virtual Acoustics Scenarios

Introduction: Mobile technologies are changing the lives of millions around the world. One of the most common applications of mobile technologies on health is the self-monitoring. If such technology works for monitoring our physical activity, could similar technology be used to monitor the how we use our voice in our daily life?

Objectives: As a first step to answer this question, the study was designed to better understand how self-reported vocal fatigue is related with objective voice parameters (voice intensity, pitch, and their fluctuation), and the duration of the vocal load. This information will allow us to identify trends between the self-perception of vocal fatigue and objective parameters that may quantify it.

Methods: Thirty-nine subjects were recorded while reading a text. Different acoustics scenarios were artificially created to increase the variability in the speech produced presented in a random order. For each scenario, the subjects answered questions addressing their perception of vocal fatigue on a visual analogue scale.

Results: A model of the vocal fatigue to acoustic vocal parameters is proposed. The duration of the vocal load contributed to 43.5% of the variance explained by the model, followed by the intensity modulation (25.3%).

Conclusions: If mobile technology is going to be used for people to monitor their daily voice use in different environments, the results of this study provide valuable information needed for the design of mobile technology. A low cost, mobile system, with output easy to understand is possible.

Keywords: vocal fatigue; room acoustics; voice monitoring

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Communication in Restaurants - How Much Would You Spend to Eat at this Restaurant?

Introduction: Restaurants are not merely eating and drinking sites; they are also popular settings for important social and business conversations. Previous studies showed that the sound levels measured in restaurants are ranging from 45 dBA to 85 dBA. In a noisy environment, speakers unconsciously attempt to maintain a level that allows them to be understood by the listener. The involuntary tendency to raise the level of the voice with an increase in the level of the background noise is called Lombard effect.

Objectives: The objective30 of this study is to determine the minimum level of noise in a restaurant that starts the Lombard effect and how it relates to the perceived communication disturbance and vocal discomfort. Moreover, the relationship between noise levels and willingness to spend for a dinner was addressed.

Methods: 20 normal-hearing young adult subjects (10 males, 10 females) were instructed to read a passage with the goal of being understood by a listener at the opposite side of a table (1.5 m far), in an IAC sound booth. Two loudspeakers, located 1.5 m in front of the subject's ears, emitted restaurant noise. This background noise varied in level from 30 dBA to 85 dBA in 5 dB increments, in a randomised order. The audio-signal was captured by a head-mounted microphone. Subsequently, a regression model was fit with segmented relationships to the data, estimating the slopes and the break-point(s) in the relationship between the explanatory variable, background noise level (Ln) and the response variables: (1) ΔSPL (within-subject normalised SPL); (2) communication disturbance; (3) vocal discomfort; and (4) willingness to spend for a dinner.

Results: Results indicate that there is a change-point in the Lombard effect associated with the level of the background noise. As the noise level increases incrementally from 30 dBA to 85 dBA, initially, talkers begin to be disturbed by the increased noise level. Having perceived the disturbance, talkers begin to strongly increase their speech level due to the Lombard effect. Finally, when the noise exceeds that at the change-point, the talkers experience greater discomfort. The relationship between the willingness to spend for a dinner and the noise levels is discussed.

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Low-Cost Aerodynamic Measures Using a Vortex Whistle

Objectives: Studies published over fifty years ago showed that a vortex whistle could be used as a low-cost but extremely accurate flow meter. The vortex whistle produces a frequency that is proportional to the flow rate of air through the device. In recent years, the vortex whistle has been reevaluated as a potential low-cost spirometer. This presentation will detail (a) the necessary parameters for the construction of an effective vortex whistle, (b) the development of software to capture the vortex whistle sound wave and calculate estimates of vital capacity (VC) and FEV1, and (c) initial experiments to validate estimates via vortex whistle and developed software as effective measures of flow and volume.

Methods: A series of vortex whistles were created using a Flashforge Creator Pro 3D printer (Flashforge USA, Los Angeles, CA). Diameters of whistle cylinder and outlet tube dimensions were varied to result in the best SNR for the output whistle tone. A consistent volume (3 L) was input into the vortex whistle at various rates and a custom program was written in Java to record the output tone of the vortex whistle for each trial. Software was developed for recording and to produce a frequency vs. time contour.

Results: Correlational analysis between whistle frequency and flow rate confirmed that the vortex whistle may be used to produce extremely accurate measures of flow. In addition, frequency curves can be integrated to give precise measures of volume.

Conclusions: Our results confirm those of previous studies that have demonstrated that a vortex whistle can produce valid and reliable measures of air flow and volume in a simple, low cost, highly durable device. The software developed in Java is easily transportable to other platforms (various computer platforms, tablets, phones) and may be used by voice clinicians to obtain and document basic measures of respiratory volume (VC), FEV1, and estimates of mean airflow in vowel production via the Phonation Quotient (PQ).

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What Causes Airflow Vibrato?

Objective: Airflow vibrato is the fluctuation in average laryngeal airflow while singing with vibrato. It is a production-based, rather than perception-based, phenomenon with physiological, pedagogical, and clinical relevance since it reflects phonatory aerodynamic control. Two potential sources of airflow vibrato, subglottal pressure and glottal adduction, are explored in this study.

Methods: Four trained amateur singers (2 sopranos, 1 baritone, and 1 tenor) participated. Airflow vibrato and F0 vibrato measures were compared among normal singing, bleating (a primarily adductory gesture), and external epigastric pumping (EEP, a subglottal pressure manipulation). Utterances included speaking and singing (constant /a/ vowel at different pitches and loudness levels).

Results: Bleating had the fastest rates and the largest airflow modulation extents with an average of 144 cm^3/s. Vocal vibrato and EEP had normal rates and airflow extents of 30 cm^3/s for vibrato and 46 cm^3/s for EEP. Airflow vibrato waveforms typically lead the F0 vibrato waveform, and has a more complex waveshape. The study suggests that (1) a subglottal pressure driven vibrato provides in phase airflow and F0 vibrato with potentially wide extents for both, (2) a laryngeal adduction driven vibrato provides relatively low and inconsistent F0 vibrato extent, but high and inconsistent airflow vibrato extent, and (3) a primarily CT driven vibrato appears to result in moderate to large F0 vibrato extents, and relatively low airflow vibrato extents, with variable consistency.

Conclusions: Airflow vibrato has a range of simple to complex waveshapes (more complex than F0 vibrato), with a wide range of airflow vibrato extents, and a causation that appears to be related to CT contraction, subglottal pressure (Ps) variation, and glottal adduction. This study creates a profile of measures that suggests the influence of all three (CT, Ps, Adduction variations). Confirmation of airflow vibrato sources will require videoendoscopy and multisignal recordings (airflow, subglottal pressure, EMG).

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Vibratory Onset of Adductor Spasmodic Dysphonia and Muscle Tension Dysphonia: A High Speed Video Study

Objective: High speed video provides analysis of voice samples prior to onset of phonation and during phonation despite sudden voice breaks, pitch breaks or other non quasi-periodic events during phonation. Adductor spasmodic dysphonia (ADSD) is a voice disorder that is characterized by voice breaks and aperiodicity. It is often misdiagnosed as muscle tension dysphonia or another hyperfuntional disorder. Past studies have shown that ADSD can be identified from other disorders such as muscle tension dysphonia by its vibratory characteristics. The present study examines the onset characteristics of ADSD and MTD to determine if these two disorders can also be identified by voice onset characteristics.

Methods: High-speed video recordings of four adults with ADSD and matched with four adults with MTD were obtained prior to treatment. Digital kymography (DKG) was used to obtain precise vibrogram data prior to and at the onset of phonation. Vibrograms were obtained at the anterior, mid-membranous and posterior regions of the right and left vocal folds. The data was submitted to spectral analysis to quantify cycle-to-cycle changes in each vocal fold. Data were subsequently categorized by one of the authors blinded to the diagnoses.

Results: From the HSV Vibrograms, the ADSD samples were categorized correctly by voice onset characteristics. Time to vocal fold closure, motion irregularities and vibratory interruptions were identified in the ADSD group

Conclusion: HSV provides an additional method of diagnosis to categorize ADSD from MTD. Using HSV, voice pre-onset motion provides additional information regarding the non-symmetric pre-phonatory pattern of ADSD compared to MTD. HSV may identify the side on which to focus Botulinum toxin injection.

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Evaluating Timbre Spectrum and Glottal Open Quotient via Pitch-Synchronous Segmentation of Voice Signals

Objective: Timbre spectrum and glottal open quotient are important features of human voice, especially in the basic research of singing and acoustic phonetics. Traditionally, to evaluate timbre spectrum, the voice signals are first segmented into frames, typical 25 msec in length and 10 msec in shift, then multiplied by a Hamming window function. Using fast Fourier transform (FFT) or linear predictive coding (LPC), the envelope of the timbre spectrum is either obtained from the amplitude of overtones of the fundamental frequency, or from the roots of LPC coefficients. Because pitch information and timbre information are mixed, accuracy is low. By completely separating pitch information and timbre information, timbre spectrum can be made much more accurate. Glottal open quotient is typically evaluated from electroglottograph (EGG) signals. While the derivative of EGG signals at glottal closings has sharp and strong peaks; at glottal openings, the signals are much weaker and not well defined. It is known that glottal openings connect the vocal tract with the lungs and the decay of voice signal is accelerated. However, the correlation between voice decay and EGG signals is not clear. The objective of the current study is to make more accurate evaluation of timbre spectrum and clarify the correlation between the evolution of voice signals with glottal closing/opening events from EGG signals.

Methods: The basic idea is to use pitch-synchronous segmentation and framing method to completely separate pitch and timbre information, then evaluate timbre spectrum and glottal open quotient from the evolution of signals within each pitch period. The segmentation points are derived from EGG signals if simultaneous EGG signals exist, and from voice signals if EGG signals do not exist. Using an ends-matching procedure, the voice signals in each pitch period can be made cyclic, to become a sample of a stream of continuous periodic signals. The side effects of processing windows (such as Hemming windows) are completely eliminated. Using Fourier analysis, timbre spectrum for each pitch period is obtained. Furthermore, by applying a window much shorter than a pitch period to the periodic signals, starting point by point, then perform Fourier analysis, the evolution of instantaneous power through the entire pitch period is obtained. The resulting curves are then correlated to the glottal closing instants and glottal open instants from EGG signals.

Results: Because this technique should be applicable to both singing and speech (for acoustic phonetics), both types of voice recordings were tested. The singing samples were 85 recordings from 7 professional opera singers recorded using VoceVista. The speech samples were the standard ARCTIC databases for speech synthesis from Carnegie-Melon University. All 2264 sentences from a male speaker (bdl) and a female speaker (slt) were tested. All samples have simultaneous EGG signals. High-definition timber spectra of each pitch period are obtained for all those voice samples. The evolution of very-short-time power with time in a single pitch period clearly showed the expected behavior: the very-short-time power peaks at the glottal closing instant, and its decay rate maximizes near the glottal opening instant.

Conclusions: Using pitch-synchronous segmentation and framing methods, accurate evaluation of the timbre spectrum and the evolution of speech signals with each pitch period can be obtained. Very-high-resolution graphs of formant structure within each pitch period are demonstrated. The correlation between the evolution of voice signals within a pitch period and the waveforms near the glottal opening instants of the simultaneously acquired EGG signals is clarified. Those concepts and methods are useful for basic research in singing and acoustic phonetics.

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Tension and Contraction of the Thyroarytenoid Muscle: A 3D Analysis during Singing

Objective: Singing can be seen as a complex interaction of different laryngeal muscles. When singing from low to high pitches, the cricothyroid muscle (CTM) first tensions the vocal folds (VF) first, in a second step the lateral cricoarytenoid muscle then leads to an additional elongation of the VF. Then role of the thyroarytenoid muscle (TAM) in this process, however, remains unclear. Aim of the study was, to analyse the behaviour of the TA during singing from low to high pitches (over two octaves).

Methods/design: We examined 49 professional female singers. Three HRCT scans were performed during singing of F0, the 1st and 2nd octave above. DICOM scan data were rendered and 3D-visualized using the software MIMICS®. As an indicator of the contraction (or the thickness) of the TAM, all three coronal HRCT scans and their corresponding 3D reconstructions of the 49 singers were analysed. The angle between the medial surface of the VF and the subglottic plane were measured.

Results: On both sides, the angle of the VF outlined above, was 58° at F0, 47° at F1 and 59° at F2. There was a significant change of the angle between both, F0 and F1 ($p<0.001$) and between F1 and F2 ($p<0.001$), respectively.

Conclusions: The results show, that the TAM is contracted (larger angle) at F0 and F2, whereas in the TAM is elongated/stretched at F1 (smaller angle). We conclude, that in lower pitches the TAM is just contracted, but not tensioned, whereas at F1 (after CT-elongation) the TAM is tensioned/stretched, and at F2, the TAM contracts once again in order to stiffen the VF and to reach higher pitch thereby.

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Detection of Diplophonia in Audio Recordings of German Standard Text Readings with Automatic Temporal Segmentation

Objectives: Diplophonia is a common and often misinterpreted disordered voice symptom and needs objectification. Here, we investigate whether diplophonia can be detected from audio recordings of text readings by means of a dedicated audio signal processing, i.e., a descendant of a formerly published "Diplophonia Diagram". In particular, the proposed approach is capable of automatic temporal segmentation of diplophonic time intervals, and so enables analysing running speech. Its performance is evaluated via detection accuracy and positive likelihood ratio of a two-class classification problem (diplophonic versus non-diplophonic) at the level of signal frames. In addition, descriptive statistics regarding the frequency of occurrence of diplophonic time intervals in diplophonic subjects are presented.

Study design: Retrospective diagnostic study.

Methods: Forty subjects that have been clinically rated as diplophonic are included in the study. For each subject, the audio of the German standard text "Der Nordwind und die Sonne" is recorded. Reference boundaries of diplophonic time intervals have been manually obtained by the first author. Each time interval is labelled as diplophonic or non-diplophonic.
The audio recordings are analysed with a purpose-built audio signal processor that estimates the number of co-existing fundamental frequencies at the level of signal frames. In particular, a personal computer takes audio recordings as input, and outputs estimates of the time instances of the boundaries of diplophonic time intervals, as well as the intervals' labels, i.e., diplophonic or non-diplophonic.

Results: In the reference segmentation, only 8.6 % of the time frames are diplophonic in diplophonic speakers. In 27.5 % of the diplophonic subjects, no diplophonic intervals are found in the standard text readings. 78 % of the analysed frames are assigned by the computer to the correct class, i.e., diplophonic or non-diplophonic. The sensitivity is 63 %, and the specificity is 80 %. The positive likelihood ratio is 3.3, which means that the odds for a frame to be diplophonic is 3.3-times higher after a positive test than before.

Conclusions: It was found that many diplophonic subjects do not present diplophonia during the reading of a standard text, which may limit ecological validity of audio recordings of standard text readings. The performance of the proposed method for detecting diplophonia automatically from running speech is promising, and might be taken into account for future clinical and scientific work.

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Vocal Fold Length during Singing: Comparison of Two Measurement Techniques

Objective: Especially, in the early stages of their musical education and in the case of a chronically strained voice, singers often consult laryngologists for information about the adequate choice of their voice type, first of all for vocal fold length and shape. As it is known, a bigger larynx with longer vocal folds is responsible for a deeper voice; e.g. comparing female with male voices. Hence, we expect longer vocal folds in altos than in sopranos. An objective measurement of this parameter is difficult because of permanent changing of the vocal fold length while breathing and phonating different pitches. Moreover, the complex laryngeal mechanisms of pitch rising is not yet fully understood.
3D measurement of laryngeal structures can amongst others be achieved using CT scans, MR imaging or by laryngoscopy using 3D-lasertriangulation.

Methods: The vocal fold length was measured in 47 female singers during singing the vowel /i/ in two singing positions: fundamental frequency (fo) and first octave ($fo+1$ 8va). The measurements were obtained from analyzing laryngeal three-dimensional images derived from high-resolution computed tomography (CT) scans and in a second set-up by means of 3D stereo triangulation with laser projection (Nd:YAG laser, 532nm, CW) during videolaryngoscopy.

Results and Conclusions: We will present and compare our results of the measured absolute length of the vocal folds and of the relative vocal fold elongation from fo to $fo+1$ 8va.. The two methods and the differences of results are discussed. In addition to a statistical analysis, we will discuss the challenges and short-comings of each method with regard to its diagnostic significance.

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Effects of the Lung Volume on the Electroglottographic Waveform
in Some Trained Female Singers

Objective: To test for an effect of lung volume on the electroglottographic waveform, in singing, and if present, to characterize that effect over the voice range.

Study design: Eight trained female singers sang the nursery rhyme "Brother John" in 3×3×2=18 conditions: phonetic: /a/, /pa/ and the lyrics; dynamic: piano, mezzoforte and forte; and lung volume: high and low; in randomized order, with one replication of each. Conditions spanned 1.5 octaves in fundamental frequency (fo) and >30 dB in sound pressure level (SPL). The results were mapped onto the fo-SPL plane, into cells one semitone wide and one decibel high, as for a voice range profile (VRP).

Methods: The voice and EGG signals were recorded in synchrony with five signals tracking respiration, larynx height, and intra-oral pressure on /p/-occlusions only. The first 10 Fourier descriptors (magnitude and phase) of every EGG pulse were analyzed, resulting in about a million 20-valued observations per subject, distributed over the voice range as exercised by the conditions. Statistical clustering of the spectral data enabled an analysis and visualization of how the EGG changed with lung volume, while accounting for the dominating effects of fo and SPL.

Results: Within subjects, the replicated conditions exhibited highly similar modifications of the EGG waveform across the whole range, indicating high reproducibility. For each cell in the fo-SPL plane, linear regressions between lung volume and the EGG spectrum descriptors often gave significant correlations in parts of the voice range, in most subjects, meaning that the lung volume often does affect the EGG shape. However, these relationships always varied across the voice range, even changing polarity from one part of the VRP to another. No common tendency was observed across subjects. Also, some subjects consistently lowered their larynx with increasing lung volume, suggesting the action of tracheal pull; but most did not.

Conclusions: A reproducible influence of the lung volume on the EGG waveform exists, but is highly variable both across a moderately wide fo-SPL range and across subjects. Different singers may be applying different techniques or compensatory behaviors for laryngeal posturing with changing lung volume. The study underlines the importance of observing the behavior of the voice over a range, and not only of phonations sustained at a comfortable pitch and level.

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What Does LTAS Tell about The Voice Source?

Objective: The long-term-average spectrum, or LTAS has been extensively used in voice research. It provides an overall measure of voice characteristics allowing to derive a large number of parameters. A minimalistic set of parameters has been identified which offers the most essential properties [Eyben et al., 2015; 2016; Scherer et al., 2017]. LTAS analysis is typically applied to audio signals of running speech or continuous singing. It reflects the combination of formant frequency and voice source characteristics. Often, e.g. in clinical settings, it is relevant to distinguish between these two sources Voice source analysis can be performed by means of inverse filtering. The aim of the present work was to analyse the relationships between LTAS and voice source properties.

Method: Three internationally touring male singers sang scales in eleven different emotional colours. This material was analysed by inverse filtering as well as in terms of LTAS. The correlations between the averages across the scale tones of the flow glottogram parameters and minimalistic set of LTAS parameters were analysed.

Results/Conclusions: A strong negative correlation was found between spectral slope and the flow glottogram's maximum flow declination rate MFDR, and a strong positive correlation between proportion of spectral energy below 1000Hz and H1-H2. Somewhat surprisingly, a strong negative correlation was found between equivalent sound level and the normalized and un-normalized amplitude quotients (the ratio between AC peak-to-peak amplitude of the flow glottogram and MFDR). Thus, these LTAS parameters seem particularly informative with respect to voice source characteristics.

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Tongue-up Your Style! The Role of the Tongue and its Physioacoustic Importance for Belting

In the recent years, the interest in the gamut of Musical Theater styles has become the center of many research papers. So far, studies show that, among others, a change of the vocal tract, laryngeal and pharyngeal activity, higher subglottal pressure, and a certain vowel selection to boost 3-5F_0 for the 'bite' can be observed in the belt style of singing.

However, even with the marked advancement of technology, such as dynamic MRI, the physioacoustics of belting in particular are still not well understood and incomplete. One of the major limitations is that most material is limited to the two-dimensional midsagittal plane (showing only high/low, front/back movements) and a low frame rate. However, constrictions and expansion in the vocal tract have to be seen through a three-dimensional lens.

This study investigated the physiology and shapes of the tongue for belting through the use of ultrasound, scanning both the sagittal and coronal plane. The tongue, a hydrostat, is considered as the most complex structure in the body in terms of muscle movements and is the biggest, most malleable active articulator within the vocal tract. Its ability to move segments in opposite directions results in various irregularities, such as grooves, along the surface. These irregularities plus the overall shape are of particular importance for the acoustic aspects of vowels and timbre.

Preliminary results of a professional belter show that specific tongue movements and shapes are applied to achieve the desired timbral 'bite' of the style. Furthermore, as the biggest most malleable filter within the vocal tract, the tongue seems to be an essential equalizer to accommodate changes such as a higher larynx position, medium open mouth etc..

The presentation will employ ultrasound videos, acoustic analysis (spectrography) and stop-action imagery to illustrate the applied tongue maneuvers in belting.

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A Comparison of Videokymography and Electroglottogram for Measuring Contact Quotient Values in Classically Trained Singers

Objective: The closing quotient (CQ) of the vocal folds has been considered an important parameter of voice physiology since the work of Timke, von Leden, and Moore in 1958. Several systems for measuring CQ have been used including images from high speed film and video recordings, images from videokymography (VKG), and signals from electroglottography (EGG). Several algorithms have been developed for deriving CQ from EGG signal (CQ_{EGG}). However, these algorithms provide differemt CQ_{EGG} values for the same signal. The purpose of this research is to determine the validity of a recently developed algorithm for deriving CQ_{EGG}. This algorithm utilizes the EGG signal, the differentiated EGG signal, and the differentiated audio signal to determine the closing and opening of the vocal folds so the contact quotient (CQ) can be derived. Previous work has demonstrated this algorithm to be reliable when measuring the CQ_{EGG} of classically trained females singing through their *passaggio*. Determining the CQ from this algorithm and a simultaneously recorded VKG signal can demonstrate the validity of this algorithm.

Methods: A group of seven male and seven female trained singers will sustain vowels for three seconds at comfortable notes in their chest, mixed, and head registers. Their vocal fold motions will be recorded through a rigid endoscope connected to VKG equipment and through surface electrodes connected to EGG equipment. The data from the VKG and EGG will be independently measured for closing quotients.

Results and Conclusions: The CQ values from the VKG and EGG systems will be compared to determine their similarity using a chi-square goodness of fit test. These results will be discussed in light of previous studies reporting CQ values from VKG and EGG

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Limbo Balley of Source Spectrum Partials

 Objective: The timbral properties of the voice are partly determined by the voice source, i.e., the pulsating glottal airflow. This airflow can be analyzed by means of inverse filtering and is generally displayed as a flow glottogram showing glottal airflow versus time. In an attempt to document effects of source-filter interaction, Maxfield and associates recently studied pitch-glides into vinyl tubings [1]. They found that the three lowest formants could affect the amplitudes of the four lowest spectrum harmonics, such that the partial's amplitude did not increase and decrease at the same rate when it passed through a formant. Rather, an asymmetric peak was observed on an intensity-time curve when a partial passed through a formant. The aim of the present study was to study these spectrum effects in more detail.

Method: Glide tones, performed by six male singers on a constant vowel, were analyzed by inverse filtering, using the custom-made Sopran freeware (Svante Granqvist, KTH). The filter settings were determined on the criterion of a ripple-free closed phase. The amplitudes of the lowest spectrum partials of the inverse filtered signal were determined and measured as function of frequency.

Results and Conclusions: Marked spectrum envelope dips occurred at f_o that produced a partial at F_1, but not at other f_o values. Thus, during the pitch glides the amplitude of the source spectrum partial passing F_1 decreased was reduced but recovered after the passage. These dips would be caused by source-filter interaction. The partial closest to F_1 typically determines the SPL of a vowel. Therefore, these findings suggest that the peak in SPL, which should occur when a spectrum partial coincides with a formant, is attenuated by source-filter interaction. This assumption was supported by comparisons between pitch glides produced by the subjects and by the Madde synthesizer, which lacks such interaction.

[1] Maxfield L, Palaparthi A, Titze I. New evidence that nonlinear source-filter coupling affects harmonic intensity and f0 stability during instances of harmonics crossing formants. Journal of Voice 31: 2 (2016) 149–156.

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Tutorial and Guidelines on Measurement of Sound Pressure Level (SPL) of Voice

Purpose: SPL measurement of voice and speech is often considered a trivial matter but the measured levels are often reported incorrectly or incompletely making them difficult to compare among various studies. This paper aims at explaining the fundamental principles behind these measurements and providing guidelines to improve their accuracy and reproducibility.
Method: Basic information is put together from standards, technical, voice and speech literature and from practical experience of the authors, and is explained for non-technical readers.
Results: Variation of SPL with distance, sound level meters and their accuracy, frequency and time weightings and background noise topics are reviewed. Several calibration procedures for SPL measurements are described for stand-mounted and head-mounted microphones.
Conclusions: SPL of voice and speech should be reported together with the mouth-to-microphone distance so that the levels can be related to vocal power. Sound level measurement settings (i.e., frequency weighting and time weighting/averaging) should always be specified. Classified sound level meters should be used to assure measurement accuracy. Head-mounted microphones placed at the proximity of the mouth improve signal-to-noise ratio and can be taken advantage of for voice SPL measurements when calibrated. Background noise levels should be reported besides the sound levels of voice and speech.

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Detection of Vocal Fatigue in Voice Acting Using Glottal Notch Acceleration

Objectives: Voice actors are exposed to vocal fatigue as professional voice users. The objectives of the present study were to investigate: (1) indicative acoustic parameters of vocal fatigue derived from glottal notch accelerometer (GNA) signals; and (2) modulations of these parameters after a vocal warm-up exercise.

Methods: Professional voice actors were recruited for this study. Participants were randomly assigned to either a vocal warm-up group or a no-training control group. An accelerometer placed above the suprasternal notch (GNA) was used to measure neck-skin vibration. The recorded signals were used to evaluate vocal performance and quantify vocal dose. The acoustic voice quality index (AVQI), the spectrum slope and tilt, the harmonics to noise ratio, the cepstral peak prominence (CPP) and shimmer were calculated using Praat. The data were collected before, during and after an onsite recording session, about 4 hours long. For the vocal warm-up group, participants were trained with semi-occluded vocal tract exercises. The same acoustic measurements were implemented for both groups. The verification of the GNA-based metrics with microphone acoustic data is ongoing.

Results: The results suggest that the CPP is sensitive to vocal fatigue after a voice acting session. A decrease of CPP was detected over the course of the recording session. Notably, the AVQI varied from healthy to pathologic up to 48 hours after the recording.

Conclusions: Preliminary results suggest that both the CPP and AVQI are sensitive to detect vocal fatigue from GNA signals. This methodology could provide, if successful, a tool for monitoring the voice condition of voice actors. Vocal fatigue data highlighted the strain of voice acting as well as the effects of a vocal warm-up on vocal fatigue.

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The Relationship between Listener Voice Quality and Pitch Discrimination Ability When Listening to Different Auditory Signals in a Self-Identified, Non-Disordered Population

Objective: An inherent relationship between auditory perception and vocal production is implied in the internal model of motor control. One recent study has suggested a difference in pitch discrimination (PD) ability in subjects with muscle tension voice disorder, however, the relationship in different populations is conflicting. The relationship between auditory-perceptual skills and voice quality (VQ) in a general population is currently unknown. It is also unknown if auditory-perceptual abilities are modulated by the presentation of different types of auditory signals. This study aims to examine the relationship between listener VQ and PD ability in non-disordered populations. The impact of different auditory signals on PD ability will also be investigated.

Methods/Design: Sixty-three female volunteers aged 18-34 were recruited in an observational, cross-sectional pilot study. Connected speech and prolonged vowel voice recording samples were collected and harmonics to noise ratio, cepstral peak prominence, Cepstral Spectrum Index of Dysphonia analysed. Computerised PD tasks with randomised two-tone, auditory signals were conducted using The Newcastle Assessment of Pitch Discrimination to determine PD accuracy in sine and sawtooth waveforms. Spearman's correlations were used to determine relationship between VQ and PD ability. Wilcoxon tests were used to compare PD accuracy in both waveforms.

Results: Moderate correlations between the standard deviation of the fundamental frequency and CSID in the prolonged vowel task with PD accuracy were observed. No other correlations were observed. No significant difference was observed in PD abilities between sine and sawtooth waveforms.

Conclusion: Only correlations between acoustic VQ measures on a prolonged vowel and PD abilities when listening to different auditory signals were observed in a self-identified, non-disordered population. This may reflect a lack of sensitivity in the measurements used. These results can be used to compare to other populations and inform future studies.

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The Relationship between Voice Quality and Pitch Discrimination Ability in a Population with Features of Mild Vocal Hyperfunction

Background: Maladaptive vocal-motor responses to auditory perturbation have been demonstrated in individuals with muscle tension voice disorder (MTVD). The relationship between auditory-motor adaptation and the underlying mechanism of MTVD in the context of pitch discrimination has not been explored.

Aim: To examine the relationship between voice quality and pitch discrimination ability in females with auditory-perceptual features of mild MTVD. We hypothesise that auditory discrimination and muscle tension changes in patients with features of mild MTVD may be interdependent, as suggested in a reduced pitch discrimination accuracy.

Methods: A cross-sectional case-control design was used, with 24 subjects (aged 18 – 39) with features of a mild MTVD and 63 controls (aged 18 – 34) completing a computer-administered pitch discrimination test. Tonal language, musical, singing, and vocal training information, and their voice quality measures were collected and analysed for the control group. The means of pitch discrimination accuracy were compared across the two groups. Participants' voice acoustic measures were analysed for fundamental frequency, intensity, Cepstral Peak Prominence (CPP), and Harmonics-to-Noise Ratio (HNR).

Results: Participants with features of mild MTVD performed poorer than controls on the pure tone pitch discrimination test (r=-0.216, p=0.044). For the mild MTVD features group, pitch discrimination accuracy scores showed moderate correlation with CPP in participants' CAPE-V phrases (r=0.581, p=0.042), but not with CPP, CPPs, F0 variability or HNR in the prolonged vowel or the Rainbow Passage.

Conclusion: People with features of mild MTVD may have a reduced pitch perception ability as a result of the adaptation effect. Further research is required to test this hypothesis. More sensitive voice quality measures are required to assess and compare vocal quality in people with mild features of MTVD. Implications for the underlying mechanism of MTVD are discussed.

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Acoustic Quantification and the Roles of Vibrato and Sound Level in Formant Tuning during the Second Passaggio of a Professional Female Singer

Objective: In standard, techniqued soprano voice, researchers have studied an acoustic change between D5♮ (587 Hz) and F5♮ (698 Hz). For low vowels, this transition typically involves a change from second resonance tuning of the second harmonic (f_{R2}/f_{2fo}) at D5♮ to first resonance tuning of the fundamental/first harmonic (f_{R1}/f_o) by F5♮. Our objectives were to quantify this acoustic change, which should reflect a measurable amplitude difference between the first two harmonics (A_1-A_2) and to examine the roles of vibrato cycle and sound level on this measure.

Method: A professional soprano produced three repetitions each of techniqued and untechniqued chromatic scales with and without vibrato at three sound levels. VoiceSauce software was used to calculate mean A_1-A_2 for each note and at vibrato maxima and minima.

Results and Conclusions: Results showed a substantial change from negative to positive A_1-A_2 values at a pivot point between E5♭ and E5♮. Non-techniqued singing in the same singer showed no such change. Examination of vibrato cycle (extent ≈ 90 cents) at the pivot point revealed that A_1-A_2 values were positive at vibrato maxima but negative at minima. Specifically, at vibrato maxima A_1-A_2 values changed from negative to positive between D5♮ and E5♭ while vibrato minima did not exhibit the change until between E5♮ and F5♮.This suggests that as f_o fluctuated toward a maximum, it came in closer proximity to f_{R1}, thus boosting the amplitude of the fundamental and increasing the value of A_1-A_2. This is consistent with the literature stating that f_{R1} sits just above the phonation frequency in the upper range of the soprano voice. Regarding sound level, A_1-A_2 values were greater and less variable at soft phonations than at normal and loud ones, thus supporting Fant's theory that softer phonations will strengthen the amplitude of the fundamental frequency more than louder phonations. (299 of 300 allowed words)

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Laser-Calibrated System for Laryngeal Transnasal Flexible High-Speed Videoendoscopy

Objective: Initial description of a newly developed laser-projection transnasal flexible endoscope coupled with a high-speed videoendoscopy (HSV) system that enables in-vivo spatial calibrated measurements of the laryngeal structures during phonation.

Method: The transnasal flexible endoscope has three optical channels. The calibration channel implements a diffraction   based laser projection system producing with wavelength of 520 nm. The laser pattern size is 16x16 mm at working distance of 20 mm. The imaging channel allows for coupling the endoscope with a color high-speed digital camera and recording of the superior view of the larynx with the projected laser pattern at distance ranging from 1 to 4 cm. The third channel utilizes a fiberoptic light-delivery system that can be coupled with a xenon light source with power up to 300 W. The configuration of the laser beams in the recorded mesh pattern is designed to allow calibrated lateral and dorsal measurement of the laryngeal tissues, as well as estimation of the distance of each laser beam to the endoscopic tip.

Results: The laser-projection system performed well in terms of image quality and visibility of projected laser pattern at HSV frame rates of 6,000 fps. Further improvement is possible through optimal tuning of HSV camera settings or selecting optimal HSV camera model.

Conclusion: The proposed transnasal high-speed videoendoscopy system provides the capability of absolute measurements of lateral and dorsal length, and distance to endoscopic tip. Custom image processing software could allow for automated calibrated measurements.

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Evaluation of Sharpness of Lateral Peaks of the Vocal Fold Vibrations in High-Speed Videokymographic Images

INTRODUCTION: Sharpness of lateral peaks of vocal fold vibrations in high speed videokymographic (VKG) images has been previously found to be a helpful clinical feature indicating on the presence of vertical phase differences and mucosal waves on the vibrating vocal folds. This study aims at subjective evaluation of the sharpness of the lateral peaks through visual inspection of the VKG images and identification of quantitative features derived from the automated image analysis that best correlates with the visual ratings.

METHOD: 54 VKG images with different degree of sharpness of lateral peaks were selected from clinical records of patients with voice disorders. The sharpness of the lateral peaks on the left and right vocal folds in these images were independently visually evaluated by three judges using a systematic form developed by Svec et al in 2007 and rated in 4 categories (sharp – rather sharp – rather rounded – rounded). The order of the VKG images displayed for evaluation in a test set was randomized and the test was repeated again by all the raters after a month. Inter and intra-rater correlation coefficients (Pearson product moment) were calculated for the visual evaluations to find out about the reliability of the visual evaluations. Finally, a consensus among the three raters was established for the visual evaluations. In the second part of the study, extraction of vocal fold vibration contours was done using the newly developed software VKG Image Analyzer. Numerous parameters were then defined and measured in order to quantify the sharpness of lateral peaks. The results were correlated with the consensus of visual ratings in order to find out which of the parameters shows highest correspondence to the visual ratings.

RESULTS: The intra-rater and interrater correlation coefficients were within the range of 0.85-0.88 and 0.69-0.80, respectively, for the visual ratings. The highest correlations coefficients between the visual ratings and quantitative parameters reached the values of 0.74 and 0.71 for the parameters OT80 (defined as the proportion of time during which the vocal folds displacements exceed 80% of vibration amplitude within a period) and PQ95 (defined as the proportion of time during which the vocal folds displacements exceed 95% of vibration amplitude within an open phase), respectively.

CONCLUSION: Among the different quantitative parameters, OT80 and PQ95 parameters stood out as the possible candidates for capturing the sharpness of the lateral peaks. The reliability of these parameters appears comparable to the inter-individual reliability of visual ratings. The results may be helpful in developing the computer algorithms in future to automatically quantify the sharpness of lateral peaks from the VKG images.

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Analysis and Estimation of the Glottal in Connected Area via Speech via Temporal and Spatial Segmentation of High-Speed Videoendoscopy

Objective: An automated technique for measuring glottal area changes of the vibrating vocal folds during connected speech is proposed, which is based on spatial segmentation of laryngeal high-speed videoendoscopy (HSV).

Methods: A custom-built flexible fiberoptic HSV system was used to record a "Rainbow Passage" production from a vocally normal female. The onset and offset timestamps of the vocal fold vibrations were estimated using a temporal segmentation algorithm. A motion compensation was performed to align the vibrating vocal fold across the frames between each phonation onset to the following offset. Digital kymograms were then extracted from the HSV sequence at different sections across the vibrating vocal folds. A spatial segmentation algorithm was developed to extract analytically the edges of the glottis in the kymograms. The extracted edges in the kymograms were registered to the HSV frames. The glottal area waveform was then estimated as the area enclosed by the segmented edges across the frames.

Results: The kymograms were extracted successfully after the motion compensation. The accuracy of the result of glottal area segmentation across the frames was validated by a rater. Comparison of the automatically extracted glottal area waveform to the visually tagged vibratory data showed excellent agreement.

Conclusions: Accurate estimation of the glottal area can be performed based on spatial segmentation of the glottal edges in the kymograms of the HSV during connected speech. The estimated glottal area can be used for measuring vibratory features of the vocal folds during connected speech to describe the laryngeal mechanisms of voice production.

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Animal Study of Vocal Fold Repair using Glyco-Chitosan with Collagen III Fibrils

Objectives: A new injectable biomaterial for the regeneration of the vocal fold lamina following injury or atrophy was recently investigated *in vitro*, with encouraging results [Latifi *et al.*, *Scientific Reports*, in revision]. The injectable hydrogel consists of a glyco-chitosan matrix, with imbedded hybridized collagen III fibrils (GCS/COLIII). The use of collagen III was postulated to promote cell migration and recruitment while limiting scar formation. The objective of the present study was to investigate the biological response of live vocal fold tissue to GCS with and without COLIII fibers to assess the potential risks for toxicity or inflammation, and to verify the restoration of voice function following a time period commensurate with tissue reconstruction.

Methods: This animal study included 20 rabbits. The ethics protocol was approved by the McGill University Institutional Review Board. Three groups of five animals were injected with either 1) glycol-chitosan hydrogel (GCS), 2) GCS with imbedded collagen III fibrils (GCS/COLIII), 2) a saline solution. The fourth group of five animals was an uninjured control. The animals were initially kept over a period of one week for acclimation. At Day 0, they were then operated on one vocal fold to simulate a microflap injury. The injured area was injected with 0.15 ± 0.5 mL injectable material immediately after injury. The animals were sacrificed 42 days later for laryngeal excision. Immediately after harvesting, the larynges were transported in a saline solution to the biomechanics laboratory. After dissection to remove the false vocal folds and extraneous tissue, the larynges were placed on a customized flow bench. Flow rate, transglottal pressure, radiated sound pressure, and high speed imaging data were obtained for seven different operating conditions within a period of 60 ± 15 minutes after sacrifice. Onset and offset pressures were also obtained.

Results: A detailed statistical analysis of the data was performed to compare the phonation characteristics of the injured and repaired folds with those of the uninjured controls. The influence of animal weight, vocal fold length, injectable material, quantity of material injected, and of the flow operating condition was investigated. The output variables included the phonation frequency, the MFDR, asymmetry ratios, glottal area, and many other parameters obtained through the use of the University of Erlangen's Glottis Analysis Tools software.

Conclusions: There were no significant differences between the phonation characteristics of the three groups, which exhibited a high variability. There was no sign of toxicity nor inflammation in any of the injected animals. Further work on the biological response of the tissues is presently under way.

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Inspiratory Vocal Fry: Anatomical and Physiological Aspects and Application in Speech Therapy, Vocal Pedagogy and Singing. A Pilot Study

Objective: in our clinical and rehabilitative experience Inspiratory Vocal Fry (IVF) was used to improve vocal folds elasticity and muscle relaxation, to facilitate vocal warm-up and cooling. The aim of the study is to highlight anatomical and physiological characteristics of IVF, to assess the effects on spoken and singing voice, to confirm the usefulness in speech therapy and vocal pedagogy. In scientific literature there is not any study in this field.

Methods: 32 healthy subjects (17 male and 15 female) underwent videolaryngostroboscopy to assess the degree of false vocal folds adduction, pharyngeal wall contraction and degree of vocal folds stretching in different types of phonation: expiratory and inspiratory phonation, Expiratory Vocal Fry (EVF) and IVF. All these parameters were evaluated by a group of 3 speech therapists and 1 phoniatrician not belonging to the research group. In addition, for each subject an electroglottography (EGG) was performed for all the types of phonation previously mentioned, highlighting Contact Quotient (CQ) and Closing/Closed Quotient (CCQ). 3 subjects underwent electromyography for a preliminary study of the muscle activation in IVF.

Results: false vocal folds adduction was significantly reduced in IVF compared to EVF (p-value = 0.000005) such as for pharyngeal wall contraction (p-value = 0.001155); on the contrary, vocal folds stretching was significantly higher in IVF (p-value = 0.000031). Electroglottographic CQ was significantly higher in IVF compared to EVF (p-value = 0.019592) and the other types of phonation. We obtained similar results considering CCQ, as IVF values for this parameter were significantly higher compared to EVF (p-value = 0.013062) and expiratory phonation (p-value = 0.001324).

According to our results, IVF is characterized by higher elastic tension due to a reduced hypertonic contraction of TA muscle and a higher contraction of CT muscle. Electroglottographic results showed a wider vibratory cycle with an improved massaging effect on vocal folds mucosa.

Conclusion: IVF is an excellent exercise useful to reduce muscular hypertonic tension and to facilitate mucosal elasticity. It could be applied in speech therapy approach to dysfunctional and organic dysphonias, post-surgical treatment, in pedagogy and practice of artistic voice.

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Active or passive? – A Closer Look at the "Purring" Sound Production Mechanism of Domestic Cats
(***Felis silvestris catus***)

Most mammals and birds produce vocal sounds according to the myo-elastic aero-dynamic (MEAD) principle, through self-sustaining oscillation of laryngeal or syringeal tissue. In contrast, purring cats are believed to produce their low-frequency vocalizations through active muscle contractions (AMC), where neurally driven EMG burst patterns (typically at 20 – 30 Hz for cat purrs) cause the intrinsic laryngeal muscles to actively modulate the respiratory airflow. Unfortunately, direct empirical evidence for this AMC mechanism is sparse [1].

Here, the fundamental frequency (f_o) ranges of eight domestic cats (*Felis silvestris catus*) were investigated in an excised larynx setup with computer-controlled and manual pressure sweeps, in an attempt to rule out the MEAD voice production mechanism for low-frequency vocalizations.

Surprisingly, all eight larynges produced self-sustaining oscillations at the typical rates of cat purring. In six of the eight specimens gradual f_o variation in the ranges of about 15 to 200 Hz occurred, thus creating an f_o continuum between purrs and other stereotypical call types. Histological analysis of the investigated larynges revealed the presence of connective tissue embedded in the vocal fold, with up to 4 mm in diameter [2]. This added mass might be responsible for achieving the low f_o values observed.

Our data demonstrate the possibility for purring-like sound production at typical frequencies of 25 to 30 Hz according to the MEAD principle, without the need for cyclic activation of the intrinsic musculature at the rate of vocal fold vibration (AMC). Short of constituting an alternative hypothesis for the purring vocal production in cats, our findings give reason to assume that cat purring is facilitated by special anatomical adaptation, at least in domestic cats.

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Machine-Learning Approach for Automatic Detection of Calibrating Laser Light in Transnasal Flexible High-Speed Videoendoscopy

Objective: Presented is an automated machine-learning-based method for segmentation of the positions of structured laser-projected lights in image frames acquired via transnasal flexible high-speed videoendoscopy (HSV). The purpose of accurate detection of the laser-mesh positions is to produce calibrated measurements of the in-vivo lateral and dorsal length, and vertical displacement of the laryngeal anatomic structures during phonation.

Method: This study used a custom-developed laser-projection transnasal flexible endoscope that projected a grid pattern of 7x7 green laser dots on the field of view. The positions of these laser dots were recorded at the frame rate of 6,000 fps using a transnasal fiberoptic color HSV system. One of the main challenges in processing the recorded images was accurate detection of the laser dots. In order to address this issue, all local maxima of the green channel were found. A support vector machine (SVM) was trained on features extracted from the local maxima. The trained classifier was then used for accurate detection of the laser dots. Finally, the detected dots were employed for calibrating spatial measurements from the HSV images.

Result: Comparison of the results of the automatic laser-light detection with hand-annotated data showed high accuracy and reliability of the proposed automated method. The reliability and accuracy of detection of the laser dots were found within the precision necessary to enable calibrated spatial measurements from the HSV images.

Conclusion: Reliable detection of laser beams on transnasal flexible HSV image frames is a prerequisite for calibrated measurements and three-dimensional reconstruction of phonatory vocal-fold kinematics. This task can accurately be accomplished using machine learning.

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Safety Aspects of Endoscopic Laser-based 3D Imaging

Objective: It has been demonstrated that vocal folds are oscillating three dimensionally. However, standard examinations of structural and functional characteristics in the larynx commonly still rely on 2D imaging. The endoscopic laser-based 3D imaging presents the opportunity to investigate and evaluate the 3D oscillation behavior of the vocal folds in the clinical routine, which might create a profound added value.

Future clinical application demands a save and tolerable measuring device as well as a fast and robust analytical process. Considering the lack of specific exposure limits for mucosal tissue, we want to present guidelines on the technical boundaries of the presented imaging technique.

Methods: A short introduction to the measuring concept and the design of the laser projection unit will illustrate the challenge to consolidate the medical and technical demands in this project. The automated image processing requires sufficient visibility (brightness, contrast) to distinguish the laser projection from the surrounding tissue and specular reflections. The *in vivo* recording situation above all imposes limitations on the irradiation values to prevent tissue damage. Additionally, we are faced with large variations in the geometry of the pharynx, which directly influences the resulting visibility. Based on the experimentally determined maximum exposure duration, we present the calculation of exposure limits following international standards.

Results: In order to ensure steady conditions for robust image processing and safety concerns, the variations within the projected grid and along the propagation axis are kept to a minimum. In a conservative estimate, we determined an exposure limit of 11kW/m².

Conclusions: Our present set-up with 5.9-9.7 kW/m^2 is below the determined exposure limit and guarantees the patient's safety while generating sufficient visibility in most recordings. Considering the absence of specific regulations for mucosal tissue, further studies are required to explore the limitations and possibilities for further developments.

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Experienced Listeners Perception of Dissimilarity Within and Between Voice Categories

Objective The terms "soprano" and "mezzo-soprano" are frequently used by vocal pedagogues to describe a main category of singing timbre categorization, while the terms "lyric" and "dramatic" are often used to describe sub-categories of "soprano" and "mezzo-soprano". A handful of studies have reported on the perceptual dissimilarity of main voice categories, but few, if any, have focused on within voice category perceptual distinctions such as dramatic and lyric vocal timbre. This study seeks to examine experienced listener perception of dissimilarity of timbre, both between and within voice category using stimuli produced by classically trained female singers.

Methods/design: Twelve singers, 3 dramatic sopranos, 3 lyric sopranos, 3 dramatic mezzo-sopranos, and 3 lyric mezzo-sopranos, were recorded singing the vowel "ah" at three pitches, C4, G4, and F5. At each pitch, the 12 sung stimuli were combined in all possible pairs for a total of 66 paired stimuli at each pitch. The paired stimuli are currently being presented to 24 experienced listeners who are being instructed to rate the similarity of the stimuli using a visual analog scale. Additionally, upon completion of the main experiment, each experienced listener is rating the stimuli along a continuum of "mezzo-soprano" to "soprano" and "lyric" to "dramatic". Multidimensional scaling procedures will be used to determine the perceptual dimensions used by experienced listeners to categorize the stimuli. These dimensions will be correlated with acoustic measures and with the experienced listeners perception of vocal category and lyric-dramatic sub-categorization.

Results: Preliminary results suggest that in a paired-comparison task, dissimilarity may be most strongly related to main voice category at lower pitches, but may be most strongly related to lyric-dramatic categorization at higher pitches.

Conclusion: While voice category and sub-category distinctions are commonly used to describe the overall timbres of singing voices, these distinctions may not be able to uniquely and consistently predict the perceptual difference between any given paired-comparison of vocal stimuli, particularly across pitch.

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Effect of Vocal Intensity on Cepstral Peak Prominence and Spectral Slope in Women with and without Voice Disorders

Objective: Spectrum based voice measures such as smoothed cepstral peak prominence (CPPS) and spectral slope have been associated with laryngeal pathology and perceptual voice quality. Recent work has shown that the spectral measure of Harmonics-to-Noise-Ratio (HNR) increases with elevated voice sound pressure level (SPL) in healthy speakers and individuals with voice disorders. It is unclear if similar SPL effects are present in cepstral and other spectral measures. In the present study, SPL effects on CPPS and spectral slope were investigated in women with and without voice disorders.

Methods/Design: In a retrospective matched case-control study, 59 female voice patients 18–61 years of age (mean 27, SD 12.4) were paired with 59 vocally healthy women according to approximate age and occupation. Diagnoses included nodules (66%, n=39), polyps (9%, n=5), and muscle tension dysphonia (MTD, 25%, n=15). All participants sustained the vowel /a/ at "soft", "comfortable", and "loud" conditions. Voice SPL, CPPS and spectral slope were computed from acoustic microphone recordings using Praat. Linear mixed models were applied to statistically assess the effects of loudness condition (soft/comfortable/loud) and measured voice SPL (dB SPL). Diagnosis (healthy/pathological), differential diagnosis (nodules/polyps/MTD) and treatment effects (before/after treatment) were determined with Wilcoxon signed-rank tests.

Results: In both healthy and patient groups, increased loudness was associated with higher values of CPPS (R^2=0.64) and less negative (less steep) spectral slope (R^2=0.48; $p<0.001$). Diagnosis, differential diagnosis and treatment effects were not linked to significantly different CPPS or spectral slope.

Conclusions: In female subjects with and without a diagnosed voice disorder, higher loudness levels were associated with increased CPPS and less steep spectral slope. Future studies could investigate how vocal intensity effects should be controlled for in clinical voice assessments to improve the value of acoustic-based spectral and cepstral measures.

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The Crico-Thyroid Joint: What a Physician Should Know About This Joint

Objective: Even today, a lot about the functioning of the CTJ remains in the dark. Traditionally, there was a strong belief, that the rotational axis of the thyroid to the Cricoid cartilage runs through both CTJs. New studies, however, shed a different light on the the biomechanic of this joint. Aim of the study was to, firstly, elucidate the revised biomechanic of the CTJ and to, secondly, show the potentional clinical impact of this important joint.

Methods/design: We examined 60 men and 60 women. Three HRCT scans of the larynx were performed. DICOM scan data were rendered and 3D-visualized using the software MIMICS®. The distance between cricoid and thyroid cartilage were measured.

Results: All the 120 (60 and 60) CTJ could be visualized and 3D reconstructed using HRCT scans. Type A CTJ showed the typical protuberance in HRCT scans and 3D images, while type B/C CTJ showed the typical flat cricoidal cartilage. 61% (73/120) of the *male larynges* had a type A CTJ and 39% (47/120) a type B/C CT joint. In *female larynges*, the distribution was similar: 61% (74/120) had a type A CTJ and 39% (46/120) a type B/C CT joint. The intercartilaginous distance in Type A was 0.71mm in *male* and 0.75mm in *female* larynges. The distance in type B/C joints was 1.13mm in *male* larynges and 1-32mm in *female* larynges.

Conclusions: the typical signs of the CTJ are the protuberance and a small intercartilaginous space (<1mm), while the Type B/C CTJ is characterised by a flat cricoid cartilage with a large intercartilaginous space (>1mm).

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Impact of Non-modal Phonation on Estimates of Subglottal Pressure from Neck-Surface Acceleration in Healthy Speakers

Objective: Subglottal pressure (Ps) plays a major role in voice production and has been used clinically to differentiate individuals with normal voices from those with voice disorders and to act as a clinical outcome measure. Previous work has shown promise for the robust estimation of Ps from a neck-surface accelerometer during typical modal voice production across multiple pitch and vowel contexts. This study seeks to better understand the impact of non-modal phonation on the relationship between accelerometer signal amplitude and Ps.

Methods/Design: For this pilot study, Ps estimates were obtained via intraoral pressure (IOP) recordings during occlusive plosives using an intraoral catheter connected to a pressure sensor. Subjects with normal voices repeated /p/-vowel syllable strings from loud-to-soft levels in multiple vowel contexts (/pa/, /pi/, /pu/), pitch conditions (comfortable, lower than comfortable, higher than comfortable), and voice quality type (modal, breathy, pressed, rough). Ps for each vowel was estimated by taking the average of IOP peaks preceding and following the vowel. The coefficient of determination was computed between neck-surface acceleration amplitude and Ps within and across vowel, pitch, and voice quality contexts.

Results: Strong relationships were found between acceleration amplitude and Ps within modal and breathy voice qualities, with individual linear regression equations exhibiting different slopes and intercepts. This relationship exhibited more inherent variability for pressed and rough phonation. Accelerometer-based measures of cepstral peak prominence aided in discriminating voice quality type, indicating their potential to be integrated to more accurately predict Ps from the accelerometer signal.

Conclusion: Results suggest that non-modal voice qualities have a significant impact on the relationship between neck-surface acceleration amplitude and Ps. Thus, taking voice quality into account is hypothesized to be important to obtain robust estimates of accelerometer-based Ps during natural speech in individuals with voice disorders, who could benefit from ambulatory monitoring and biofeedback paradigms as they go about their daily activities.

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Classification of Subjective Parameters of Voice Using Artificial Neural Networks

Objective:

The purpose of this paper is to identify the predominance of auditory-perceptual voice parameters, such as roughness, breathiness and strain using an intelligent classifier based on artificial neural networks.

Background:

Auditory-perceptual assessment is widely used in voice clinical evaluation due to the perceptual nature of voice. However, it has been criticized because it is subjective and depends on diverse variables, such as, listener experience and internal standards, the voice sample quality, type of perceptual scale, etc.

In the other hand, artificial neural networks have become a very interdisciplinary field, spanning computer science, electrical engineering, biology, and linguistics as well. This computational approach has the purpose of resolve problems in the same way as the human brain. Artificial Networks have shown the possibility to learn complex functions, generalize effectively, tolerate noise, classify, and estimate different kind of functions and parameters. In order to improve the clinical perceptual voice assessment, we proposed to train a Multi-Layer Perceptron (MLP) to classify the predominance of roughness, breathiness and strain in human voices.

Materials and methods:

Research was performed using a database of 30 voice samples of sustained vowel /ae/, provided by Centro de Estudos da Voz- CEV. This database includes recordings of different native Braziliam Portugues speakers, 10 samples for each perceptual parameter. Voice files were windowed, in order to increase the database to 3800 samples. Time-frequency analysis was performed using walevet packet transform and signal energy levels were extracted. An automatic algorithm found the MLP best classifier topology.

Results/Conclusion: The artificial networks trained were efficient to classify roughness, breathiness and strain predominance in voice. Results presented rates higher than 95% of correct the classification, even in cases where the voice file had never been presented.

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An Investigation of Acoustic Parameters in the Speech of Mimicry Performers

Objective: Mimicry besides being a form of entertainment, may tell us how a speaker can modulate his or her voice. Previous studies have investigated mimicry performers and reported on acoustic analysis of the speaker. It has been found that mimicry performers sometimes use an exaggerated range of fundamental frequency (F0, Bessler, 1991). For other speakers it has been reported that the mean F0 and the pattern of its variations matched the target speaker very closely (Erikson and Wretling, 1997).

In this study, mimicked examples of targets were compared to original target speaker. A further comparison with the mimicry performer was used to find which acoustic parameters remain constant and which are the ones that have shifted.

Method: Speech samples of three target speakers, speaking Malayalam were recorded. Four male mimicry performers were recorded imitating the target speakers, and speaking the same material in their typical voice.

Results: Comparison of acoustic parameters between the original voices of targets and the mimicry performer's typical speaking voice showed significant differences for F0, range of F0 and intensity, jitter and shimmer.

Comparison of acoustic parameters between the target's voices and the mimicked voices each by the four performers showed differences which could be explained in terms of their years of experience and possible artist to artist variations.

Conclusions: In this exploratory study shows there are significant differences between the target's voice and imitated examples of the target, but these differences vary between the mimicry performers.

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Comparison of Two Computational Approaches for Dynamic 3D Vocal Fold Parameters

Objective: Laser-based 3D imaging in combination with high-speed videoendoscopy provides a new perspective on the complex 3D phonation process. In order to potentially support the diagnostic process effectively, the obtained 3D surface information has to be reduced to only a few significant parameters. However, an unambiguous definition of 3D amplitudes and velocities is difficult due to the absence of distinct marker points comparable to the glottis contour in 2D.

Methods: We present two different approaches to calculate 3D parameters on the reconstructed 3D surface of the superior vocal folds. The tentative parameter sets are tested against two common hypotheses, in a preliminary study, on ten healthy subjects: (1) Healthy phonation is commonly associated with symmetric oscillation patters. Hence, we will analyze the symmetry of the lateral and vertical parameters obtained from both methods. (2) On the basis of hemilarynx data, it is assumed that the vertical oscillation amplitude reaches approx. 80% of the lateral counterpart. We will investigate the ratio of lateral and vertical component for our data in both approaches.

Results: In contrast to previous *ex vivo* findings, our *in vivo* study on the superior vocal fold surface shows that in 80% of the data the maximum vertical displacement is more prominent than the maximum lateral displacement. Further, the obtained data suggests that healthy phonation is not necessarily accompanied by symmetric oscillation patterns. Asymmetries in the lateral and vertical direction appear independently from each other and dynamic vertical asymmetries seem to be more pronounced than lateral ones.

Conclusions: As a next step, extensive studies are required to determine the best calculation method yielding diagnostically conclusive parameters. However, the measured parameters of both methods already allow new insights and confirm added value of this imaging technique.

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Salivary Pepsin Test: Helpful Tool for Laryngopharyngeal Reflux Diagnosis

Objective: Laryngopharingeal Reflux (LPR) is a disease characterized by the presence of symptoms, signs and tissue damage caused by retrograde flow of gastric contents to the upper aerodigestive tract. It represents up to 10% of otolaryngology consultations. The aim of the study is to determine the sensitivity, specificity, positive and negative likelihood ratios (LR) of the salivary pepsin test (PEP-test) for diagnosis of symptomatic LPR.

Methods: 223 subjects (85 men and 138 women) aged 30-65 years were recruited. All of them completed the Reflux Symptom Index. The salivary pepsin test was carried out in all subjects on fasting and a second test one hour after eating only on those with negative results. Subjects with a score above 13 on the RSI scale underwent laryngeal endoscopy and those with infectious or tumoral laryngeal pathology were excluded.

Results: The results of our study show that fasting salivary pepsin assay has 97.56% specificity, 40% sensitivity, positive LR of 16.4 and negative LR of 0.61. When both test were carried on to the same patient (on fasting and after eating), the results obtained were as follows: specificity 95%, sensitivity 48.05%, positive LR of 9.61 and negative LR of 0.55.

Conclusions: The salivary pepsin test is a simple, low-cost, non-invasive and easily repeatable tool which could minimize empirical treatments and invasive tests for LPR diagnosisOur study shows that the salivary pepsin test (PEP-test) has a very high specificity and positive LR. It seems to be a very helpful tool for LPR diagnosis when the salivary pepsin assay is positive. A negative salivary pepsin assay does not rule out the LPR diagnosis. Patients with clinical suspicion of LPR but negative salivary pepsin assay should undergo other diagnosis test such as the 24 hours double-probe pH-metry.

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Dysphonia, Perceived Control, and Psychosocial Distress: A Qualitative Study

Objective
The purpose of this qualitative study was to examine relations between psychological factors, particularly perceived control, and voice symptoms in adults seeking treatment for a voice problem.

Methods
Semi-structured interviews of adult patients with a clinical diagnosis of muscle tension dysphonia were conducted and transcribed. Follow-up interviews were conducted as needed for further information or clarification. A multidisciplinary team analyzed the interview content using inductive techniques. Common themes and subthemes were identified. A conceptual model was developed to represent the association between voice symptoms, psychological factors, precipitants of ongoing voice symptoms, and perceived control.

Results
Thematic saturation was reached with n=23. No participants reported a psychological cause to their voice problem, although half described significant life events preceding the onset of the voice problem (e.g., miscarriage and other personal health problems, conflicts with others, marriage and divorce, and family members' illnesses, injuries, and deaths). Participants described psychological influences on voice symptoms that led to rapid exacerbation of their voice symptoms. When asked to talk about prescribed or recommended therapies, participants described the helpfulness of speech therapy and sometimes also frustration due to difficulties in applying techniques into daily life. They also discussed personal coping strategies that included behavioral (e.g., avoiding triggers, diet, seeking social support) and psychological (e.g., adaptive thinking, mind-body awareness, emotion regulation) components. Voice-related perceived control was associated with adaptive emotional and behavioral responses, which facilitated symptom improvement.

Conclusions
In this qualitative pilot study, patient narratives suggested that psychological factors and emotions influence voice symptoms, facilitating development of a preliminary conceptual model of how adaptive and maladaptive responses develop and how they influence vocal function.

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The Utility of Pulmonary Function Testing in Patients Presenting with Dysphonia

Summary Objectives: Evaluate the utility of pulmonary function testing, particularly FEF25-75%, in patients presenting with dysphonia.

Study Design: Retrospective chart review.

Methods: Records of 199 patients who presented with dysphonia were reviewed to determine whether in-office pulmonary function testing (PFTs, which we perform routinely) leads to new pulmonary diagnoses or the need for additional pulmonary medications, after assessment by a pulmonologist. The number of pulmonology referrals, completed referrals recommended, and diagnoses after referral were assessed to see whether there is utility in performing PFTs routinely and in using FEF25-75% of predicted values less than 80% as a marker for occult pulmonary disease in patients presenting with dysphonia. The effects of age, gender, body mass index, smoking history, prior history of lung disease, and classical singing training on FEF25-75% predicted values also were analyzed.

Results: The age of patients ranged from 18-88 years, with a mean age of 46.8 years. The BMI ranged from 17.5-53.4kg/m^2. There were 70 male and 129 female subjects. There were 44 patients with a history of pulmonary disease and 155 patients without a history of pulmonary disease. There was no difference in smoking history between these two groups. One hundred five (52.8%) patients had FEF25-75% values less than 80% of predicted (poor midflow values). Of these patients, 76 (72.4%) were referred to a pulmonologist, 22 of 76 (28.9%) completed the referral, and 17 of 22 (77.3%) received a new pulmonary diagnosis or change in medications. Both a prior history of lung disease and a smoking history correlated significantly with midflow values less than 80%. Of the patients without a history of pulmonary disease, 76 had poor midflow values, 57 (75%) of these patients were referred, and 12 of 57 (21%) completed the referral. Eight (67%) of these patients were diagnosed with a previously unrecognized pulmonary disorder. Of the patients with a history of pulmonary disease, 29 (65.9%) had poor midflow values. Nineteen (65.5%) of these patients were referred, and 9 (47%) received a new pulmonary diagnosis or a change in their medications. Smoking history was not related to obtaining a new diagnosis or change in medications. There were 51 classically trained singers and 148 non-classically trained singers or non-singers. The average midflow value in classically trained singers and non-singers was 80.96±24.7 and 80.73±28.4, respectively. There was also no significant difference in the percentage of classically trained singers with poor midflow values compared to non-singers (53.5% vs. 49%, respectively).

Conclusion: This study suggests that patients with dysphonia may have unrecognized underlying pulmonary disease, and pulmonary function testing should be considered as part of the routine initial voice evaluation for patients presenting with dysphonia.

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The Effect of Ccricothyroid and Thyroarytenoid Muscle Botulinum Toxin Injection on Airway for Bilateral Recurrent Laryngeal Nerve Paralysis

Objective: We discussed the clinical effect of small dose of botulinum toxin injection on the cricothyroid muscle and thyroarytenoid muscle for patients with incomplete bilateral recurrent laryngeal nerve paralysis.

Methods: We selected 6 patients with I or II or III degree of dyspnea diagnosed with incomplete bilateral recurrent laryngeal nerve by laryngeal electromyography (LEMG), and small dose of botulinum toxin injection was performed in cricothyroid muscle and thyroarytenoid muscle as a treatment. Degree of dyspnea was assessed before and one month after the treatment, and stroboscopic laryngoscope results, acoustic parameters and CT image of the patients were also collected in the 6 patients. The angle between bilateral vocal cords in stroboscopic at full inspiratory was calculated, acoustic parameters (F0, Jitter, Shimmer) were analyzed, and vocal length, width and the smallest region were measured. Then, the paired t test was performed for statistical analysis between before and one month after injection, the one way analysis of variance was performed among vocal parameters in CT image. At present, all 6 patients were seen for follow-up visits once every three months.

Result: Botulinum toxin injection was successfully completed in the 6 patients, followed with no serious complications; the degree of dyspnea was alleviated to some extent after treatment in all the 6 patients; the angle between bilateral vocal cords at the end of a deep inspiration were significantly increased (P<0.05) after the treatment. The change of F0 and jitter between before and after treatment were not statistically significant (P>0.05). Shimmer was significantly decreased after treatment (P<0.05). Vocal fold length, width and vocal region increased with F0, there was a statistical significant difference between different F0 before injection, but there was no statistical significant difference between different F0 after injection.

Conclusion: Small dose of botulinum toxin injection in bilateral cricothyroid muscles and thyroarytenoid muscles can relieve dyspnea to some extent, accompanied with no serious complications, despite the slightly worse in sound quality. In the six months after injection, the above symptoms were significantly improved. This method could permit a transitional treatment for bilateral recurrent laryngeal nerve injury in the recovery period. Vocal fold length, width and vocal region increased with F0.

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Detection of Arytenoid Dislocation Using Pixel-Valued Cuneiform Movement

Objective: To assess utility of pixel-valued movement software in detecting arytenoid dislocation.

Methods/Design: Twenty-seven patients diagnosed with unilateral arytenoid dislocation were included. Diagnosis of arytenoid dislocation was confirmed by lack of vocal fold paralysis on pre-operative laryngeal electromyography and by intraoperative findings of cricoarytenoid dislocation. A region-tracking software algorithm developed by Zhuang et al. was used to analyze 27 pre-operative endoscopic videos of patients diagnosed with arytenoid dislocation. Vector analysis measuring cuneiform movement during inspiration was used as an indirect measure of arytenoid movement. Values were normalized using vocal fold length. Two raters blinded to diagnosis of arytenoid dislocation measured vocal fold length and cuneiform movement on both the dislocated and non-dislocated sides.

Results: Pixel-valued cuneiform movement was 92.46 ± 68.50 on the dislocated side and 159.53 ± 81.51 on the non-dislocated side. Unitless cuneiform movement was 0.23 ± 0.14 for the dislocated side and 0.43 ± 0.21 for the non-dislocated side. P-values were significant (<0.05) for both values. Interrater intraclass correlation coefficient (ICC) was 0.780 for the dislocated side and 0.747 for the non-dislocated side. Intrarater ICC was 0.869 for the dislocated side and 0.908 for the non-dislocated side. The software incorrectly identified laterality of arytenoid dislocation in 7 of 27 patients (25.9%). The receiver operating characteristic (ROC) curve revealed an area under the curve between 0.763 and 0.834 (95% CI 0.632- 0.896).

Conclusion: Our data revealed precision of the software, with good interrater and intrarater ICC and values similar to the previous study by Zhuang et al. However, the software misdiagnosed several patients for sidedness of dislocation and had high standard deviations for each calculated value. The laborious process of using this software and its inaccurate diagnoses suggest that this software is of limited clinical usefulness in its present state.

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Relating Cepstral Peak Prominence to HSV Glottal Waveform Parameters in Patients with Hoarse or Breathy Voice: A Pilot Study

Objective: Smoothed Cepstral Peak Prominence (CPPs) been shown to be an effective indicator of hoarseness and breathiness (Hillenbrand and Houd, 1996). Direct imaging using videostroboscopy is the gold standard for diagnosing voice pathology, with high-speed videolaryngoscopy (HSV) frequently being used as a complement to stroboscopy especially when asymmetric or aperiodic vocal fold vibration is present in dysphonic voices. Although the relationship between vocal fold physiology as seen by direct imaging and dysphonia as determined by acoustic analysis is not always clear, there is some evidence that asymmetric vocal fold vibration and incomplete glottal closure can often be seen in the video exams of patients with hoarse or breathy voices. This paper will report on a pilot study to investigate the relationship of CPPs to vocal fold vibration and glottal waveform parameters obtained from flexible fiberoptic high-speed video nasolaryngoscopy, in subjects with rough, hoarse, or breathy voices.

Methods: Patients with normal and disordered voices were asked to produce sustained vowel phonations while undergoing a flexible HSV examination. Sample audio of their phonations were also obtained during the exam.

Results and Conclusion: Glottal Area Waveform (GAW) analysis was performed on the HSV exams to extract GAW parameters such as Open Quotient, Closed Quotient, and Speed Quotient. Left and right vocal fold displacement was also extracted and parameters such as left-right phase asymmetry and left-right amplitude asymmetry were examined. CPPs measures from acoustic analysis of audio recordings during the HSV exam were also obtained. Correlations among the GAW parameters, vocal fold displacement parameters, and CPPs values in the microphone recordings were investigated. (259 words)

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Injection Augmentation for Benign Essential Tremor: Diagnostic Injection and Autologous Fat Results

Objective: Vocal fold injection augmentation is often employed diagnostically for patients with subtle glottic insufficiency to explore voice and other complaints. Its use in patients with both subtle glottic insufficiency and benign essential tremor (ET) has been reported but not after durable augmentation with autologous fat. This study intends to evaluate the success of diagnostic vocal fold injection augmentation and subsequent results of autologous fat injection augmentation in patients with both glottic insufficiency and ET.

Methods/Design: Retrospective review. Subjects included had subtle glottic insufficiency from true vocal fold atrophy and benign essential tremor. Some subjects had tried botulinum toxin injections previously. Diagnostic injection result (successful or not) will be reported. VHI-10, RSI, frame by frame analysis of glottic closure, aerodynamic data including subglottic pressure and airflow, and the tremor scoring scale were evaluated before diagnostic injections with carboxymethylcellulose and 3 months after autologous fat injection.

Results: 9 subjects met inclusion criteria. Patients who went on to fat injection will be the study group. The data will be finalized, evaluated and manuscript prepared for the symposium 2018. Anecdotally at the time of abstract submission, the majority demonstrated improvement after diagnostic injection and had similar success after autologous fat injection. The tremor did not resolve completely in any subject, but patient satisfaction and function was improved.

Conclusions: Although data analysis is pending, injection augmentation for ET in the setting of true vocal fold atrophy appears to offer benefit and may be an alternative treatment pathway for a chronic neurologic condition affecting the larynx.

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Validation of Adequacy of Topical Anesthesia for Office Based Laryngeal Procedures By Green Dye: A Preliminary Study

Introduction: With increased popularity of office laryngeal procedures, there is a need to validate the adequacy of topical anesthesia prior to interventional laryngeal procedures. We postulate that adding green color food dye to topical Lidocaine will help the clinician to validate the adequacy of laryngeal anesthesia, thereby reducing the chance of premature procedure termination.

Material and Methods: Seventeen subjects undergoing office laryngeal procedures were enrolled. Ten cc of 4% topical Lidocaine USP is mixed with 10 drops of green food dye. Two cc of the 4% Lidocaine is drawn up and used for topical laryngeal anesthesia by: a. trans-tracheal injection, b. nebulizer therapy using Pulm-aid nebulization, c. indirect trans-oral instillation, or, d. Instillation by large particle atomizer via the fiber-optic laryngoscope channel. Video- laryngoscopy was done. Presence of the green color on the larynx was correlated to the surgeons' judgment of the adequacy of the local anesthesia for the procedure.

Results: Seventeen subjects had office KTP laser, tran- tracheal steroid injection and injection laryngoplasty. Fourteen were completely successful procedures while 3 were less than completely adequate. All the successful cases showed green color on the vocal folds while the three failures had minimal green dye on the vocal folds. Direct instillation by trans-tracheal instillation was most effective. The green color did make KTP laser effect on tissue slightly more difficult to visualize.

Conclusion: Green color on the vocal fold was associated with good local anesthesia and excellent patient. It is a simple way to validate adequate laryngeal anesthesia.

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Impact of the Human Papillomavirus 9-Valent Vaccine on the Disease Burden of Patients with a Partial Response to the Quadrivalent Human Papillomavirus Vaccine

Summary/Objective. Previous research shows a 40% remission rate in patients with recurrent respiratory papilloma (RRP) vaccinated with the quadrivalent human papillomavirus vaccine (Gardasil[R]) and partial response in an additional 25%. The cause of incomplete response is unknown, but may be due to a significant presence of viral types not included in the Gardasil[R] vaccine. The purpose of this study was to examine the effect of the Human Papillomavirus 9-valent Vaccine, Recombinant (Gardasil 9), on the disease course of patients with very severe RRP who achieved only partial remission with Gardasil[R].

Methods. Retrospective chart review of 4 patients with severe RRP who had had a partial response to Gardasil[R] and requested additional vaccination with Gardasil 9. Efficacy was assessed by evaluation of tumor burden noted during surgery after completion of the vaccine series and effect on papilloma histopathology.

Results. Tumor burden decreased in 3 of 4 patients and progressed in 1 patient. Two patients had histopathology showing severe dysplasia prior to revaccination. The histopathology in the patent with worsening tumor burden progressed to invasive squamous cell carcinoma. Histopathology was unchanged in the other 3 patients, including the other patient with severe dysplasia. P16 positivity and invitro hybridization studies documenting low risk RRP remined unchanged after Gardasil 9 vaccination in both the patient with severe dysplasia and the patient with malignant degeneration. No patient has achieved remission.

Conclusions. The Gardasil 9 vaccine can modulate the severity of RRP partial responders to Gardasil[R] with very severe disease suggesting that vaccination with additional subtypes may be beneficial. Histopathology of the papilloma was not affected. Offering Gardasil 9 to partial responders to Gardasil[R] with less severe disease may be beneficial to decrease disease burden. The ability to induce remission in patients with mild to moderate disease with revaccination with Gardasil 9 remains uncertain.

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Treatment and Prognosis of Closed Laryngeal Trauma with Arytenoid Injury

Abstract Objective: To investigate the clinical characteristics, operation methods and function recovery of closed laryngeal trauma with arytenoid injury.

Methods: Five patients with closed laryngeal trauma with arytenoid injury were treated with microsuture with self-retaining laryngoscope, and the clinical characteristics and therapeutic effect of these patients were analyzed.

Results: All of the five patients were male, aged from 7 to 30 who are admitted to hospital 15 to 48 hours after closed laryngeal trauma. The causes of the injury were neck hitting hard edges. All the patients complained of throat pain and swallowing pain without dysphagia, and severe hoarseness, hemoptysis secretion without obvious dyspnea. No subcutaneous emphysema was found by physical examination. Via microlaryngoscope, major damage was found at unilateral or bilateral arytenoid area with ventriculus laryngis mucosa avulsion and arytenoid injury, accompanied by pseudo membrane formation. Vocal cord immobility was found in 3 patients. The cervical CT revealed laryngeal mucosa swollen, mucosa discontinuity of the arytenoid and ventriculus laryngis, and pneumatosis around throat. Fracture of the thyroid cartilage was present in one patient. Microsuture under self-retaining laryngoscope was performed to reconstruct the damaged mucosa, restore the shape of the larynx, and preserve the integrity of the mucosa. In one case a preventive tracheotomy was performed and after the operation the trachea tube was removed. No laryngeal stenosis was found in follow-up. The degree of hoarseness was significantly improved after surgery instantly, and was nearly normal four weeks postsurgery. Of the 3 patients with vocal cord immobility, two patients recovered and one achieved improved mobility.

Conclusion: Some patients with closed laryngeal trauma may combined with arytenoid injury and laryngeal mucosa avulsion. Early diagnosis and microsuture technique under self-retaining laryngoscope can effectively reduce the occurrence of vocal cord immobility, laryngostenosis, and preserve voice function.

Keywords: closed laryngeal trauma; mucosa avulsion; microsuture; arytenoid injury

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Can the Female Voice Reveal Reproductive Cues to Males?

Objectives: Investigate to what extent the female voice is a cue for sexual attraction to men and to female fertility.

Methods: Two listening tests were carried out with seventy-seven heterosexual healthy male participants. Each test contained the same nine female voices reading the same phrase of the Rainbow Passage at menstrual, follicular and luteal phases of the menstrual cycle. These recordings were made at the third month of an oral contraceptive pill (OCP) and a matched placebo use, randomized and double blind allocated within the six consecutive months of experiment. For each of the nine female voices contained in the two listening tests, male participants were asked to order six samples of the same women using a visual analogue scale of sexual attraction, displayed in the custom made software *Visor*. The use of *Visor* allowed for double blind and randomized presentations of the stimuli. Ethical approval was given by the Ethics Committee at both Coimbra and UNED Universities.

Results: A two-factor within subjects ANOVA was carried out to assess whether consistent ratings (n = 19, Chronbach alpha > 0.7) were different between phases of the menstrual cycle and the two study conditions, i.e. placebo and OCP use. No differences were found between phases of the menstrual cycle during placebo use; female voices were significantly rated as more sexually attractive at the follicular phase and less sexually attractive at the luteal phase during OCP use ($p < 0.05$).

Conclusions: The female voice constitutes a cue for sexual attraction to men; however, such attraction seems not to be related with female fertility. Female voices were rated as more sexually attractive when an OCP with antiandrogenic and antimineralocorticoid properties was taken, suggesting that low concentrations of testosterone are responsible for female voices attraction to men.

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The Relationship between Voice Handicap Index and Laryngeal EMG Findings in Patients with Vocal Fold Paresis and Paralysis

Objective: To determine whether there is a correlation between Voice Handicap Index 10 (VHI-10), a validated quality of life measure, and laryngeal EMG findings in patients with vocal fold paresis or paralysis.

Methods: A retrospective chart review of 159 patients who were diagnosed with vocal fold paresis/paralysis was performed. Patients were excluded if records were incomplete. Subjects completed VHI at their initial visit. Patients were examined with videostroboscopy and referred for laryngeal electromyography (LEMG) if neuromuscular weakness was suspected. LEMG used to both identify the affected nerves and to quantify subjectively the degree of paresis in the respective nerves.

Results: There were 61 patients diagnosed with unilateral superior laryngeal nerve (SLN) paresis. The mean VHI-10 score for these patients was 15.05. The severity of the SLN paresis ranged from a 15-40% decrease in recruitment. The mean decrease in recruitment in patients with unilateral SLN paresis was 25. There was no correlation (r=0) between the degree of paresis and the VHI score in this group. There were 39 patients with bilateral SLN paresis with a mean VHI of 16.87. There was no correlation (r=.12) between the degree of paresis and VHI scores in bilateral SLN paresis.

Conclusion: The VHI-10 is a validated instrument to identify patients' self-perception of the impact of voice problems. This study did not identify a significant relationship between degree of weakness identified on laryngeal EMG and the patients' voice complaints.

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Dysphonia in Performers: More Prevalent Lesions and Vocal Emergencies

Objective: To determine the prevalence of abnormal laryngeal findings during strobovideolaryngoscopy in performers and vocal emergencies presented by them.
Study design: Retrospective study of professional singers and actors who presented vocal evaluation.

Subjects and Methods: A chart of singers or professional actors who presented in a private otorhinolaryngology clinic between 2014 and 2016. The prevalence of laryngeal lesions and as vocal referrals were reviewed

Results: A total of 140 records of actors and singers were evaluated for the presence of laryngeal lesions and vocal emergencies.
The sulcus was a more prevalent lesion 36% (n = 33), cyst 27% (n = 25) and acute laryngitis, 14% (n = 13).
Thirty-seven (26.4%) performers were treated for emergence due to dysphonia. Of these professionals, 83.8% (31) presented some structural lesion or infection in the vocal folds, while 16.2% presented dysphonia, which required emergency care without structural lesion in the vocal folds. (p <0.05)
Eighty-nine percent (33) of the professionals presenting voice emergency with dysphonia (37) were treated with corticosteroids.
The RFS (reflux finding score) was calculated and the exams that presented RFS greater than or equal to seven were considered suspected of laryngopharyngeal reflux (LPR). Thirty-three percent (n = 47) of the professionals presented scores ≥7.
 Nineteen professionals (40%) with signs of LPR were treated for emergency due to dysphonia. The professionals with signs of LPR had more emergency dysphonia than those who did not suspect LPR. (19.4%) p = 0.008.

Conclusion: The more prevalent lesion in the study was vocal sulcus. In the strobovideolaryngoscopy, we can also evaluate the presence of signs of laryngopharyngeal reflux that may be related to the pathophysiology of dysphonia. Vocal emergencies in this group of professionals are common and require specialized assessment, especially if they occur close to a presentation or performance.

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Bilateral Posterior Cricoarytenoid Myoneurectomy for Abductor Spasmodic Dysphonia

Objective: To discuss the utility and outcomes of bilateral myoneurectomy for treatment of abductor spasmodic dysphonia.

Methods: Bilateral myoneurectomy is a known treatment option for patients with adductor spasmodic dysphonia. Its use for treatment of abductor spasmodic dysphonia, however, has not been previously documented. In this case report, treatment and long-term outcomes of abductor spasmodic dysphonia with bilateral myoneurectomy are discussed.

Results: A 50-year-old male presented with abductor spasmodic dysphonia. His initial VHI-10 score was 29, and he had breathy breaks during 60 series. He had no improvement in vocal quality after 6 botulinum toxin injections over 21 months. He underwent staged bilateral posterior cricoarytenoid partial myoneurectomy, with the left posterior cricoarytenoid myoneurectomy performed 33 months after presentation and right posterior cricoarytenoid myectomy 11 months later. Eight years post-operatively, his VHI-10 score was 12. During postoperative 60 series, the patient demonstrated few breathy breaks. Overall, the patient reports improved quality of life and satisfaction with his voice.

Conclusion: This case report presents the first documented case of bilateral myoneurectomy for treatment of abductor spasmodic dysphonia. Long-term VHI-10 results suggest improvement of symptoms, despite mild difficulty with 60 series. While botulinum toxin therapy is the mainstay of management for abductor spasmodic dysphonia, surgical treatment is a potential alternative approach at least for refractory cases.

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Vocal Fold Tissue Remodelling through Mechanotransduction by Lax Vox Therapy Case Presentation of Two Special Cases with Severe Vocal Fold Pathologies

OBJECTIVE:

The purpose of this study was to investigate the effect of phonation into tubes at two special cases with severe vocal fold pathology and to hypothesize, that the principles of mechanotransduction will explain the effect of tissue remodelling in two severe cases of organic vocalfold pathologies

INTRODUCTION:

'Mechanotransduction' is the term for the ability, first described by 19th-century anatomist Julius Wolff, of living tissues to sense mechanical stress and respond by tissue remodelling. Response to mechanical stress is important for tissue homeostasis, tissue architecture and muscle regeneration All cells of an organism are subject to at least one of three types of mechanical stress: compression, shear stress or tension. Mechanotransduction must therefore be viewed as a force-induced process initiating biochemical responses and initiating signal pathways leading to gene expression, protein synthesis, and cellular phenotype change.

METHODS and RESULTS:

The authors will presentate two special cases, one case with a dislocation of the bioplastique material after vocalfold augmentation and the other case with an severe vocalfold polyp. Both cases where treated only with the concept of lax vox therapy, established by Ilter Denizoglu from turkey. The authors hypothesize, that the principles of cellular mechanotransduction could explain and underline the result of the above-mentioned cases. There is not only the effect of aerodynamic, acoustic, and electroglottographic signals but also the effect of tissue remodelling by that principles.

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Can Diabetes Mellitus Lead to Voice Changes? A Systematic Review of Literature

Objective:

Diabetes Mellitus affects a large number of the population and its prevalence is increasing at an alarming rate due to the present lifestyle. Patients with diabetes report of a higher prevalence of gastrointestinal symptoms as compared to the general population. Further, since diabetes has an effect on the neurologic, vascular and muscular systems, there might be an impact on the phonatory system as well. A systematic review of literature was conducted to identify the influence of diabetes on voice.

Methods/Design:

A systematic literature search was carried out on PubMed, Scopus and Cochrane databases. The keywords 'diabetes mellitus', 'voice' and 'phonatory system' were used in different combinations. Articles that discussed the effect of diabetes mellitus on voice were included in the review.

Results and Conclusion:

Five studies were identified to be suitable for inclusion in the review. There is limited literature available on the effect of diabetes mellitus on voice. The studies pointed out at a higher prevalence (12.5%) of voice problems among individuals with diabetes mellitus as compared to general population. Higher gastroesophageal reflux disorder related symptoms. Further, higher reflux symptom index and voice handicap index scores have been reported in these individuals. The other voice related changes reported across the studies include presence of laryngeal involvement, hoarseness, and increased strained voice. Even though there is limited literature available on voice changes among persons with diabetes mellitus, it points towards the presence of voice problems among them. The findings of the present review draw attention towards the need to have additional research in this population. This would help in designing suitable voice assessment and management strategies for persons with diabetes mellitus.

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The Incidence of Thyroid Disease in Patients with Voice Complaints

OBJECTIVES: Thyroid disease is prevalent in the United States, and its symptoms can be easily overlooked or misdiagnosed, particularly early in the disease process. One common symptom of thyroid disease is dysphonia, which is often noted in patients who present for evaluation of the thyroid secondary to symptoms of hypothyroidism, hyperthyroidism, thyroid neoplasm, goiter, and/or thyroiditis. However, among the patient population who for evaluation of primary voice complaints, the incidence of thyroid disease as a contributing factor is unknown. The purpose of this study is to evaluate the incidence of thyroid disease in individuals who present to a laryngologist for evaluation of voice complaints.

METHODS: This study is a retrospective and prospective chart review of all patients seen in a private, tertiary laryngology practice from 9/2011 through 9/2014 for voice complaints. Patients' records were reviewed and data regarding the voice complaints and visit diagnoses were recorded and analyzed using a Pearson Chi-Square analysis.

RESULTS: 477 patients presented for evaluation of voice complaints during the 3 year study period. Of these, 162 (33.9%) were found to have thyroid disease: 83 goiter, 74 multiple thyroid nodules, 40 hypothyroid, 24 Hashimoto's thyroiditis, 15 thyroid cancer, 14 benign thyroid neoplasm, 8 chronic lymphocytic thyroiditis, 8 Grave's disease, and 30 with other thyroid disorders. The presence of thyroid disease was more commonly associated with superior laryngeal nerve paresis than the absence of thyroid disease at a level that reached statistical significance (Pearson Chi-Square (1) = 23.622, p<0.001). The presence of thyroid disease was not associated with any other laryngeal diagnosis.

CONCLUSIONS: Approximately 1/3 of patients who present to a tertiary laryngology center for evaluation of voice complaints have associated thyroid disease. Of these, the only associated laryngeal pathology noted at a level of statistical significance is superior laryngeal nerve paresis.

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A Survey of Voice Rest Practices after Phonomicrosurgery

Objective: The aim of this study was to examine current protocols for voice rest and post-surgical rehabilitation implemented by laryngologists immediately after phonomicrosurgery for benign lesions- vocal nodules, cysts, polyps, Reinke's edema, leukoplakia and papilloma.

Methods: A cross-sectional survey study was conducted. A 24-item survey was sent via electronic mail to laryngologists across the country to provide their recommendations of type (complete voice rest, relative voice rest, combination or no voice rest) and dosage of voice rest, factors involved in this decision and other recommendations for behavioral modifications. Descriptive and inferential statistics were performed on the responses obtained.

Results and conclusions: Eighty-five laryngologists returned the survey for a response rate of 47.5%. The respondents practiced in the specialties of general laryngology, head and neck surgery and/or pediatric laryngology. They were evenly distributed across years of experience and location across the United States. The more common recommendation for complete voice rest is 7 days for nodules, cysts, polyps and Reinke's edema and 1-4 days for leukoplakia and papilloma. Relative voice rest when recommended is typically recommended for over 8 days. Voice rest recommendations were not affected by surgery type alone, but were determined by lesion and a combination of lesion and surgery type. Other findings from this survey study such as factors involved in the decision making and recommendations for behavioral modifications, will be presented.

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Behavioral and Neurophysiological Effects of Combined LSVT-LOUD® and Transcranial Magnetic Stimulation in Speakers with Parkinson Disease

Objective: We investigated ways to accelerate the therapeutic effects of voice therapy while maintaining and/or enhancing the duration of its therapeutic effects. We tested the efficacy of 5 Hz TMS as a treatment adjuvant with Lee Silverman Voice Treatment (LSVT). We examined a variety of acoustic and perceptual measures as well as FMRI imaging of brain activity in speakers with Parkinson Disease (PD) before and after LSVT and at follow up (FU).

Method: We randomized 18 patients with PD hypophonia into receiving LSVT only (sham TMS), or LSVT with TMS applied to left or right primary laryngeal motor cortex (LTMS, RTMS respectively). Participants underwent TMS and voice therapy 4 days a week for 4 weeks. TMS was delivered using neuro-navigation at $M1_{larynx}$. Voice and speech data were collected twice a week. We examined the changes in rate of skill learning, vocal intensity, and blood oxygenation level dependent signal (BOLD) in the speech motor network following treatment and at 3-month follow-up in the three groups. V-RQOL self-ratings, acoustic measures of overall intensity (dB), cepstral peak prominence (CPP), and the Single Word Intelligibility Test (SWIT) were obtained before and after treatment and at 3 month FU.

Results and Conclusions: Overall intensity, CPP and SWI improved significantly and was maintained at FU for all three groups, supporting the efficacy of the treatments. V-RQOL improved post treatment for each group but was maintained at FU for the Sham TMS Groups receiving TMS had significantly greater ($p < 0.05$) change in the rate of increase of vocal intensity during phonation than with sham TMS (slope 1.82 for TMS groups vs. 1.27 for sham group). Across groups, when compared to baseline activity during speech tasks, there was increased activation of the right postcentral gyrus, and left $M1_{larynx}$/premotor cortex, sensory association areas, superior temporal gyrus, and insula immediately post-treatment that persisted at follow-up. Compared with sham TMS, the LTMS group at post-treatment showed stronger activations in auditory cortex, insula, putamen and amygdala, all regions that modulate vocal intensity and pitch. Our data are first to demonstrate that adjuvant TMS accelerates therapeutic learning and improves maintenance of some therapy gains. TMS also resulted in stronger activations across the feedforward and feedback components of the speech motor network.

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Objective Voice Measures in Patients with Unilateral and Bilateral Superior Laryngeal Nerve Paresis

Objective: To determine whether there is a statistical difference in objective voice measures between patients with unilateral and bilateral SLN paresis.

Methods: A retrospective chart review of 65 patients diagnosed with SLN paresis was performed at Philadelphia ENT Associates, which is affiliated with Drexel College of Medicine. Patients were excluded if records were not complete. Subjects completed objective voice measures during their initial evaluations. Laryngeal electromyography (LEMG) was used to identify the affected nerves and quantify subjectively the degree of paresis. The objective voice measures between the unilateral and bilateral SLN paresis were compared using the two-tailed Student's t-test.

Results: There were 39 patients with unilateral SLN paresis, of whom 23 were female and 16 were male. There were 24 patients identified with bilateral paresis, of whom 17 were female and 7 were male. In females with unilateral paresis, the means for objective measures were: 1.79% for jitter, 4.24% for shimmer, 0.16 for noise-to-harmonic ratio (NHR), 13.31 seconds for maximum phonation time (MPT), and 199.74 mls/sec for mean flow rate (MFR). In the female bilateral paresis group, the means for objective measures were: 1.92% for jitter, 5.15% for shimmer, 0.23 for NHR, 14.36 seconds for MPT, 182.05 mls/sec for MFR. There was no significant statistical difference between the objective voice measures in females with unilateral and bilateral SLN paresis. In males with SLN paresis, the means for objective voice measures were: 1.16% for jitter, 3.30% for shimmer, 0.14 NHR, 19.19 seconds MPT, 349.88 for MFR for the unilateral group, and 1.59% for jitter, 4.52% for shimmer, 0.20 for NHR, 16.96 seconds MPT, 193.00 mls/sec for MFR in the bilateral group. There was a significant statistical difference between the MFR in unilateral and bilateral SLN paresis in males (p=.03).

Conclusion: In the selected objective voice measures, jitter%, shimmer%, NHR, MPT, and MFR there was no statistical difference between unilateral and bilateral SLN paresis in women. However, in men, there was as significant difference between MFR in unilateral and bilateral SLN paresis group.

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Relationship between Vocal Fry and Vowel Height

Background: Due to the prevalent use of vocal fry in normal linguistic contexts, there is a need to assess which factors influence the production of this vocal register. **Purpose:** To assess the differences in percentage of vocal fry between high/low vowels. **Methods:** In total, 22 college students (12 females and 10 males) participated in this study. Participants were English native speakers. They recorded eight sentences that contained four words including vowels preceding a voiceless stop. Four sentences contained the words at the beginning of the production, whereas the other four sentences contained the words at the end. The speech material was produced under nine different 'virtual-simulated' acoustic conditions. Among the four words, two words contained low height vowels (act, pot), and two words with high height vowels embedded in diphthongs (shape, strikes). The targeted vowels were /æ/, /ɒ/, /eɪ/, and /aɪ/. The calculation of the percentage of automatically detected vocal fry was performed by means of an analysis technique for the automatic detection of vocal fry in the four targeted vowels from the selected words of the Rainbow Passage (act, pot, shape, strikes). **Results:** Our results show that the participants had higher occurrences of vocal fry in low height vowels compared with high height vowels. Also, production of vocal fry was more frequent on low vowels located at the end of the sentences compared with low vowels produced at the beginning of the sentence. **Conclusion:** Our findings indicate a statistically significant effect of vowel height in the production of vocal fry.

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Variations in Occurrence of Vocal Fry under Different Virtual Simulated Acoustic Conditions

Background: Vocal fry has is considered a syntactic marker because of its increased occurrence at the end of paragraphs or sentences. On the other hand, room acoustics have been found to be associated with changes on voice production, and therefore the occurrence of voice disorders. although vocal fry is considered one of the three vocal registers (fry, modal, falsetto), there is a dearth of studies in the relationship between vocal fry and room acoustics. **Purpose:** Define the relationship between perceptually identified vocal fry and room acoustics (background noise levels and reverberation time). **Methods:** In total, 40 college students (22 females and 18 males) participated in this study. Participants were English native speakers. They recorded one speech sample (Rainbow passage) under nine different 'virtual-simulated' acoustic conditions. The recorded speech was perceptually evaluated by three speech-language pathologists. Generalized Estimating Equations (GEEs) were used to determine which room acoustic parameters were associated with the presence of perceptually determined vocal fry. **Results:** Babble background noise (OR=0.8) and pink background noise (OR=0.7) were associated with a lowered likelihood of vocal fry. **Conclusion:** There appeared to be an association between background noise conditions and the perceptual identification of vocal fry, suggesting the influence of noise conditions on the perceptual identification of vocal fry at individual level. Specifically, our results indicated that US college students are less likely to fry under noisy conditions.

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The Effects of Stress Type, Vowel Identity, Baseline f_0, and Loudness on the Relative Fundamental Frequency of Individuals with Healthy Voices

Objective: Relative fundamental frequency (RFF) has been investigated as a possible acoustic measure to assess the presence and degree of the laryngeal tension. This study aimed to identify possible factors in RFF stimuli (stress type, vowel identity, baseline f_0, and loudness) that might also affect RFF values. Methods: Fifteen speakers with healthy voices produced short RFF stimuli (vowel-/f/-vowel; e.g. /ɑfɑ/) in different conditions. They produced the stimuli with three different stress types ('stress first', 'stress second', and 'stress same') and four vowels (/ɑ/, /ə/, /i/, /u/). Participants also produced stimuli in three different baseline f_0 conditions (comfortable, low, and high) and three different loudness conditions (comfortable, soft, and loud). The mean RFF and within- and between-subject standard deviation of RFF were estimated for each stimuli condition.

Results: Stress type, vowel identity, and baseline f_0 showed statistically significant effects on either RFF means or within-subject standard deviation. The 'stress first' stimuli had the lowest offset 10 and highest onset 1 RFF values and the 'stress same' stimuli had the lowest within-subject standard deviations. The low vowel /ɑ/ resulted in significantly higher onset 1 RFF values than the high vowel /u/. Baseline f_0 showed a significant effect on both offset 10 and onset 1 RFF mean values, with significantly higher RFF during low baseline f_0 production. Loudness did not have any significant effect on RFF but onset 1 RFF values produced with soft voice showed an unexpectedly high between-subject standard deviation.

Conclusion: Stress type, vowel identity, and baseline f_0 are important factors to consider in RFF measurement. Future experiments using RFF should control for these factors.

Key Words: Relative fundamental frequency, Syllable stress, Vowel, Baseline f_0, Loudness, Laryngeal tension

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The Impact of Double Source of Vibration Semioccluded Voice Exercises on Objective and Subjective Outcomes in Subjects with Voice Complaints

Objective: The present study reports the effects of double source of vibration semioccluded vocal tract exercises (SOVTEs) on subjective and objective variables in subjects with voice complaints.

Methods: Eighty-four participants with voice complaints were randomly assigned to one of four treatment groups: (1) water resistance therapy, (2) tongue trills, (3) lip trills, and (4) raspberry (tongue and lip trills at the same time). Before and after voice therapy, participants underwent aerodynamic, electroglottographic, and acoustic assessments. Measures for the Vocal Tract Discomfort Scale (VTDS), self-assessment of resonant voice quality, and sensation of muscle relaxation were also obtained. Three assessment sessions were conducted: (1) before the therapy session (Pre), (2) immediately after the voice therapy session (Post 1), and (3) 1 week after home practice (Post 2).

Results: Significant differences between baseline (Pre) and both post measures were found for the perception of muscle relaxation and resonant voice quality. No significant differences between Post 1 and Post 2 for any exercises were observed. This indicates that all voice exercises improved subjective self-perceived voice quality immediately after exercises and that improvement remained stable after 1 week of practice. Water resistance therapy and raspberry attained the highest effect. A significant decrease for all exercises was also observed for VTDS values after 1 week of practice. Although some significant changes were observed in objective variables, no clear patterns could be detected.

Conclusions: SOVTEs with secondary source of vibration may reduce vocal symptoms related to physical discomfort in subjects with voice complaints. Objective variables apparently do not fully reflect subjective positive outcomes, or they are not sensitive enough to capture changes. No significant differences between four observed SOVTEs were observed.

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Do Different Semi-occluded Voice Exercises Affect Differently Vocal Fold Adduction in Subjects Diagnosed with Functional Dysphonia?

Objective: In voice clinic, the degree of a patient's impact stress during phonation is one of the most relevant topics. In fact, impact stress is the main cause of vocal fold nodules and other phonotraumatic lesions of the superficial lamina propria. The aim of the presente study was to observe the possible differential effect of 8 different semi-occluded vocal tract exercises on glottal contact quotient (CQ) as a measure of vocal fold impact stress.

Methods: Eighty participants were divided into two groups: an experimental group with hyperfunctional dysphonia and a control group of vocally healthy subjects. The participants were recorded before, during and after the exercises. Electroglottographic samples were analyzed to obtain CQ.

Results: All exercises had a significant effect when pre, during and post conditions were compared. For the experimental group, all exercises, except lip trills and tongue trills, had an overall significant effect when conditions before, during and after the exercises were compared. The CQ presented differently across the 8 semi-occluded postures during exercise for both groups. For the experimental group, most exercises increased the CQ during practice. Only lip and tongue trills demonstrated lower CQ during exercise. Males demonstrated higher values of CQ compared to females. Considering semi-occluded exercise, straw submerged 10 cm below the water demonstrated the highest value for CQ, while tongue trills obtained the lowest value.

Conclusions: Different semi-occluded exercises differentially affect vocal fold adduction. Lip and tongue trills produced the lowest CQ. Therefore, they may be recommended for decreasing glottal adduction. A straw submerged 10 cm below the water surface presented the greatest CQ. A shallower depth led to a lower CQ, while deeper submersion produced a higher CQ.

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Development and Validation of the Protocol for the Evaluation of the Voice in Subjects with Hearing Impairment (PEV-HSI)

Objective: To develop an instrument for evaluating the voice of cochlear implanted individuals, establishing its validity for clinical and scientific purposes.

Methods: The instrument underwent the validation steps suggested by the Scientific Advisory Committee of the Medical Outcomes Trust that include the conceptual and measurement model, determining content validity, reliability, construct validity, interpretability and burden. For validation, voice samples of 78 cochlear implanted persons (experimental group) and their hearing peers (control group) were used. The groups were divided by age range – children from 3 to 5 years; children from 6 to 10 years and adults from 18 to 46 years of age. They participated in a voice recording of the sustained vowel /a/, connected speech and spontaneous conversation, which were rated by three voice specialists, using the proposed instrument. It consists of visual-analog scales of suprasegmental aspects, respiratory-phonatory coordination, resonance, phonation, additional parameter and general vocal perception.

Results: Evaluation by an expert committee and a pilot test established content validity. Reliability measures showed excellent test-retest reproducibility for the majority of the parameters. Analysis with the ROC curve showed that perceptual evaluation with the sustained vowel did not strongly differentiate cochlear implanted and normal hearing individuals. The parameter "speech rate" did not differentiate the groups, so it was excluded from the protocol. For the connected speech and spontaneous conversation, the majority of the parameters differentiated the experimental group from the control group with an area under the curve ≥ 0.7. The cutoff values with maximum specificity and sensitivity were 30.5 for mild, 49.0 for moderate and 69.5 for intense deviation.

Conclusions: The PEV-SHI is a reliable and useful tool for assessing the particularities of the voice of cochlear implanted individuals and can be used in research and clinical settings to standardize evaluation and facilitate information exchange among services.

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Changes on Voice Quality after Pure Tone Stimulation: A Pilot Study

Objectives: Characterize, acoustically and perceptually, changes on voice quality after the use of pure tone stimulation (PTS) among a group of patients with organic voice disorders, and a group of controls with normal voices. **Methods:** Data of thirty-nine participants (28 patients with voice disorders, and 11 controls with normal voices) were analyzed for this study. Eight females and 3 males were part of a control group (no prior voice problems, mean age = 22 y/o). The group of patients were made up of 19 women and 9 men (mean age = 54 y/o). All the participants (patients and controls) went under a PTS program. The duration of the program was variable for the patients (depending of their needs, it included therapy sessions with the speech-language pathologist/voice pathologist, and exercises at home), whereas for the controls the PTS was implemented in one session of two repetitions (each one of about 10 minutes). The PTS consists of a binaural auditory stimulation with different pure tones half a step apart. The participants were requested to match the pure tone that they were hearing by producing the sound /hee/ with good breath support. Before and after the PTS program, all the participants recorded a speech sample (Rainbow passage). The speech sample was used to measure acoustically (fundamental frequency, pitch strength and cepstral peak prominence) and perceptually (GRBAS scale) the possible effect of this technique on voice quality. **Results:** After PTS there was an increase in fundamental frequency (F0) and CPPs. The results of regression analysis show that there is a significant increase in fundamental frequency, pitch strength and CPPs after PTS. The results of the perceptual assessment shows that after PTS, there was a decrease in the perception of hoarseness, roughness, and breathiness (G – R - B Scores ≥ 1). **Conclusions:** There is a significant effect of PTS in the voice quality, measured acoustically and perceptually. Specifically, PTS seems to be beneficial in the treatment of patients with incomplete glottal closure, and superior laryngeal nerve injury.

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Factors Contributing to Vocal Abuse and Voice Disorders of Clergy

Objectives: The purpose of the study was to identify the factors contributing to vocal problems among clergy by comparing the mean scores from the Voice Handicap Index (VHI) and a health questionnaire, the Alexander Vocal Health Questionnaire (AVHQ) that includes demographic information.

Methods: The mean scores from the Voice Handicap Index (VHI) and a health questionnaire (Alexander Vocal Health Questionnaire-AVHQ) that included demographic information, were compared and analyzed for a statistically significant difference between the scores on the index and the questionnaire given various independent variables such as denomination, number of services preached per day, size of the congregation, preaching style, previous vocal training and medical concerns. Using an electronic database, data was collected from two sources for pastors and ministers. QuestionPro, the survey, was distributed at the conference, completed manually and entered into the QuestionPro system.

Results: There was a statistically significant difference in the mean scores on the Voice Handicap Index-VHI for respondents with medical problems such as gastro-esophageal reflux and upper respiratory problems, such as gastro-esophageal reflux and upper respiratory problems as a central part of vocal care.

Conclusion: The results of this study support the inclusion of training regarding medical problems, such as gastro-esophageal reflux and upper respiratory problems, as a central part of vocal care for clergy. It is recommended that seminary lectures and possible course on vocal care become part of the curriculum on the preaching and teaching tracks at seminaries and Bible colleges. The need for tools to provide subjective measurement of voice problems in the area of vocal arts is indicated.

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maskVOX: A New Device for Voice Therapy and Vocal Training

Objective: LaxVox Voice Therapy Technique (LVVT) is a multidimensional strategy providing various exercises and devices to the clinician and the vocal pedagogue as well. Artificial elongation of the vocal tract and backpressure by narrow (3-11mm) tubes and bubbling water are the main tools in LVVT. One missing point is the limitation of articulatory movements during phonation into the tube. An oral mask has been designed by the author in order to serve for free articulatory movements of the lips, the jaw, and the tongue as well.

Methods: After several steps of engineering/reverse engineering and design, an oral mask (maskVOX®) for phonatory use of purpose has been devised. The maskVOX® is made of medical grade elastic silicone in order to fit the face and not to irritate the skin. The outlet of the maskVOX® can be mounted to the phonatory inlet of the doctorVOX® and pocketVOX® devices which have been devised for LaxVox applications. By using the maskVox® device, it is possible to speak or sing into the mask and benefit the physical and physiological effects of artificial elongation and backpressure. It can also be used as a sound muffler which additionally provides the singer use the full voice without disturbing others in a calm environment.

Results and Conclusions: The maskVOX® is a unique device in the related literature and will be presented first time as an oral presentation. Practical implications will also be mentioned. The maskVOX® may be a therapy tool of choice not only for voice problems but also for motor speech disorders. Future clinical research is warranted.

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A New Treatment Method for Puberphonia: High Backpressure in LaxVox Therapy

Objective: Puberphonia (mutational falsetto) is a functional problem beyond pubertal period which is seen mostly in males. Treatment of puberphonia can be done by applying pressure externally; by exercises for lowering vertical laryngeal position (humming, gliding to low pitches, and half swallow boom technique) or by surgery (Type III thyroplasty). A new method is presented by Denizoglu et al. using high backpressure during phonation.

Methods: 21 male with puberphonia and 25 age-matched healthy male were included in the study. ENT examination, VLS, acoustic (SPL, mean F0, first three formants, jitter%, shimmer%, NHR) and EGG (CQ and CI) analysis were performed, at pretreatment, first and sixth months of treatment. VHI-10 and the GRBAS scales were performed for perceptual voice evaluation. LaxVox Voice Therapy Technique was applied to the patients diagnosed as puberphonia with the doctorVOX Voice Therapy and Vocal Training Device. The tip tuner was adjusted to provide a high backpressure (over 20 cmH2O) to the user. No other methods were used, but high backpressure by doctorVOX. After skill acquisition, therapy was completed by developing the new behaviour.

Results and Conclusions: All patients were able to find their chest register in the first two sessions and use their chest register in a normal habitual speaking tone and timbre after two weeks of therapy. All patients showed statistically decrease in VHI-10, GRB, F0, F1, F2, F3, %Jitt, %Shimm, NHR and CI whereas an increase in CQ after treatment (first month). At the 6th month post-treatment, no patient got back to falsetto register; despite VHI-10, %jitt ve NHR values were higher than of control. LaxVox Voice Therapy Technique with high backpressure provided by the doctorVOX device was shown to be an effective treatment of puberphonia.

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A Novel Laryngeal Palpatory Scale (LPS) in Patients with Muscle Tension Dysphonia

Objectives: Laryngeal palpation is a more convenient and accessible method for evaluation of the patients with muscle tension dysphonia (MTD). The aim of this study is to develop a new comprehensive valid and reliable ''laryngeal palpatory scale'' (LPS), based on psychometric criteria. The LPS is able to assess anatomical structures influenced in MTD using a quantitative-based measurement.

Methods: The scale items were developed using an in-depth analysis of the literature and an expert focus group. Furthermore, scale item generation and item reduction carried out by selection of 45 items during psychometric assessment of LPS's qualitative and quantitative content validity and qualitative face validity, followed by interrater reliability. For this purpose, 531 patients were assessed and finally 55 patients with pure MTD (26 women, mean age: 40.8 years, S.D: 12.5; 29 male, mean age: 41.6 years, S.D: 11.8) participated in the study.

Results: In the phase of content validity ratio (CVR) assessment, 3 items obtained a score of less than 0.62, and were omitted. The rest of questions were assessed for content validity index (CVI). The results of the CVI calculation formula showed that the I-CVI of all the items was greater than 0.79 and the S-CVI was equal to 0.96. Finally, the interrater agreement for all items included in the analysis was ICC = 0.97 (confidence interval = 0.95-0.98), suggesting almost perfect agreement.

Conclusions: The laryngeal palpatory scale (LPS) is a reliable and valid instrument for assessing patients with muscle tension dysphonia (MTD). However, future studies regarding the concurrent validity are needed.

Key Words: muscle tension; dysphonia; laryngeal palpatory scale; validity; reliability.

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Can We Create a Functional Voice-lift? What is the Effect of Vocal Warm-up Exercises on the Vocal Quality of Elderly Women?

Purpose: The purpose of this study is to assess the effect of a well-defined vocal-warming up program on vocal quality and vocal performance among Dutch-speaking women aged 60+ years. An increase of the overall vocal quality and the vocal performance is hypothesized.

Methods: Thirty female subjects between the age of 60 and 80 years (mean age 67.4 years) were included. The experimental group consists of 15 subjects who performed vocal warm-up exercises during 30 minutes. The control group consists of 15 subjects who read aloud during 15 minutes. In both the experimental and control group subjective (questionnaire, perceptual evaluation) and objective (vocal performance, aerodynamic measurement, determination of the Dysphonia Severity Index) assessment techniques were used before and after performing the vocal task (reading or vocal warm-up exercises). The well-defined vocal warm-up exercises were selected to improve the dynamics of the extrinsic and intrinsic laryngeal muscles

Results: A significant decrease in jitter and lowest frequency and significant increase in highest frequency and Dysphonia Severity Index (overall vocal quality) is measured in the experimental group (subjects receiving a vocal warm-up program). In the control group no significant differences were measured.

Conclusion: An improvement in the vocal quality and vocal performance (frequency) is observed in women aged 60+.

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Performance of Different Acoustic Measurements to Discriminate Individuals with and without Voice Disorders

Objective: To analyze accuracy of different acoustic measurements for discriminating individuals with and without voice disorders.

Method: A total of 541 recorded sustained / ɛ /, and visual laryngeal examination. The overall deviation of each voice sample was determined in a 100-point visual scale. 52 normal individuals samples (normal larynx and reduced overall deviation of less than 35.5points) and 489 dysphonic subjects samples (structural or functional changes and higher vocal deviation of more than 35.6 points) were submitted to a traditional (mean and standard deviation values of the fundamental frequency – F0, jitter, shimmer, and glottal to noise excitation - GNE), non-linear (correlation dimension – D2, maximal Lyapunov exponent - Λ_1, and first minimum of mutual information function – FMMI) and recurrence quantification (determinism – DET, ; recurrence time type 1-T^1, transitivity - TRANS, average and maximum length of diagonal lines - L_{max} and L_{med}, Shannon entropy – ENTR, average and maximum length of vertical lines- TT and V_{max}, laminarity- LAM, and entropy of type 1 recurrence time – RPDE) measurements. We also analyzed parameters related to recurrent vocal production system topology (immersion dimension, m; reconstruction step, τ; and neighborhood radius, Radius). Quadratic discriminant analysis and accuracy, sensitivity and specificity of performance measures were used to investigate discriminatory power of these measures, as well as cross-validation of random signals' combination with and without disturbance.

Results: Only isolated traditional (GNE) and recurrence quantification (ENTR, L_{med} and TRANS) measurements showed acceptable performance ratings of $\geq$ 70% to discriminate between individuals with and without voice disorders with an accuracy. Traditional measures combined (F0 mean and GNE) and recurrence measures combined improve the classification performance, with accuracy of 78.57% and 83.27%.

Conclusions: Recurrence quantification measures, alone or combined, present superior performance for discriminating individuals with and without voice disorders, compared to traditional and non-linear measures.

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Exercise-induced Paradoxical Vocal Fold Motion Disorder: Clinical Features and Mechanisms

Objectives: To prospectively identify clinical benchmarks indicative of exercise-induced paradoxical vocal fold motion disorder (E-PVFM) and investigate two mechanisms driving clinical expression: autonomic imbalance and stress reactivity. These objectives were motivated by the high prevalence of misdiagnosis and protracted mismanagement in E-PVFM.

Methods: 13 adolescent athletes with E-PVFM and 14 athletic volunteers participated in an exercise challenge and simultaneous flexible laryngoscopy. Participants were asked to rate their symptoms at rest and exercise from a list of symptoms associated with PVFM using a visual analog scale (VAS). Participants were then asked to complete the Early Adolescent Temperament Questionnaire – Revised (EATQ-R) Fear Subscale to measure stress reactivity. Cardiovascular measures were taken throughout the protocol to evaluate group autonomic response differences. Glottal configuration and supraglottic responses at rest and exercise from previously recorded endoscopic videos were also analyzed.

Results: Statistical differences between group and condition were seen with dyspnea severity and glottal aperture ($p < .05$). Other clinical features prevalent in the E-PVFM cohort—arytenoid prolapse, throat tightness, and stridor—were variably present amongst individuals with and without E-PVFM. Trends in decreased sympathetic responses and faster parasympathetic reactivation were observed in the E-PVFM group. The EATQ-R Fear Subscale showed stress reactivity to be similar between the two groups ($p > .05$), yet significantly different from the general adolescent population ($p < .001$).

Conclusion: Results showed dyspnea ($> 30/100$ on VAS) and inspiratory glottal configuration ($> 8°$ adduction) with provocation to be good diagnostic indicators of E-PVFM. Blunted expiratory abduction responses in the E-PVFM group ($< 32°$ abduction) suggests respiratory compensation. Sympathovagal balance may play a role in E-PVFM and should be further investigated. Caution should be taken when extrapolating effects of temperament to E-PVFM pathogenesis. Outcomes can improve clinical management and sensitivity of inclusionary criteria for future studies.

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The Fake Phone Call: an iOS-based Voice Recalibration Tool. Feasibility, Usability, Utility and Preliminary Efficacy

Objective: To avoid the self-consciousness of public vocal warmup, an iOS app was developed to assist users in recalibrating their speaking-voice technique while seemingly engaged in a cellular phone call.

Methods: Twelve adults in the generalization stage of therapy received 4 Fake Phone Calls per day for 1 week. Participants imitated their own pre-recorded "self-as-model" target voice quality in this context. Usability, utility and preliminary efficacy were measured via number of calls completed, perceptual evaluation of voice quality in call responses, semi-structured interviews and self-report scales.

Results On average 2 calls per day were completed without bystander detection of their simulated nature. Voice quality accuracy was greater in repetition than extemporaneous speaking. System Usability Scale ratings were good. Utility (i.e. usefulness) was exemplified in qualitative themes of "Physical Practice is Vital" "Matching Yourself" and "Vocal Awareness." Preliminary self-efficacy and generalization data suggested that call completion unexpectedly improved participants' vocal self-assessments skill.

Conclusion: The Fake Phone Call is a useful and feasible tool for covert public voice technique practice.

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A Comparative Study of the VHI-10 and the V-RQOL for Quality of Life among Chinese Teachers with and Without Voice Disorders

Summary: Objectives. To investigate the differences and correlation between the Voice Handicap Index-10 (VHI-10) and the Voice-Related Quality of Life (V-RQOL) in teachers in China with and without voice disorders.

Study Design. This is a cross-sectional descriptive analytical study.

Methods. The participants were 864 teachers (569 women, 295 men) whose vocal cords were examined using a flexible nasofibrolaryngoscope. Questionnaire results were obtained for both the VHI-10 and the V-RQOL.

Results. Of the 864 participants, 409 teachers had no voice disorders and 455 teachers had voice disorders. The most common voice complaint was hoarseness (n = 298) and the most common throat complaint was globus pharyngis (n = 79) in teachers with voice disorders. Chronic laryngitis (n = 218) and polyps and nodules (n = 182) were the most frequent
diagnoses in teachers with voice disorders. Significant differences were seen on the VHI-10 between teachers with and those without voice disorders (P < 0.05) and in function between female and male teachers with voice disorders (P < 0.05) and between those with different voice disorders (P < 0.05). Moderate to strong correlations were observed between VHI-10 total score and those for the three domains of the VHI-10 and the V-RQOL (P < 0.0001).

Conclusions. There is a high prevalence of voice disorders in teachers. Teachers with voice disorders have poor voice related quality of life, with more impairment seen among female than male teachers. Different groups of voice disorders have different effects on voice-related quality of life. A moderate correlation was found between the results of the VHI-
10 and the V-RQOL.

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Changes after Voice Therapy in Acoustic Voice Analysis of Chinese Patients with Voice Disorders

Summary: Objectives. This study aimed to evaluate the effects of voice therapy on patients with voice disorders by comparing the acoustic parameter changes before and after treatment.
 Study Design. This is a retrospective study.

Methods. Forty-five female patients with early-stage vocal nodules or polyps, postoperative patients, and patients with chronic laryngitis were divided into three subgroups. Videostroboscopic, acoustic analysis (fundamental frequency, jitter, shimmer, mean harmonics-to-noise ratio), and maximum phonation time (MPT) were measured before and after treatment. Fifty healthy female volunteers were the control group.

Results. After treatment, 24.4% of nodules or polyps had decreased in size, 11.1% of patients with chronic laryngitis and postoperative patients had reduced edema, and the mucosal wave of vocal folds had different degrees of recovery in postoperative patients. All acoustic analysis values and MPT in the patient group were statistically worse than in the control group, except for fundamental frequency before treatment ($P > 0.05$). After treatment, the acoustic analysis and MPT values were improved. However, the jitter, mean harmonics-to-noise ratio, and MPT values in the patient group were still worse after voice therapy than in the control group ($P < 0.05$).

Conclusions. Most of acoustic analysis values can be useful as a complementary tool in diagnosis and assessment of voice disorders; however, it is not recommended to use a single parameter to assess voice quality. Voice therapy can improve voice quality in patients with voice disorders, but a period longer than 8 weeks is recommended for these patients.

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Mandarin (Simplified) Chinese Version of the Voice Activity and Participation Profile: Adaptation and Validation

Objective: The purpose of this study was to evaluate the reliability and validity of the Mandarin (Simplified) Chinese version of Voice Activity and Participation Profile (MC-VAPP) in Mainland China.

Methods: This study enrolled 786 subjects from February 2015 to March 2017, including 456 individuals with voice disorders (Dysphonic group) and 330 vocally healthy individuals (Non-dysphonic group). The internal consistency (Cronbach's alpha coefficient), test-retest reliability (intra-class correlation coefficient, ICC) and differences of the MC-VAPP scores were compared between the two groups; Exploratory factor analysis was performed; The receiver operating characteristic curve and cutoff point were calculated.

Results: The MC-VAPP had a high internal consistency, Cronbach's alpha coefficients for the subsection scores were from 0.86 and 0.96, with 0.98 for the total score. Test-retest reliability was high for the total score (ICC = 0.98). The four factors' cumulative contribution was determined to be 74.68%. The dysphonic participants displayed significantly higher total score and subsection scores than the non-dysphonic participants ($p < 0.001$). There were significant differences in total activity limitation scores and the total participation restriction scores between the two groups ($p < 0.001$). The cutoff point for screening between the two groups was 36.5, with a sensitivity of 76.80% and specificity of 80.30%.

Conclusion: The MC-VAPP is a reliable and valid instrument for the evaluation of voice-related quality of life in Chinese speaking individuals. It is also recommended that the MC-VAPP would be a useful tool for screening individuals with and without voice disorders based on the cutoff value of 36.5.

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Effects of a Variably Occluded Face Mask on the Acoustics and Aerodynamics of Connected Speech in Patients with and without Voice Disorders

Objective: The present study reports on the results of two experiments that were designed to (a) examine the immediate effects of a variably occluded facemask on estimated subglottal pressure (Psub) in normophonic subjects, and (b) to examine effects on aerodynamic and acoustic characteristics of voice in a group of dysphonic subjects.

Methods: The outlet ports of standard disposable anesthesia facemasks were fitted with plastic caps with variable diameter drilled openings (9.6mm; 6.4mm; 3.2mm; and 1.6mm) to create a series of variable mask openings. In Experiment 1, Psub was measured in normophonic subjects during repetitions of /i:pipipipipipipi/ using the facemask in unoccluded (i.e., open outlet port) and in the variable diameter opening conditions. In Experiment 2, aerodynamic (Psub, mean airflow, and glottal resistance) and acoustic measures (cepstral peak prominence – CPP; Cepstral Spectral Index of Dysphonia – CSID) were obtained in a group of dysphonic speakers pre and post use of the variably occluded mask during a 2 minute duration speech repetition task.

Results: In Experiment 1, mean PSub was observed to decrease while using the variably occluded mask in all occlusion conditions vs. non-occlusion, with a significant reduction in Psub observed between the baseline vs. the 6.4 mm condition (7.40 cm H_2O vs. 6.58 cm H_2O). In Experiment 2, data analyses using effect size measures (standardized mean differences) showed that the majority of dysphonic subjects produced reduced Psub, increased airflow, and improved acoustic measures in connected speech and repeated syllables post use of the variably occluded mask in least one of the three occlusion conditions.

Conclusions: Beneficial changes in both aerodynamic and acoustic characteristics of voice may be obtained in a variety of dysphonic speakers using a variably occluded mask. By moving the place of occlusion outside of the oral cavity, therapeutic target stimuli options may be extended beyond standard vowel and humming elicitations to connected speech productions. This may assist with generalization of voice therapy target techniques to conversational speech.

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Acoustic and Perceptual Correlates of Reduced Vibratory Capability of the Vocal Folds

Objective: To study the correlation between severity of reduced vibratory capability of the vocal folds and acoustic and perceptual data, including characterization of spectrograms, LTAS, ADSV parameters and GRBAS scale.

Methods: This retrospective study will examine 24 patients (16 females and 8 males) that demonstrated reduced bilateral vibratory capability of the vocal folds of varying severities on a stroboscopic exam. The vibratory capabilities were rated by a fellowship trained laryngologist (author AR) and then randomized. The randomized sample contained laryngeal diagnoses of scar, chronic or acute laryngitis (ulcerative, fungal, bacterial). The blinded voice recordings were then analyzed by two speech-language pathologists who specialize in assessment and treatment of voice disorders (authors AC and JC). Acoustical analysis and perceptual assessments were completed by both voice pathologists separately. The voice samples included a sustained /a/ vowel and "The Rainbow Passage".

Results and Conclusions: This study will show the correlation between severity of reduced vibratory capability of the vocal folds and acoustic and perceptual data.

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The Relationship between Voice Quality and Pitch Discrimination Ability in a Population with Features of Mild Hyperfunction

Background: Maladaptive vocal-motor responses to auditory perturbation have been demonstrated in individuals with muscle tension voice disorder (MTVD). The relationship between auditory-motor adaptation and the underlying mechanism of MTVD in the context of pitch discrimination has not been explored.

Aim: To examine the relationship between voice quality and pitch discrimination ability in females with auditory-perceptual features of mild MTVD. We hypothesise that auditory discrimination and muscle tension changes in patients with features of mild MTVD may be interdependent, as suggested in a reduced pitch discrimination accuracy.

Methods: A cross-sectional case-control design was used, with 24 subjects (aged 18 – 39) with features of a mild MTVD and 63 controls (aged 18 – 34) completing a computer-administered pitch discrimination test. Tonal language, musical, singing, and vocal training information, and their voice quality measures were collected and analysed for the control group. The means of pitch discrimination accuracy were compared across the two groups. Participants' voice acoustic measures were analysed for fundamental frequency, intensity, Cepstral Peak Prominence (CPP), and Harmonics-to-Noise Ratio (HNR).

Results: Participants with features of mild MTVD performed poorer than controls on the pure tone pitch discrimination test ($r=-0.216$, $p=0.044$). For the mild MTVD features group, pitch discrimination accuracy scores showed moderate correlation with CPP in participants' CAPE-V phrases ($r=0.581$, $p=0.042$), but not with CPP, CPPs, F0 variability or HNR in the prolonged vowel or the Rainbow Passage.

Conclusion: People with features of mild MTVD may have a reduced pitch perception ability as a result of the adaptation effect. Further research is required to test this hypothesis. More sensitive voice quality measures are required to assess and compare vocal quality in people with mild features of MTVD. Implications for the underlying mechanism of MTVD are discussed.

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Effect of Whole Body Vibration on Phonatory Function: A Possible Therapeutic Technique

Background: Whole body vibration is a passive exercise modality with a vertically vibrating platform on which a person stands or sits. The physical oscillations transfer energy to the subject's body and cause muscle contraction. These oscillations also set body organs, including the larynx, into vibration. It has been shown whole body vibration reduces muscle tension and fatigue.

Objectives: This study aimed to investigate whether whole body vibration would reduce vocal fatigue.

Methods: Thirty healthy individuals, aged 19 to 25 years were divided into two groups. Both groups underwent a prolonged karaoke singing task and sang continuously for at least 120 minutes. The experimental group was given 10 minutes of whole body vibration after the singing task and the control group was given a sham laser probe around the neck area for 10 minutes. Changes in ease of phonation, vocal fatigue symptoms, and phonatory function, as measured by the highest pitch produced, were measured before and after the interventions.

Results: The group that received whole body vibration intervention demonstrated significant greater improvement in ease of phonation ($p < .01$) and vocal fatigue symptoms ($p < .001$) than the control group.

Conclusion: Whole body vibration has a potential in improving vocal fatigue and may be a useful tool in voice therapy. A physiological hypothesis will be discussed to account for the apparent effect of whole body vibration on phonatory function.

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Validation of a Set of Synthetic Stimuli to Study Perception of Dysphonic Voices in Continuous Speech

Aim: When studying impact of dysphonia on intelligibility or appreciation of speakers, using multiple dysphonic speakers introduces biases linked to speech differences other than voice quality. Synthesizing one speaker's voice into different dysphonic qualities would permit to isolate the impact of dysphonia by maintaining other speech characteristics constant. Our aim is to create validated synthesizes mimicking natural dysphonic voices.

Methods: Forty eight natural dysphonic samples of the sentence "Le cocher a fouetté sa jument" were extracted from the dysphonic vocal database ECLIPSE and 10 natural normophonic samples of the same sentence were obtained from 10 euphonic speakers. The software VoiceOne from Telemetrics was used to create 14 different dysphonic syntheses out of the 10 normophonic samples. Ten naïve judges (5 females) and 3 experts (1 female) listened to the stimuli and rated the vocal severity on a 10 point scale. They then judged if the voice was natural or synthesized and last how certain they were of this on a 10 point scale.

Results: Overall, judges had difficulty to differentiate synthetic stimuli from natural but more so for the naïve judges (43% correct identification compared to 73% correct identification for experts). Interestingly, while experts were more confident in their judgment when they were right, naive judges became more confident when they were wrong, $(F(3,1866)=23,283, p<.001)$. Finally, the syntheses obtained mean severity scores ranging from 1,91 (SD=2,02) to 3,75 (SD=1,91) while the natural dysphonic voices obtained a mean score of 5,29 (SD=3,34).

Conclusion: The syntheses were mostly identified as natural voices by naïve judges. Although they were judged as less severe than the natural dysphonic voices they were still judged as dysphonic. Three syntheses with severity scores >2,8 identified as natural >50% of the time by naïve judges are retained as valid syntheses of dysphonic voices for experiments with naïve listeners.

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Immediate Effects of the Semi-Occluded Ventilation Mask on Subjects Diagnosed with Functional Dysphonia and Subjects with Normal Voices

Objective: The present study aimed to evaluate the immediate effects of the semi-occluded ventilation mask (SOVM) in subjects with functional dysphonia and subjects with normal voice. We hypothesized that (1)voice exercises with SOVM would promote a more economic voice production and also a more resonant voice quality in both subjects with dysphonia and subjects with normal voice; (2)these positive effects would be reflected in both objective (aerodynamic, electroglottographic, and acoustic measures) and subjective variables.

Methods: Sixty-five participants were included in this study. Thirty-one of them were diagnosed with functional dysphonia and thirty-four with normal voice. All subjects (including dysphonic and normal) were assigned in two groups at random: an experimental group using the SOVM and a control group without SOVM. Once the two groups were assigned (with and without mask), a second division was made based on their vocal condition: 1) subjects with normal voices with SOVM, 2) subjects with normal voices without SOVM, 3) dysphonic subjects with SOVM and 4) dysphonic subjects without SOVM. All participants underwent to aerodynamic, electroglottographic, acoustic and self-assessment. Counting numbers was requested as a phonatory task.

Results: Significant differences were found for aerodynamic, electroglottographic and acoustic variables when comparing SOVM groups (dysphonic and normal) with control groups. Cepstral peak prominence, SPL and electroglottographic contact quotient showed an increase for both experimental groups (dysphonic and normal voices). The self-perceived resonant voice quality showed an increase in both experimental groups. L1-L0, Glottal airflow, Phonation threshold pressure, and Subglottic pressure showed a decrease for the both SOVM groups.

Conclusion: The present study suggest that immediate positive effect could be produced by connected speech phonatory tasks using the SOVM in both dysphonic subjects and subjects with normal voice, being the change greater in the former. SOVT seems to promote an easy voice production and a more efficient phonation.

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Vocal Care Knowledge among Speech Language Pathologists

Objective: One of the most important components in the prevention and treatment of voice disorders is vocal hygiene and care. Thus, it is important to have a good understanding of vocal care and hygiene. Speech Language Pathologists are trained to provide voice care advice to individuals with voice disorders. Therefore, the SLPs should have a sound knowledge about the same. Hence a preliminary attempt was made to understand this knowledge among student SLPs regarding vocal hygiene.

Method: The questionnaire developed by Fletcher, Drinnan and Carding (2007) was used to investigate the knowledge of vocal care in 92 student SLPs (graduate and post graduates of speech language pathology) in India. The questionnaire consisted of 28 vocal hygiene factors which are frequently given to individuals with voice problems. The SLPs were asked to indicate whether these factors have a positive, negative or no influence on voice. Descriptive statistics was performed to summarize the percentage of correct and incorrect responses.

Results and Conclusion: The SLPs exhibited sound knowledge for some important factors hampering voice such as coughing, drinking alcohol, throat clearing, loud singing, smoking, whispering, and shouting. However, for some of the factors the SLPs were unclear about its effect on the voice. The present study helps to identify the areas in which student SLPs have a good knowledge and areas of lacunae. These findings would help in designing focused educational programs, seminars and research.

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Massed versus Spaced Practice in Vocology: Effect of a Short-term Intensive Voice Therapy versus a Long-term Traditional Voice Therapy

Objective. The purpose of this study was to compare the effect of a short-term intensive voice therapy (IVT) with a content-identical traditional long-term voice therapy (TVT) on the vocal quality and vocal capacities of patients with dysphonia. An additional comparison was made between two types of IVT programs: an individualized program (IVT-I) and a group program (IVT-G).

Design/Methods. A longitudinal, pragmatic, single-blind controlled trial with a multiple baseline design was used. Forty-six patients (mean age, 23.2 yrs.; range, 18 – 60 yrs.) diagnosed with dysphonia were assigned into one of the three treatment groups: IVT-I ($n = 15$), IVT-G ($n = 15$), and TVT ($n = 16$). The IVT groups practiced with a frequency of 1h20min a day and a duration of 10 consecutive work days (2 weeks). The TVT group practiced with a frequency of two 30 minute-sessions a week and a duration of 6 months. Both therapy programs were content-identical and guided by the same voice therapist. A standardized voice assessment consisting of both subjective (videolaryngostroboscopy, anamnesis, subject's self-report, auditory-perceptual evaluation) and objective vocal measures and determinations (maximum performance task, aerodynamic measurements, voice range profile, acoustic analysis, Acoustic Voice Quality Index, Dysphonia Severity Index) was used to evaluate the participants' voice. Time points of the assessment were at baseline (twice), after 1 week, 2 weeks, 2 months, 3 months, 4 months, 6 months, and 1 year. Additional voice evaluations were performed after each therapy day in the IVT groups.

Results. Data are currently being analyzed and the results will be available for the conference. A pilot study of Meerschman et al. (2017) performed in healthy subjects showed that an intensive short-term voice training may be equally, or even more, effective than a longer-term traditional voice training.

Conclusions. Data are currently being analyzed and the conclusions will be available for the conference.

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Effect of Three Semi-occluded Vocal Tract Therapy Programs on the Vocal Quality of Patients with Dysphonia: Lax Vox, Straw Phonation and Lip Trill

Objective. The purpose of this study was to investigate the effect of three semi-occluded vocal tract (SOVT) therapy programs "lax vox", "straw phonation" and "lip trill" on the vocal quality and vocal capacities of patients with dysphonia.

Design/Methods. A multigroup pretest-posttest control group design was used. Thirty-six patients with dysphonia were assigned into one of three experimental groups (practicing either lax vox, straw phonation or lip trill) or a control group (receiving a sham therapy) using blocked randomization. Each group received 6 sessions of 30 minutes over 3 weeks. A standardized voice assessment consisting of both subjective (anamnesis, subject's self-report, auditory-perceptual evaluation) and objective vocal measures and determinations (maximum performance task, aerodynamic measurements, voice range profile, acoustic analysis, Acoustic Voice Quality Index, Dysphonia Severity Index) was used to evaluate the participants' voice pre- and post-therapy.

Results. The experiment is currently being performed and results will be available for the conference.

Conclusions. The experiment is currently being performed and the conclusions will be available for the conference.

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Effects of Lee Silverman Voice Treatment (LSVT LOUD®) with Spanish-Speaking Population

The majority of people with Parkinson's disease (PD) experience speech and voice disorders at some point during the course of the disease; these deficits may impair their quality of life. Medical and surgical treatments alone have not sufficiently alleviated speech disorders for people with PD, and in some cases have exacerbated or resulted in voice and speech impairment. A speech treatment approach called Lee Silverman Voice Treatment (LSVT LOUD®) has generated efficacy data for successfully treating voice and speech disorder in this population. The LSVT LOUD targets vocal loudness as a means of increasing vocal effort and improving coordination across the subsystems of speech. LSVT LOUD is delivered in a high dose that consists of four consecutive, individual 1-hour treatment sessions per week for 4 weeks (i.e., 16 sessions in 1 month); daily homework practice is assigned. Research has documented that treatment results can last out to two years, making LSVT LOUD the "gold standard" in treating speech disorders for people with Parkinson's disease. Despite the established efficacy of LSVT LOUD, treatment of speech and voice remains an unmet need for many individuals in Puerto Rico due to lack access of trained and certified clinicians and inability to travel outside the island to receive the services.The objective of this study is to assess the clinical effectiveness of LSVT LOUD® in the Spanish speaking population of Puerto Rico for treating voice disorders associated with Parkinson's disease. A pre-test-post test design is applied to assess the effectiveness of LSVT for the improvement of vocal loudness in the Spanish speaking population diagnosed with Parkinson's disease. The findings from this study will have an important implication for enhancing treatment accessibility for individuals with Parkinson's disease who seek voice and speech treatment.

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Ambulatory Voice Measures During Singing and Speech in Patients With Phonotraumatic Vocal Fold Lesions Compared to Matched Controls

Objective:
Professional singers are at high risk for phonotraumatic vocal fold lesions, likely because their occupation requires heavy voice use and extreme vocal behavior. Previous studies using ambulatory voice monitoring to compare subjects with nodules/polyps and matched healthy controls did not show differences in average fundamental frequency (f_o), sound pressure level (SPL), vocal doses, or spectral/cepstral measures. Most of the subjects in these studies were singers, thus results combined both singing and speech segments into one distribution for all comparisons. Since singers with nodules/polyps often report vocal issues only during singing, we hypothesized that the clinical utility of ambulatory voice monitoring would be enhanced if singing and speech segments were examined separately.
Methods/Design:
The study included 53 singers with phonotraumatic vocal fold lesions (vocal fold nodules or polyps) and 53 age-, sex-, occupation-, and musical genre–matched individuals with no vocal pathology. Anterior neck-surface acceleration was recorded over the course of one week using a smartphone-based ambulatory voice monitor. Weeklong statistics of voice SPL, f_o, cepstral peak prominence (CPP), and H1-H2 were computed separately for phonation classified (via logistic regression model) as singing or speech.
Results:
Compared to healthy matched-controls, singers with phonotraumatic lesions exhibited more statistically significant differences in ambulatory voice measures during singing versus speech. In particular, H1-H2 mean was significantly lower for the patient group ($p < 0.002$) during singing (no difference for speech).
Conclusions:
Separately investigating singing versus speech can help elucidate phonatory differences between patients with nodules/polyps and controls. Results suggest that singers with phonotrauma exhibit heightened effects of vocal hyperfunction only during singing; i.e., a less steep spectral tilt indicating more abrupt vocal fold closure. Future work is aimed at determining the extent to which these findings reflect etiological mechanisms and/or compensation for the presence of vocal fold pathology.

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Comprehensive Voice Habilitation Program [CVHP] For Hyperfunctional Voice Disorders - A Study from South India

Objective: Socio-cultural adaptations to a voice therapy regimen augments patients' compliance and concordance to therapy. This study details the construction, implementation and evaluation of outcomes of one such exercise prescription for individuals with hyperfunctional voice disorder [HVD].

Method/Design: A filtered list from pubmed and google scholar search with key words relevant to aspects of vocal habilitation approaches, delivery methods and vocal exercise physiology were reviewed. It included 51 scholarly articles, 7 books & 3 instructional videos. Adaptations were introduced to a chosen set of exercises. Practicality in applying the principles, techniques, targets & monitoring of outcomes were considered. Two SLPs verified the exercises and its prescription for contents and feasibility of use. The beta version of CVHP included nine graded steps with culture appropriate instructions on vocal hygiene, postural exercises, stretching exercises, yogic breathing exercises, vocal warm up, onset, and resonant voice exercises. Exercises aimed at improving voice quality, flexibility and endurance. Five individuals with HVD participated. Therapy outcomes were reported using multidimensional voice assessment protocol (Boominathan et al., 2014), Vocal Fatigue Index (VFI) (Nanjundeshwaran et al., 2015), and descriptive self-report about the learning process and the use of technique after therapy. Wilcoxon signed rank test was used to assess pre-post therapy changes.

Result: Participants completed the program in 16-22 sessions (over 8 to 11 weeks of therapy; @ two sessions/week). Post therapy, stroboscopy revealed alteration in vocal fold movement pattern with reduced hyperfunction. Measurement such as MPT, DSI, VFI and self-perception showed significant improvement post therapy. Use of pictorial representation for technique, feedback (auditory & visual), scheduler for daily monitoring were reported to be useful.

Conclusion: CVHP in the treatment of hyperfunctional voice disorder showed a positive effect on vocal fold movement pattern and voice quality.

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Does Resting Respiratory Resistance Differ between Teenage Girls With and Without Paradoxical Vocal Fold Motion Disorder?

Objective: Paradoxical vocal fold motion disorder (PVFMD) is an episodic laryngeal breathing disorder (Shembel et al., 2017) that can be triggered by vigorous exercise, primarily affecting female teenage athletes. Previously, Gallena et al. (2015) tested inspiratory (R_i) and expiratory (R_e) resistance in girls with exercise-induced PVFMD and age-, height-, and weight-matched girls without PVFMD. They demonstrated the expected differences in R_i and R_e with exercise. Surprisingly, the groups also differed in R_i and R_e during resting tidal breathing (RTB), such that respiratory resistances were significantly lower in the group with PVFMD. This study aimed to replicate that unexpected result.

Method: The Airflow Perturbation Device (APD) measured R_i and R_e during three 1-minute trials of RTB in 16 teenage female athletes with PVFMD and 16 sex-, age- and height-matched controls. Multiple linear regression examined group, age, height, and weight as predictors of R_i and R_e.

Results: The overall regression models were weak but statistically significant for R_i [R^2 = .42; $F_{(1,27)}$ = 4.832, p = .005) and R_e [R^2 = .41; $F_{(4,27)}$ = 4.705, p = .005]. Regression for each factor revealed that group [t = -2.188, p = .037; t = -2.101, p = .045] and height [t = -1.998, p = .056; t = -2.012, p = .052] were the strongest predictors for R_i and R_e, respectively.

Conclusion: These results support the group differences reported by Gallena et al. (2015) that R_i and R_e during RTB are lower in teenage girls with PVFMD than in matched teens without any signs or symptoms of PVFMD, although the magnitude of the differences was smaller. Height was a stronger predictor of R_i and R_e than age or weight, most likely because height is a strongest indicator of physical maturation. The group difference may provide insight regarding factors that can predispose people to PVFMD.

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Association of Shyness with Vocal Handicap in Professional Voice Users

INTRODUCTION: Communication plays an increasingly important role in the labor market. Phycological aspects, such as shyness and introversion may play a negative impact in self-perception of vocal characteristics. A previous study concluded that shyness negatively influences the perception of vocal handicap of the general population. For professional voice users specifically, it is important to study the impact of this psychological characteristic. **OBJECTIVE:** To explore the association of self-perceived vocal handicap and self-reported shyness trait, according to self-reported vocal complaint, in professional voice users. **METHODS:** 208 professional voice users (spoken and/or singing voice modality), 116 (56%) women and 92 (44%) men, aged between 18 and 79 years old (mean age 36 years) volunteered to answer a survey indicating the presence/absence of self-reported vocal complaint, and two protocols, the Voice Handicap Index - VHI-10 (cutoff value of 7.5 for Brazilian Portuguese speakers) and the Shyness Scale from Cheek & Buss (a 13 question instrument with a total score). **RESULTS:** From 208 participants, 59 (28%) failed the VHI-10 cutoff value (p=0,0000); from those, 39 (66%) presented self-reported vocal complaint and 20 (34%) referred no vocal complaint (p=0,0005). From these 20 participants (failed VHI and no vocal complaint), 14 (70%) presented trait positive to shyness (p=0,0114). **CONCLUSION:** Professional voice users with shyness trait that have no vocal complaint present high probability of VHI failure, mainly due to items related to vocal intensity and projection. Therefore, VHI-10 should be used with caution when shyness is a potential trait.

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Infrared Thermography as a Tool to Infer Vocal Load: A Preliminary Observation

Summary, Objectives: The purpose of this study was to determine pre-post comparison of difference if any in change in temperature (near the neck region), fundamental frequency (F0), speaking fundamental frequency (SF0) and self-rating questionnaire (3-point rating) on ease of voice production. Also, the study aimed to analyse the effect of hydration on neck/throat temperature after vocal loading task.

Methods: 40 phono-normal adults (20 men and 20 women) participated in the study. The experiment was carried out in three conditions. Conditions I: Participants were asked to drink 250 ml of water to measure throat temperature, to phonate the vowel /a/ steadily, to read a standardised Rainbow passage, and to complete a self-rating questionnaire. Under Condition II: Participants were asked to read a novel for 30 minutes at 70-80 dB SPL. Same tasks as in baseline was repeated in Condition III. All the parameters were compared between Condition I and III. Three experienced Speech Language Pathologists completed a random perceptual analysis of the reading task (Condition I & III) using GRBAS scale.

Results: There was increase seen in F0, SF0 and self-rating questionnaire scores along with increase in temperature at vocal region immediately after reading when compared to pre-reading. Neck/throat temperature was decreased post hydration.

Conclusion: Infrared Thermography can be used as a potential tool to infer vocal loading alongside other acoustical and aerodynamic measures. Following vocal loading task, hydrating throat helps in reduction of temperature and also provides a soothing effect (based on self-rating scale) after voice use for a longer duration.

Keywords: Hydration effect; Thermal imaging; Infrared thermography; Vocal loading; Acoustic analysis.

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Longitudinal Case Study of Transgender Voice Changes under Testosterone Hormone Therapy

Objective: The purpose was to comprehensively evaluate voice changes in one healthy individual undergoing hormone therapy for medical transition.

Methods: The participant was a 30 year old transgender male undergoing testosterone therapy. Comprehensive testing occurred 3× before hormone therapy (baseline) and every two weeks thereafter. At each time point, data collected included measures of acoustics, aerodynamics, and laryngeal structure/function via nasoendoscopy. Data also included self-reported medical testosterone dosage as well as subjective impressions of voice quality and change during daily life and as a high-intensity avocational choral singer. These data allow for analysis of a variety of voice measures over time: habitual fundamental frequency (F_0), absolute F_0 and intensity ranges, jitter and shimmer during speech and singing, formants, vocal fold vibratory characteristics, gross ab/adductory kinematics, supraglottic compression, subglottal pressure, and phonatory threshold pressure.

Results: Preliminary data analyses reveal several changes after 6 months of testosterone: decrease in mean F_0 from 194 Hz to 153 Hz during a standard reading passage; change in absolute singing range from E_3–$D\#_6$ to $A\#_2$–G_5 (156–1284Hz to 118–799Hz). Kinematic analyses show a larger glottic angle during an abductory gesture (/i/-sniff) from 49 degrees to 54 degrees. However, vocal fold adductory kinematic measures and subglottal pressure estimates have remained stable. Overall, analyses will characterize a wide range of possible changes occurring in the vocal mechanism as well as provide a relative time-course for particular changes over one year of hormone therapy.

Conclusions: Few studies document in detail the variety of voice changes that occur during cross-sex hormone therapy; instead, most existing studies of transmasculine people undergoing testosterone therapy focus on F_0 alone. Although F_0 is the most obvious marker of gender and of vocal fold changes under testosterone, a multitude of other changes occur and may impact the speaker and his gender expression.

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Phonation Quotient as a Low Cost Alternative for Estimates of Transglottal Airflow

Aim: The aim of this study was to measure if derived measures of phonation quotient using low cost aerodynamic systems were comparable to phonation quotient and airflow measures with a higher cost aerodynamic system.

Method: The aerodynamic instruments of choice were an analog spirometer, a digital spirometer and a pneumotachograph based system. The spirometers constituted the low cost while the pneumotachograph was the higher cost aerodynamic system. Healthy adult males and females with normal voice quality completed tasks of maximum phonation time, vital capacity on all three instruments and, comfortable sustained phonation on the pneumotachograph. Phonation quotient using the formula PQ=VC/MPT was calculated for all three instruments. A measure of airflow rate was obtained using the flow waveform on the pneumotachograph based system.

Results: Statistically significant differences were found in vital capacity measures for the digital spirometer compared to the windmill type spirometer and PAS for males and females across age groups. Strong positive correlations were present between all three instruments for both vital capacity and derived phonation quotient measurements. Derived measures of phonation quotient obtained with the spirometers were not statistically significant from the airflow measure obtained from the pneumotachograph based system.

Conclusions: Phonation quotient can be used as an estimate of transglottal airflow in the absence of a pneumotachograph based system. These data demonstrate the feasibility of performing aerodynamic assessments in clinical settings with limited resources. These results are specific to the spirometers used and caution must be exercised before generalizing the results to other spirometers.

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Vocal Health: Awareness and Perceptions in Undergraduate Vocal Music and Theatre Majors

Objective: The purpose of this study was to identify the perceptions of students majoring in vocal music and theatre, regarding the instruction they received in their undergraduate curriculum on vocal health education. Research questions focused on perceptions of: (a) vocal hygiene strategies, (b) the connection between the speaking and singing voice, (c) vocal rehabilitation and the professionals to contact and (d) students' level of trust for their voice teacher.

Methods: A descriptive research design with qualitative analysis was used to explore the research questions. A survey was developed by adapting questions from a similar study by Beeman (2016). Permission was granted for the adaption by the author. The survey went through two stages of review and revision by an expert panel of professionals across vocal music and theatre, followed by a pilot study of 13 undergraduate vocal music majors. The final survey contained 57 items, incorporating two forms of questions, a 6-point Likert scale and multiple choice. It was disseminated to undergraduate vocal music and theatre majors across the United States via Survey Monkey TM.

Results: Students reported receiving knowledge on vocal health from their voice teachers and implementing it. However, they indicated low levels of compliance for specific vocal hygiene parameters. Additionally, students recognized the connection between the singing and speaking voice, they were unclear of the role of the speech-language pathologist in voice care, and they indicated trust in their voice teacher as it pertained to their voice and personal life. .

Conclusions: A new approach to promote understanding and compliance of voice care strategies needs to be implemented in the undergraduate setting. Connecting both performance majors and speech-language pathology majors in an interprofessional education collaboration may prove to be mutually beneficial to both the clinician and the performer

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Student Attitudes towards Individuals with Voice Disorders

Objective: The purpose of the study is to identify student attitudes towards individuals with voice disorders. Specific questions include: (a) if a voice disorder will lend to a negative perception towards individuals with voice problems (b) will the perception be different between a teacher and non-teacher, (c) would the negative perception impact the trusting relationship between a student and a teacher and (d) will the age, gender, and grade of a student influence the perception.

Methods: Voice recordings were obtained from three speakers, each representing one of the following voice types, non-dysphonic, mildly dysphonic, and severely dysphonic. Each speaker read passages related to two specific topics that were created for each age group and each recording lasted approximately one minute in length. Students in 2nd –3rd grade, 5th-6th grade, and 9th-10th grade served as participants. Participants listened to two different sets of three recordings each. For the second set of recordings, participants were instructed to imagine that the voice they were hearing was their teacher's voice. For each voice recording in each set, participants completed a semantic differential questionnaire. The semantic differential scale included 12 differential ratings on a 100mm visual analog scale. In addition to the completion of the semantic differential scale, a series of open-ended questions were included.

Results & Conclusions: Data analysis is still in progress. Individual ANOVAs will be completed (a) to identify the listener attitudes between non-dysphonic and dysphonic speakers, (b) to identify the effect of age, gender, and grade level on listener attitudes, and (c) to identify the difference in listener attitudes between a teacher and a non-teacher. Descriptive date from the open-ended questions will be completed to identify the impact of listener attitudes on the relationship between teacher and student.

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Vocal Quality in Musical Theater Actors

Objective: The purpose of this study was to determine the overall vocal quality in professional musical theater performers (MTP) and musical theater students (MTS) as measured through perceptual findings of the investigator, questionnaires and voice quality indices. Furthermore, statistical differences in vocal quality between both groups were examined.

Methods: Thirty participants were included, whereof eighteen MTS and twelve MTP. The overall vocal quality was measured through a perceptual finding of the investigator (GRBASI), questionnaires (VHI, VHI adapted to the singing voice, VTD, the corporal pain scale and influencing factors) and voice quality indices (DSI and AVQI). Statistical differences between both groups were investigated through the Mann-Whitney U test using the software program SPSS Statistics 24.

Results: Both groups showed a mean VHI score lower than the clinical cut-off (MTS 13.61; MTP 12.75). However, a clinical score was found for the mean scores of the VHI-adapted to the singing voice (MTS 24.11; MTP 23.92). All participants reported at least two negative symptoms for the VTD. The most frequent reported symptoms were a dry throat, throat tightness and a tickling feeling. Headache, a sore throat, neck pain, back pain and shoulder pain were the most often reported symptoms for the corporal pain scale. The mean AVQI for female and male MTS was resp. 2.59 and 2.24. The mean score for the DSI was 7.47 and 5.84. The female and male MTP reached a mean AVQI score of 2.66 and 2.55 and a mean DSI score of 7.96 and 6.14. These findings correspond with an overall good vocal quality and with excellent vocal capacities. There were no statistical significant differences found between both groups.

Conclusion: Both MTS and MTP have a good overall voice quality and excellent vocal capacities.

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Outcomes and Special Considerations for Transgender Voice and Communication Management in the Military

Objective: Transgender military service members became eligible to receive voice and communication services at Walter Reed National Military Medical Center (WRNMMC) after Regulation DoDI 1300.28 was passed in June 2016. Although management strategies follow similar principles and procedures as those designed for civilian settings, the military culture and certain regulations provide unique challenges. This project documents initial assessment results and outcome measures for this clinical population.

Method: Compilation of data in an encrypted database was approved via the Quality Improvement Review process at WRNMMC in order to support evidence-based practice. Routine assessments include self-evaluation questionnaires and speech recordings for blinded-perceptual and acoustic analyses. Additional data include ratings by unfamiliar observers to a live presentation and lifestyle issues that affect behavioral carryover of new voice and communication skills.

Results: To date, we have evaluated 17 transwomen and 1 transman and provided 1-20 training sessions to 14 transwomen in various stages of transition. Outcome data from 4 transwomen reveal mixed levels of success. Due to military standards regarding dress and grooming, not all participants were permitted to practice their new voice and communication skills outside of the treatment or home environments. Pre- to post-training scores on the Transgender Self-Evaluation Questionnaire (Dacakis et al., 2013) decreased by 1-47 points. Speaking F0 improved towards a gender-neutral range for 3 of the 4 participants, and about half of 7 listeners, all of whom were blinded to the purpose of the task or any information about the talkers, identified 2 of the 4 speakers' post-training speech samples as female.

Conclusion. Procedures and guidelines are in place to provide excellent TG medical care at WRNMMC. Achieving gender congruence, however, may be hindered by the Department of Defense requirement for service members with a male gender marker in their electronic medical records to adhere to male grooming and appearance standards in the work setting while in the transition process. These regulations may deter progress on voice and communication skills for transwomen.

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The Impact of Using an Online Auditory-Perceptual Practice Tool (CAPTain) on SLP Student Learning

Background: Auditory-Perceptual rating of speech and voice is a core clinical competency of all speech-language pathologists. Auditory-perceptual rating is considered the most common form of voice and resonance assessment, and the "gold standard" due to its high ecological validity as a measure of the voice. The University of Sydney has built an interactive, online rating tool, CAPTain to facilitate student practice of auditory-perceptual rating across a number of SLP areas of practice, including Voice. Individual modules are used to rate specific features of voice and speech using internationally recognized rating protocols.

Objective: To provide an overview of the newly developed online auditory-perceptual practice rating tool, CAPTain, and present preliminary outcome data from prototype implementation with undergraduate and post-graduate coursework students. Efficacy of CAPTain on student engagement and performance in auditory-perceptual assessment examination task was also assessed.

Method: Data was collected from 150 students in 2 student cohorts over a 4 week period during teaching of the Voice and Voice Disorders Courses at The University of Sydney.

Results: A total of 6000 ratings across 20 different samples were completed, with 100% student participation. Use of CAPTain increased the class average mark of students in both courses by 14.3% and 16.9% on the same assessment, with no other changes in curriculum design to explain the improvement. Student feedback provided was unanimously positive. Intra-rater and interrater reliability data will also be presented.

Conclusion : Online practice of auditory-perceptual rating results in improved performance.

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Do Your Ears Hear What Your Eyes See?

Objective: The purpose of this presentation is to provide acoustic and laryngeal imaging data from a longitudinal study that is examining voice changes that occur as boys who sing progress through puberty. Optimal vocal training requires that choral directors recognize vocal changes in the singing voice that may relate to anatomic/physiologic changes in the laryngeal mechanism.

Methods/Design: Twenty-eight participants were recruited from a local Boychoir for this longitudinal study. For the initial evaluation, each participant was a pre-pubescent male, classified as Cooksey unchanged or Mid-Voice I, with a soprano singing voice. None of the participants were evaluated if their conversational voice was characterized as having a "voice disorder" or they were known to have laryngeal pathology. From the voice evaluation protocol, the tasks of interest for this presentation were their vocal slides (1-3-1, 1-5-1, 1-8-1) targeting four notes (G3, C4, F4, A4) and singing the Star Spangled Banner (SSB), as well as videoendoscopy images for the aforementioned four notes. Perceptual ratings of vocal slides and SSB were performed by three expert raters, who train child/adolescent singing voices. The endoscopic examinations were rated by one pediatric laryngologist and two voice pathologists.

Results/Conclusions: The pre-pubescent male singers presented with soprano singing voices that varied in voice quality (simple/light to hooty/round), breathiness (none to severe), and tone color (dark to bright). While all participants had normal conversational voice at the time of evaluation, endoscopic findings found 25% of participants had vocal cord lesions and 93% had posterior gap at one or more frequencies.

This presentation will include a segment of four participants' singing voice sample and vocal slides with perceptual ratings, followed by his endoscopic imaging evaluation. The audience will be asked to vote yes or no (raising their hand) regarding whether the audio sample of the singing voice will yield an endoscopic image with or without pathology.

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Correlations between Smoothed Cepstral Peak Prominence (CPPS), Sound Pressure Level (SPL) and Voice Activity and Participation Profile (VAPP) in Finnish Primary and Kindergarten Teachers.

Objective: The purpose of this study was to investigate the correlation between CPPS, Sound Pressure Level (SPL), the VAPP, laryngoscopic findings, voice symptoms, and voice related health problems..

Method/Design: One hundred and ninety-five teachers; 105 Kindergarten teachers, 24-64 years and 90 Primary School teachers 26-57 years, participated in this study. The Finnish version of the VAPP was used. The agreement between CPPS, SPL, the VAPP, and laryngoscopic findings was determined, with in addition the effects of weekly hours worked, voice related health variables, and voice symptoms. A 2 tailed t test was used to compare the results of the CPPS in the two speaking tasks with each other. The Pearson Product Moment Correlation was used to analyse the correlation between CPPS, SPL and the VAPP.

Results: CPPS continuous speech was significantly lower in Primary School Teachers (19.4) than in Kindergarten Teachers (26.5) $p<0.001$. There was a significant correlation between CPPS continuous speech and the subsection Emotion of the VAPP, ($p= 0.014386$) $p<0.0000$. Regarding Sound Pressure Level, there was a significant correlation between SPL text and CPPS text. $p<0.000001$. There was a positive correlation between SPL text and sums for all sections of the VAPP, $p<0.000001$. Primary School teachers had higher incidences of health problems than kindergarten teachers. Lower values on CPPS continuous speech were found in those who reported health problems. There was a highly significant correlation between pain/tiredness and all questions in the VAPP.

Conclusions:
SPL affects CPPS values, this has implications for research. There is a link between CPPS continuous speech and Emotion. The lower CPPS values for Primary Teachers may be related to the higher incidence of health problems in this group.

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Effect of Oxytocin on Public Singing Simulation Test with Professional Singers

Objective: High levels of musical performance anxiety can induce negative emotions and stress, harming a performance and pursuance of career for the professional singer. Recent studies have pointed out the general anxiolytic effect of oxytocin and its low potential for adverse reactions. This study evaluated the effects of acute administration of oxytocin in the musical performance anxiety in professional singers, having the *Test of Public Singing Simulation* as parameter.

Method: We conducted a double-blind crossover randomized placebo-controlled clinical trial, with 50 professional male singers as subjects, of whom 16% were erudite singers and 84% were popular singers, with an average period of experience of 10.96 years. All singers self-administered a singular dose of 24UI of oxytocin or placebo via a nasal spray, in different sessions, according to the group they were placed with. After 51 minutes of oxytocin or placebo administration, the *Test of Public Singing Simulation* was performed, which consisted of an acapella musical interpretation of a song of the singer's choice for 4 minutes in a controlled environment. Measures of mood indicators were analyzed, as well as performance and vocal symptoms, with self-assessment scales and analysis of voice acoustic measurements using *Multi-Dimensional Voice Program Advanced* software at six stages. An analysis of the ANOVA 2x2 variation was performed for cross-over study models with intra- and inter- subject comparisons.

Results and Conclusion: Was demonstrated an effect in the oxytocin treatment when compared with placebo, improving the in stages during and after performance. There were no changes in mood indicators, vocal signs and symptoms, or in vocal acoustic measures. Sequence and period effect were not evident for the reviewed measures. In conclusion the oxytocin had an anxiolytic effect, emphasizing an improvement in self-evaluation concerning performance with no adverse reaction in terms of voice signs and symptoms and vocal acoustic measures.

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Kinesiology Tape as an Immediate Feedback Resource for Management of the Vertical Larynx Position

Objective: Kinesiology tape (K-tape) is a latex-free elastic bandage that can be implemented over a specific area on the body with the aim to promote lymphatic drainage, support and stability of muscles and joints, and improved blood flow. Due to its elastic property, the K-tape recoil force can be used to exert a pulling force over the surface of a muscle. This pulling force can be used as a mechanical component to movement and stability, improving the alignment of weak muscles and facilitation of joint motion. Due to its elasticity the K-tape allows for a large range of motion when compared to other types of bandages. The aim of this study was to investigate the possibility of implementing the K-tape as a mechanical feedback resource to induce a lower larynx position.

Method: 12 subjects (10 females and 2 males) were submitted to pre/post K-taping voice assessments. The assessment tasks consisted of a sustained phonation of the vowel /a/ and a singing passage. EGG, and an acoustical analysis were performed with and without taping. The K-tape was administered as a straight stripe from the midline of the thyroid cartilage body (immediate below the laryngeal prominence) through to the body of the manubrium (anchoring point). The K-tape stretch was approximately 30-40%.

Results: For all parameters investigated in the acoustical analysis, only changes in the second formant were statistically significant (v=8, p-value = 0.04). All formants were lowered for the k-taping condition. Changes in the larynx height were estimated by assessing the time-delay between the EGG signal and the microphone excitation, however, even though some trends were observed, no statistical significant changes were found. Changes in CQ between conditions were also not significant. Participants reported a short-lasting awareness of a pull down effect in the laryngeal region upon the K-tape application.

Discussion: The K-tape seems to be an effective resource for skeletal muscle and joint therapy, one that could be incorporated in the treatment of voice patients. The proprioceptive aspect of the tape may be useful for voice therapy that aims to elicit a specific laryngeal position in the neck. Further analysis should be carried out to assess the possible long lasting effects of the tape as a feedback tool for vertical laryngeal displacement.

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Acoustic Voice Quality Index- AVQI – for Brazilian Portuguese Speakers: Analysis of Different Speech Material

Objective: To verify the best speech material for the AVQI for Brazilian Portuguese; to identify which stimuli best correlates with the perceptual-auditory analysis and has best diagnostic accuracy.

Method: Voices of 50 subjects were recorded (38 dysphonic; 12 vocally healthy): 3 seconds of the vowel /a/; month of the years (32 syllables); numbers 1 to 20 (42 syllables) and repetition of the CAPE-V sentences. Each sample had 3 different durations: D1- entire speech material + 3 seconds vowel /a/; D2 – speech material without voiceless parts with 3 seconds + 3 seconds vowel /a/; D3 – speech material with pre-defined cutoff point + 3 seconds vowel /a/. These samples were submitted to: perceptual-auditory analysis, 3 voice-specialists; assessment of AVQI precision and concurrent validity; analysis of the diagnostic accuracy.

Results: Intra and inter-rater reliability were acceptable. The concurrent validity of AVQI and the auditory-perceptual analysis ranged from r=0.482 to r=0.634 (Spearman rank-order correlation). Numbers presented higher values for all durations (D1, r=0.579; D2, r=0.621; D3, r=0.634). The AVQI has high specificity and showed very poor sensitivity. The best sensitivity and area under the ROC curve was for: CAPE-V sentences at D2 (0.45 and 0.59); CAPE-V sentences at D3 (0.42 and 0.59); months of the year at D3 (0.42 and 0.58). These speech materials presented the lowest AVQI Threshold (CAPE-V sentences D2=1.63; D3=1,93; months of the year D3=1.82).

Conclusion: The stimuli that best correlates with the perceptual-auditory analysis are numbers 1 to 10. The first 3 sentences of the CAPE-V had the best diagnostic accuracy. Considering that numbers is usual in the Brazilian clinic routine we suggest collecting data for AVQI using this stimuli.

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Examining Chemosensation in Laryngeal Health and Disorders

Objective: Exposures to odors and chemical irritants are associated with the onset and exacerbation of abnormal laryngeal and respiratory function. The purpose of this review is to introduce voice clinicians to the chemosensory systems within the context of disordered breathing secondary to laryngeal dysfunction.

Methods/Design: A literature review was performed using PubMed database.

Results: Chemosensation involves detecting inhaled, ingested, and dermally absorbed chemical stimuli. Orthonasal olfaction or smell is necessary to direct attention to odors and warn of potential dangers (Stevenson, 2010). Trigeminal chemesthesis is a separate chemosensory system that causes perceptions of tingling, burning, cooling, irritation, and/or pain in the upper airways (Brüning et al., 2014). Chemesthetic sensations subsequently activate defense mechanisms that result in vocal fold constriction such as coughing and sneezing (Finger et al., 2003). The close interplay between the chemosensory systems makes them difficult to distinguish, as highly concentrated odors are capable of simultaneously eliciting olfactory and chemesthetic sensations (Doty et al., 2004).
The clinical literature reveals that more than half of patients with irritable larynx syndrome report odors as symptom triggers (Morrison & Rammage, 2010). Acute exposures to chemicals such as chlorine gas are linked to the rapid onset of disordered laryngeal breathing (Allan et al., 2006; Reddy et al., 2004). Moreover, reduced pulmonary function due to chemical exposures can negatively impact the singing and professional voice. Studies demonstrate empirical evidence of paradoxical vocal fold movement via laryngoscopy during inhalation of extrinsic odors and sensory irritants (Marcinow et al., 2015; Selner et al., 1987). During provocation challenges, odor and irritant stimuli include sodium hydrochlorite or household bleach (Bhargava et al., 2000), persulfate salts or hair bleach (Herin et al., 2012), paint, perfume (Gartner-Schmidt et al., 2008), wood dust (Muñoz et al., 2007), orange extract (Tomares et al., 1993), and eucalyptus (Huggins et al., 2004). Further, intrinsic irritants such as gastric refluxate often accompany disordered laryngeal breathing (Perkner et al., 1998) and patients with gastroesophageal reflux disease experience altered chemosensory function (Aytug et al., 2016; Kabadi et al., 2017).

Conclusions: Protective laryngeal reflexes occur as defense mechanisms during chemesthesis, which can also be perceived as olfaction. The chemosensory systems are important to elucidate the role of odor and irritant triggers in normal versus abnormal laryngeal responses.

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The Production and Perception of Continuous Vocal Fry in Healthy Speakers

Objective: Vocal fry is prevalent and entrained in conversation. However, whether the use of vocal fry is directly detrimental to voice production is unclear. The primary purpose of this study was to investigate the effects of continuous vocal fry on voice production. The second purpose of this study was to investigate negative perceptions associated with vocal fry.

Methods: Ten individuals (mean age = 22.4 years) completed 2 counterbalanced sessions. In each session, participants read in continuous vocal fry or a habitual voice for 30 minutes at a comfortable intensity. Phonation Threshold Pressure (PTP_{10} and PTP_{20}), Cepstral Peak Prominence (CPP) and Vocal Effort ratings were obtained before and after each session. Then, ten healthy listeners (mean age = 24.1 years) used visual analog scales to rate these paired samples of fry and habitual voices for naturalness, employability, and amount of concentration.

Results: There was a significant increase in PTP after 30 minutes of continuous vocal fry but not with habitual voice. CPP and Vocal Effort ratings increased after both sessions. Samples of continuous vocal fry were rated as less employable, less natural, and requiring greater concentration as compared to habitual voice samples.

Conclusion: Production of continuous vocal fry did not significantly change voice measures at habitual speaking pitches (20th pitch). However, samples of continuous vocal fry were rated more negatively than samples produced in a habitual speaking voice even though they were produced by the same speakers. These data increase our understanding of the effects of vocal fry on voice production.

Note: This work is being submitted for publication to the AJSLP.

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Voice Quality of People Undergoing Radiotherapy for Laryngeal Cancer

Objectives: The dissertation mainly focused to analysis the voice quality of people undergoing radiotherapy for laryngeal cancer. The treatment approach; radiotherapy for laryngeal cancer within larynx results in changes in voice including; reducing speaking fundamental frequency because of increasing vocal fold mass, roughness of voice, vocal fatigue after prolong talking and persisting dysphonia as a result of permanent changes in the vocal folds or by attempting to overcome vocal limitations by using excessive effort. (Mathieson, 2001 p 582). This study was aimed at identifying the of voice qualities of people undergoing radiotherapy for laryngeal cancer using the adapted version of Consensus Auditory Perceptual Evaluation of Voice (CAPE-V) and interviewer-administrative questionnaire.

Method: Sinhala translated CAPE-V tool was pre tested among 10 participants to test its applicability. The voice qualities of people undergoing radiotherapy for laryngeal cancer were analyzed based on CAPE-V protocol and decide the impact of voice quality after exposure to radiotherapy using interviewer-administrative questionnaire. A descriptive cross sectional study was conducted to gather quantitative data. The study is including thirty cases of people undergoing radiotherapy for laryngeal cancer were selected using purposive sampling method. Data was quantitatively analyzed by using open source software.

Results: The results of the CAPE-V protocol indicate that all the (30) participants have dysphonic voice while participants' perspectives showed 80% of them have dysphonic voice. And the Participants perspectives indicate a positive and significant correlation with number of radiotherapy fractions (r =0.437, p=0.016).

Conclusion: It was found that the people undergoing radiotherapy for laryngeal cancer have some degree of dysphonia.

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Relative Effectiveness of a Vocal Hygiene Program among Primary School Teachers with Self – Reported Voice Problems in Matara Education Zone

Professional voice users such as primary school teachers depend entirely on their voice to earn a living. They are placed at high risk for developing voice dis-orders due to classification of vocal professionals based on their voice use and risk, which often requires intervention. Among many voice interventions, vocal hygiene programs are relatively cost-effective in supporting and preserving voice. Therefore the aim of this study was to determine the relative effectiveness of a vocal hygiene program among primary school teachers with self-reported voice problems in Matara education zone. An interventional study design was employed where forty primary school teachers with self – reported voice problems of selected government primary schools in Matara education zone were recruited. All participants completed a voice case history and Voice Handicap Index – 10 (VHI – 10) to collect pre data, followed by the vocal hygiene program. After one month of the vocal hygiene program, VHI – 10 was administered again to collect post data. There was a significant difference between pre and post scores of VHI – 10 ($p < 0.001$). Findings of the present study indicates that vocal hygiene program is a relative, cost effective intervention to reduce perceived voice symptoms in primary school teachers. The provision of information on vocal hygiene has shown to be effective in voice therapy an educational approach could be taken as the first step of preventive measure for people who engage in occupations that have a high demand on voice use.

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Voice Analysis of Radio-TV Broadcasters: Gender vs Content

Objective:

Voice parameters including intonation, intensity, rate of speech, and vocal frequency assist speakers in expressing their thoughts. This is clearly seen in broadcasters of radio and television. Pedagogical training of students in broadcasting include use of voice in carrying the message. Apart from their signature voice, they should be able to vary their delivery based on the content. The goals of this project are:

a. To analyze speech and voice parameters of Radio-TV broadcasters, both males and females.
a. To explore the differences in these parameters between Radio and TV broadcast
b. To explore the differences in these parameters based on the content (breaking news, sports, weather, political news)

Methods

Samples: Radio and TV clips of popular broadcasters will be collected by student researchers. The authenticity of these clips will be confirmed by faculty mentors. The clips will be converted to audio files using appropriate convertors.

Data: The obtained audio data will be analyzed using speech software for the following measures:

a. Rate of speech
b. Frequency of voice (pitch)
c. Frequency range
d. Perceptual qualities of voice

Analysis: The above data will be compared within subjects delivering variety of content and between the two genders.

Results and Implication:

The results of this study will identify voice patterns used by broadcasters. Quantitative data can be used for pedagogical and training purposes.

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Infant Cry Analysis of Premature Babies

Objective:

      Speech production is an intricate coordination of systems including, respiration, phonation, resonation, and articulation. Respiratory system is the powerhouse for speech. The air exiting lungs should be of adequate pressure and flow to trigger voice production. Injury to the lungs or immature lungs during birth can affect speech. Infants born prematurely often face respiratory problems due to immature lungs. Infant cry may be affected due to this condition. This study intends to analyze infant cry samples of premature babies and compare them to full-term babies. Results of this study may prove to be prognostic indicators of lung development.

Methods

Subjects: Acoustic recordings of ten infants born prematurely and ten after full-term at Texas Children's Hospital will be used as samples for this study. Identification will be performed under the guidance of the co-mentor.

Data: The obtained audio data will be analyzed using speech software for the following measures:

    a. Fundamental frequency of voice
    b. Amplitude and Intensity of voice
    c. Duration of cry sample
    d. Perceptual qualities of voice

Analysis: The above data will be compared between full-term and premature babies.

Results and Implication:

      Results of this study may prove to be prognostic indicators of lung development.

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Talkativeness, Vocal Loudness, and Voice Symptoms in Acting Undergraduates

Objectives: to investigate talkativeness and vocal loudness of undergraduate acting students along with possible vocal symptoms that may develop throughout the four years of college.

Methods: 86 students enrolled in an undergrad acting program, representing the entire student body of the institution, answered two standardized questionnaires: Talkativeness and Vocal Loudness (TVL) and the Voice Symptom Scale (VoiSS). Analyses focused on possible differences in the scores among classes and/or between genders.

Results and Conclusions: the TVL questionnaire showed that 70% of all the subjects consider themselves as having a good voice. The mean scores in vocal loudness for habitual voice were 4.8 (1-7 scale), and the mean of vocal intensity at work was 5.3. Thus, senior year students, who have a greater workload in theatrical activities than the rest of the group, reported a degree of 6 in the scale of vocal loudness at work. Senior year students differed significantly from the sophomore and junior year students in both talkativeness, and vocal loudness. However, the VoiSS revealed more symptoms in the junior class than in the senior class. Male students had significantly more voice symptoms in two domains when considering themselves with a poor or fair voice. The same relationship could not be established for the female students. Out of the 86 students, seven (8.6%) scored above the cutoff limit, compatible with dysphonia, and the most recurrent voice symptoms amid the four classes were difficulty singing, coughing/throat clearing, and nasal congestion. Overall, the subjects of this study perceive themselves as speaking loud and a lot, with no difference between habitual and work settings, and even though the majority of the students see themselves as having good voice, voice symptoms are still present in a significant part of them.

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Self-Regulation Behaviors in Chilean Subjects with Behavioral Dysphonia

Objectives: To comprehend self-regulation behaviors of Chilean individuals who present behavioral dysphonia and to correlate it to their vocal symptoms. **Methods**: 142 adults aged between 18 and 56 years participated in this study, divided into two phases: Phase 1. Linguistic and cultural adaptation of the Short Self Regulation Questionnare (SSRQ) to Chilean Spanish (42 subjects, 21 dysphonic and 21 healthy voices). Phase 2. Application of the Chilean Self-Regulation Questionnaire Reduced Questionnaire - CRAR-Ch and Chilean Vocal Symptom Scale - ESV-Ch in 50 individuals with behavioral dysphonia and 50 vocally healthy, matched by average age, sex and professional level. **Results:** The CRAR-Ch maintained the same original questionnaire amount of items, response options and types of domains: Goal Setting - GS and Impulse Control - IC. For the total ESV-Ch score, the group with behavioral dysphonia presented higher scores than the vocally healthy group. For the CRAR-Ch, behavioral dysphonia group presented lower total score and also lower scores for each domain. A correlation analysis was performed between the ESV-Ch and CRAR-Ch protocols and statistically significant differences were found between the groups for the total ESV-Ch and CRAR-Ch scores and also for the ESV-Ch and the domain IC. The higher CRAR-Ch total score and the IC domain, the lower the total score of the ESV-Ch. The GS domain, even presenting a negative correlation, has little effect on the ESV-Ch. **Conclusions:** There is a cultural equivalence of SSRQ for Chilean Spanish - CRAR-Ch. Individuals who present behavioral dysphonia have lower CRAR-Ch scores, what means worse self-regulation behaviors when compared to individuals with healthy voices.

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SOVTE in Low and High Voices: Is There Any Difference?

Objective: To investigate, in amateur choristers, the immediate effect of three semioccluded vocal tract exercises (SOVTE): Phonation into a latex tube (LaxVox®), finger kazoo and phonation into a high-resistance straw. Methods: Participants in this study constituted an intact SATB choir (soprano, alto, tenor, and bass) subdivided into high and low. The voice samples were recorded before and after each subject perform the exercises randomly during three subsequent weeks. A self-assessment questionnaire was applied. Results: Most of the subjects felt improvement in vocal quality. 11 (84.62%) of the low voices rated the LaxVox® as being the most effective, while 10 (79.92%) rated the high-resistance straw as the less effective. For the high voices, the high-resistance straw 9 (69.2%) was the most effective and the less effective were Finger Kazoo (46.15%) and the LaxVox® (38.4%). Conclusion: Our study demonstrates that although the exercises are part of SOVTE, their effects in subjects 'perception are different. The LaxVox® proved to be more suited to low voices and less suited to high voices and the high-resistance straw was better suited to high voices, accordingly the subjects self-perception. It was evidenced the need to adapt the exercises accordingly to the voice classification. There is no study that evidences effects of SOVTE according to the vocal classification or the size of the tract of the subject.

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Vocal Self-Assessment of Theater Students after Using the Lax Vox Latex Tube

Objective: To analyze the immediate effect of the Lax Vox technique on students of performing arts, as well as to compare the participants' vocal self-assessment data was the purpose of this project.

Methods: 39 performing arts students (19 men, 20 women) were invited and divided into two groups: group with vocal complaint (GC) and group without vocal complaint (GWC). They have answered the Voice Symptom Scale (VOISS) and have undergone the Lax Vox technique. Before and after the exercise the participants rated the self-perception of their voices using a 5-point Likert Scale (Terrible, Bad, Regular, Good, Very Good).

Results: The results have showed that 79.4% of the individuals have noticed a positive effect after the vocal technique. The analysis of the VOISS scores revealed that in the GWC (16 individuals), 11 of them have a score compatible with dysphonic individuals and five of them are vocally healthy, while in the GC (23 individuals), 18 have a compatible score with vocal symptoms existing in dysphonic individuals and five ones are vocally healthy. Self-perception has showed that participants from both groups experienced improvement on their voices.

Conclusion: The effect of the Lax Vox vocal was positive, since it was noticed an improvement in the subject's voice self-perceptions, even of those ones who haven't reported any voice complain.

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Quality and Readability of English-Language Internet Information for Voice Disorders

Purpose: The purpose of this study is to evaluate the readability and quality of English-language Internet information related to vocal hygiene, vocal health, and prevention of voice disorders. This study extends recent work because it evaluates readability, content quality, and website origin across broader search criteria than previous studies evaluating online voice material.

Method: Eighty-five websites were aggregated using five different country-specific search engines. Websites were then analyzed using quality and readability assessments. Statistical calculations were employed to examine website ratings, differences between website origin and quality and readability scores, and correlations between readability instruments.

Result: Websites exhibited acceptable quality as measured by the DISCERN. However, only one website obtained the Health On the Net (HON) certification. Significant differences in quality were found among website origin with government websites receiving higher quality ratings. Approximate educational levels required to comprehend information on the websites ranged from 8 to 9 years of education. Significant differences were found between website origin and readability measures with higher levels of education required to understand information on websites of non-profit organizations.

Conclusion: Current vocal hygiene, vocal health, and prevention of voice disorders websites were found to exhibit acceptable levels of quality and readability. However, highly-rated Internet information related to voice care should be made more accessible to voice clients through HON certification.

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Perception of Overall Severity of Voice Deviation in Synthesized Voices: Predictive Factors

Objective: To determine which parameters used in the production of synthesized voices are predictors of overall severity of voice deviation.

Method: 871 synthesized /ɛ/ vowel samples of both genders, with deviations of roughness, breathiness, and tension were generated by SimuVox and submitted to perceptual analysis. The severity of vocal deviation using a 100-point visual analog scale (VAS) was identified. Nine parameters used by the synthesizer to produce the signals were analyzed: Jitter%, open quotient, vocal fold stiffness, vocal fold separation, vocal fold stiffness asymmetry, subglottal pressure, wow size, tremor size, and pulsatile noise amplitude. Beta linear regression analysis was used to estimate the predictor parameters of overall severity.

Results: Four parameters were selected as predictors of severity of voice deviation. The Jitter %, tremor size, subglottal pressure and open quotient exerted a positive effect on the perception of the severity of voice deviation. The model presented good adequacy, being able to explain 75% (pseudo-$R^2 = 0,75$) of the variability of overall severity of voice deviation.

Conclusions: Jitter %, tremor size, subglottal pressure and open quotient parameters are the main predictors of the perception of overall severity of voice deviation in synthesized signals generated by SimuVox.

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Voice Characteristics of Women with Polycystic Ovary Syndrome

Purpose: The purpose of this study is to determine the vocal quality of women with polycystic ovary syndrome (PCOS) and to compare the vocal quality with age-matched and body mass index-matched healthy women.

Methods: Women with PCOS and a control group of age-matched and body mass index-matched healthy women are included. The same assessment protocol is used for each participant and consists of videolaryngostroboscopy, audiometry, perceptual voice analysis, maximum performance task, acoustic analysis (of a sustained vowel and continuous speech), voice range profile, Dysphonia Severity Index, Acoustic Voice Quality Index and self-assessment using the Voice Handicap Index. Demographic data, anthropometric measurement, and serum androgens are determined. The acoustic analysis of the sustained vowel and the determination of the voice range profile is performed using the speech lab of Kay. The auditory perceptual analysis and the acoustic analysis of the speech samples are performed using PRAAT.

Results: The study continues until April 2018. Results will be analyzed using SPSS. Voice data of the experimental and control group will be compared using a paired statistical test.

Conclusion: The results of this study will gain insight in the vocal characteristics of women with PCOS and in the differences in vocal quality compared to healthy women.

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Cross-Cultural Adaptation, Validation, and Cutoff Values of the Chilean Version of the Voice Symptom Scale: VoiSS

Purpose: To validate the Voice Symptom Scale: VoiSS into Chilean and also identify characteristics of efficacy and cutoff values Methods: 205 subjects, 89 with dysphonia and 116 without dysphonia. The validation was development according to the criteria of Scientific Advisory Committee of the Medical Outcomes Trust. After, the characteristics of the efficiency and a cutoff value for the total score was performed. Results: The cross-cultural adaptation, translation was called *"Escala de Síntomas Vocales"* – ESV, with 30 questions, five answers and three domains: Impairment (15 questions), emotional (8 questions) and physical (7 questions). Validity: significant difference was found between total score and vocal self-assessment data (p<0.001). Reliability: high levels of internal consistency (Cronbach's alpha for subscales were as follows: impairment =0.908, emotional=0.905, physical=0.718, total=0.928, all with p<0.001) and excellent 1% test-retest reproducibility (impairment: p= 0.022, emotional: p=0.116, physical: p=0.583, total: p=0.024). Responsiveness: the *ESV* showed to be responsive to treatment, as partial and total scores, and voice perceptual analysis results were statistically different when compared before and after voice therapy (impairment, total and perceptual analysis: p<0.001, emotional: p=0.003, physical: 0.004). The (ROC) curve, the cutoff score was with 35 with sensitive (90%) and specific (73%), for dysphonia. Conclusions: The Chilean version of VoiSS, called *ESV*, is a valid, reliable and responsive protocol to assess individuals with vocal complaints.

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Assessment of Tongue Position and Laryngeal Height in Two Professional Voice Populations

Purpose: The purpose of this study was to advance our current knowledge of singer physiology by using ultrasonography in combination with acoustic measures to compare physiological differences between musical theater (MT) and opera (OP) singers under controlled phonation conditions. The primary objectives were to determine: 1) If differences in hyolaryngeal and vocal fold contact dynamics occur between two singing groups (MT and OP) during specific tasks, and 2) If differences occur between MT and OP singers in oral configuration and associated acoustic resonance during singing tasks.

Method: Twenty-one collegiate singers (10 MT; 11 OP) were included in this study. Experimental procedures consisted of sustained phonation on the vowels /i/ and /ɑ/ during both a low-pitch and high-pitch task. Measures of hyolaryngeal elevation, tongue height, and tongue advancement were assessed using ultrasonography. Vocal fold contact dynamics were measured using electroglottography. Simultaneous acoustic recordings were obtained during all ultrasonography procedures for analysis of the first two formant frequencies.

Results: Significant oral configuration differences, reflected by measures of tongue height and tongue advancement, were seen between groups. Measures of acoustic resonance also showed significant differences between groups during specific tasks. Hyoid elevation was not statistically different between groups, however a trend towards higher hyoid positioning during selected tasks was observed for the MT singers. Vocal-fold contact dynamics were not significantly different between groups.

Conclusions: These findings suggest that MT singers alter their laryngeal and lingual structures differently than OP singers under certain controlled conditions. Because singers are at such a high risk of developing a voice disorder, understanding how these two groups of singers manipulate their laryngeal anatomy and physiology may improve identification of negative vocal behaviors and serve as a preventative step in vocal hygiene.

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Understanding Speakers' Ability to Increase Phonation Time Estimation Accuracy

Background: Prior research has demonstrated that most individuals are poor estimators of their phonation time (Mehta, Cheyne, Wehner, Heaton, & Hillman, 2016). This finding suggests a lack of awareness among individuals in how much they use their voices. This lack of awareness may be a contributing factor in voice disorder development in occupational voice users, individuals with jobs that require high levels of voice use (Titze, 1997).

Objective: The purpose of this study is to determine the immediate impact of feedback on phonation time estimation.

Methods/Design: Ten individuals without a history of voice disorders were asked to give a six short monologues while wearing a throat microphone attached to a recorder. After each monologue, participants took a break during which they estimated phonation time (in percent time), and phonation time was calculated (in percent time) using a custom MATLAB script. For the first three monologues, no feedback was given to establish average baseline estimation ability and determine whether accuracy improves by increased awareness alone. After the first three monologues, participants were shown the difference between their estimated values and measured values. Starting with the fourth monologue, each participant first estimated his/her percent phonation time and then received objective feedback on phonation time. A comparison in estimation accuracy between the first three monologues and the last three monologues was completed to determine the immediate impact of feedback on estimation accuracy.

Results: This is the first known study to target increasing estimation accuracy of percent phonation time. Preliminary results indicate that individuals can improve their accuracy after feedback.

Conclusions: The full results provide insight on the average immediate improvement with feedback, which could have implications for voice disorder prevention and treatment.

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The Effect of Diagnostic Information on Ratings of Voice Severity

Objective: Auditory perceptual evaluation is a highly valued clinical tool, but is prone to error. One source of error might be examiner bias. Clinical information may predispose a clinician to expect, and consequently perceive differences in voice severity. Eadie et al. (2011) investigated expectancy bias and found that listeners increased voice severity ratings along expected voice dimension(s) when medical diagnoses were provided. This study aimed to determine how the accuracy of diagnostic information might affect novice listeners' judgments of voice severity.

Methods: Speech samples from 30 speakers were categorized as benign lesion(s), vocal fold paresis/paralysis, or diagnoses not associated with a specific voice dimension. Forty master's level speech-language pathology students first rated roughness and breathiness without, and then with diagnostic information. All samples were presented with an accurate or an alternative diagnosis. Mixed effects regressions models were used to examine the effects of multiple predictors and interactions on voice severity.

Results: The speech stimuli category and diagnostic information predicted breathiness and roughness severity. The interaction between speech stimuli category and diagnostic information was a significant predictor of roughness. Ratings of breathiness were more stable across diagnostic conditions compared to roughness. Increases and decreases in severity across diagnostic conditions were moderated by accurate diagnostic information for both voice dimensions.

Conclusions: These results have training and possible clinical implications. Novice listeners' ratings of breathiness appear less susceptible to expectancy bias compared to roughness. The accuracy and presence of diagnostic information were both important predictors of roughness severity. Both increases and decreases in voice severity were observed between the no diagnosis and diagnosis conditions depending on the diagnostic information provided. This could have implications for interpretation of treatment outcomes. However, the magnitude of change in voice severity that is clinically significant and the potential effect of expectancy bias in expert listeners is unknown.

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The Use of Mindfulness Based Stress Reduction (MBSR) Treatment for Functional Voice Disorders

Objective: This study examines the use of body scan, a Mindfulness-Based Stress Reduction (MBSR) exercise, in the treatment of functional voice disorders. Body scan is aimed at shifting awareness to different parts of the body to recognize and gradually reduce tension. This study seeks to examine the impact of body scan on acoustic markers of stress (e.g., increased fundamental frequency; Giddens et al., 2013), as well as identify current methods speech-language pathologists (SLPs) use to treat functional voice disorders and their knowledge regarding MBSR.

Methods/Design:
Experiment 1: This study will include 10 adults referred for voice therapy with a diagnosis of a functional voice disorder and no history of participation in MBSR exercises. Four participants are currently enrolled. At the beginning of the participant's first therapy session, recordings of sustained vowels and connected speech are obtained, followed by training in body scan meditation. Speech recordings are obtained again after the completion of the body scan training. Voice therapy tailored to the needs of the patient follows the body scan and recording procedures. Pre/post-body scan speech recordings are completed during the first three scheduled therapy sessions.
Experiment 2: This study will pretest a short survey as a step to the development of a large-scale survey to examine the use of MBSR exercises in the treatment of functional voice disorders with approximately 20 SLPs who have a primary focus in voice disorder treatment. Survey questions relate to knowledge of MBSR and current practice patterns with functional voice disorders.

Results/Conclusions: Dependent variables for Experiment 1 include changes in fundamental frequency, perturbation measures, and speaking rate pre/post-body scan. Non-parametric analyses will be utilized to examine changes within the sessions and across sessions. Outcomes of the pre-tested questions used in Experiment 2 will be shared, as well as plans for future survey development.

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Changes in Fundamental Frequency across the Life Span in Brazilian Portuguese Speakers

Objective: To investigate changes in fundamental frequency (F0) across life span in Brazilian Portuguese speakers.

Methods: Voice samples of 526 Brazilian Portuguese speakers (263 males and 263 females) with age ranging from five to 93 years were analyzed. They had their voice judged with absence of dysphonia by three Speech-Language-Pathologists. The speakers were asked to produce a sustained phonation of vowel /a/ and the recordings were distributed into 12 age groups (5-7 years, 8- 9; 10-11; 12; 13-15; 16-18; 19-29; 30-39; 40-49; 50-59; 60-69 and 70-93 years) for acoustic analysis. Fundamental frequency (F0, Hz) was extracted using the computerized Multi Dimension Voice Program (MDVP). The Two-Way ANOVA test was used to investigate the differences in F0 for all age groups of each gender. F0 mean in both genders in each age group was compared using t test.

Results: There was a significant effect for age ($F(11,502)=79,343$ $p<0.00$), gender ($F(1,502)=540,479$ $p<000$) and an interaction between age*gender ($F(11,502)=19,275$ $p<0.00$). For females, the mean F0 for 5-7 years was significantly higher than older children and adults ($p<0.03$). The mean F0 for older children was higher than for adults (30-39 years and up; $p<0.03$). Elderly voices presented lower F0 than age groups up to 19-29 years ($p<0.00$). For males, the mean F0 for younger children was significantly higher than older children, adults and elderly ($p<0.00$). Older children presented F0 higher than adults and elderly ($p<0,00$). The mean F0 for 12-years was different from all ages groups ($p<0.00$). Significant F0 differences between boys and girls began at the age of 12 years.

Conclusions: Changes in F0 occur throughout the life span. In women, F0 decreased progressively from infancy to elderly. In men, F0 decreased until 13-15 years and then remained stable. Voice differences between genders appear to begin at the age of 12 years.

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Comparison of Laryngeal Diadochokinetic Rate (LDDK) for Reproductive Age and Post-Menopausal Women

Objective: The goal of this project was to determine if LDDK varied with hormone fluctuations associated with phases of the menstrual cycle.

Methods: LDDK frequency was obtained at 4 time points associated with 4 phases and corresponding hormone levels of the menstrual cycle (i.e., follicular, ovulatory, luteal and ischemic) for one complete cycle. For the LDDK task the participants were asked to produce both /Λ/ and /hΛ/ for seven seconds as quickly and consistently as they could during each data collection. To establish hormone levels, blood samples were obtained by venipuncture for analysis of estrogen, progesterone, and testosterone and NP-Y values. A linear mixed quadratic model will be used to determine group differences.

Results: Data will be analyzed for 28 participants (15 reproductive and 13 post-menopausal). It is hypothesized that there will be significant differences between the two groups consistent with significant differences in hormone levels which vary in accordance with the four phases of the menstrual cycle. It is also hypothesized that the reproductive age participants will have faster LDDK rates in general compared to the post-menopausal group. It is also anticipated that the reproductive age group will demonstrate slower LDDK rates during the luteal phase and higher LDDK rates during ovulation, moving in association with estrogen values and progesterone levels.

Conclusions: The goal is to identify whether there are variations in fine motor function and joint laxity associated with a phase of the menstrual cycle where women may be more vulnerable to vocal pathology and likely to experience a decline in voice function. Current descriptive evidence signals the possibility that there is significant interparticipant variability in voice function and hormone profiles across the individual phases of the menstrual cycle. Variability is also being observed within participants across more than one phase of the menstrual cycle with regard to hormone and voice function.

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Comparison of Cepstral Peak Prominence for Reproductive Age and Post-Menopausal Women

Objective: The goal of this project was to determine if CPP varied with the hormone fluctuations associated with phases of the menstrual cycle.

Methods: CPP measures were derived from the first sentence and first paragraph of the Rainbow Passage at 4 time points associated with 4 phases of the menstrual cycle (i.e., follicular, ovulatory, luteal and ischemic) for two cycles. To establish hormone levels, blood samples were obtained by venipuncture for analysis of estrogen, progesterone, and testosterone and NP-Y values. A linear mixed quadratic model will be used to determine group differences.

Results: Data will be analyzed for 28 participants (15 reproductive and 13 post-menopausal). It is hypothesized that there will be significant differences between the two groups consistent with significant differences in hormone levels which vary in accordance with the four phases of the menstrual cycle. It is also hypothesized that the reproductive participants will have higher overall CPP values compared to the post-menopausal participants. However, it is anticipated that the reproductive group will experience a CPP drop during the luteal phase when estrogen values are lower and progesterone levels are higher in preparation for the ischemic phase.

Conclusions: The goal is to identify whether there is increased aperiodicity associated with a specific phase of the menstrual cycle where women may be more vulnerable to vocal pathology and likely to experience a decline in voice function. Current descriptive evidence signals the possibility that there is significant interparticipant variability in voice function and hormone profiles across the individual phases of the menstrual cycle. Variability is also being observed within participants across more than one phase of the menstrual cycle with regard to hormone and voice function.

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Saving a Career: Treatment of Velopharyngeal Insufficiency (VPI) in a Professional Oboist

Objective: To identify a successful treatment strategy for a professional oboist with severe stress VPI. The oboist had been dealing with this problem for many years, to the point where it was feared it could be a career-ending situation.

Methods: The patient was evaluated using both rigid and flexible scopes for the degree of inefficiency, while both undergoing a regular evaluation and also while playing the oboe. The evaluation indicated significant leakage. A laryngeal EMG also indicated a 0-10% reduced recruitment in the right Superior Laryngeal Nerve. Other findings included bilateral/partial paralysis of the vocal folds, Laryngopharyngeal reflux, and edema of the larynx.   The oboist had previously had an injection pharyngoplasty with Deflux two years earlier, which did not alleviate the leakage problem.

The patient underwent a fat injection pharyngoplasty, and underwent voice therapy to better use her voice in speech and singing. Strategies included pitch glides, lip and tongue trills, stretch and massage for jaw, neck and facial muscles, and straw phonation.   She also experimented with newly-designed strategies to release tension while playing the oboe to see if they provided any help.

Results: Currently, the oboist is able to play more strongly, with an even tone from the bottom to the top of the scale, feels less fatigue when playing, and finds the VPI to be less of a problem when playing for extended periods of time. She will be monitored regularly through voice therapy, visits, and other communications to see if the treatment combination of voice therapy and surgery continues to allow her to play her oboe at the professional level and maintain a performance career.

Conclusions: Since VPI is a career-threatening situation for wind instrumentalists, the evaluation, surgical treatment, voice therapy, and new strategies she is trying to reduce tension while playing may provide more information on treating other wind instrumentalists with the same problem. We will provide more detailed information and accompanying videos to illustrate the improvement in the VPI and in the oboist's playing.

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Mapping of International Classification of Functioning, Disability and Health (ICF) Framework on Vocal Health Questionnaire for Teachers

Objective: Impaired vocal health in teachers leads to compromised vocal functioning. To understand the impact of compromised vocal health, this study aimed to map International Classification of Functioning, Disability and Health (ICF) framework on vocal health questionnaire that is culturally relevant to the Indian teachers.

Methods/Design: The vocal health questionnaire for teachers was adapted from web based resourcing of existing questionnaires and further modified to suit cultural needs. Broad items of the questionnaire included personal factors & general health, voice use related, concept of vocal health, non vocal practices, vocal symptoms related to body functions, vocal function related to activity limitations and environmental factors (as a barrier & as a supporting factor) for voice use in teachers. A total of 49 ICF codes recognized to be culturally relevant to voice were mapped to the questions. Content validity was done by three speech pathologists and one otolaryngologist. The mapped questionnaire was administered on 105 school teachers in India

Results: Teachers with voice problems reported of impaired body functions such as tiredness after speaking (78%), pain in the throat (62.8%), inability to speak soft (54.2%) and feeling upset (53.3%). As a result of these symptoms, activity limitations were seen while talking with friends and relatives (60%) as well as while engaging in social and religious ceremonies (61.9%). Chalk dust (78%), changes in climate (75%) and noisy class rooms (70.4%) were the commonly observed environmental barriers to use their voice. Teachers had positive support from their colleagues (32.3%), family and friends (31.4%) and the society (31.4%).

Conclusion: This self reported information of teachers on impact of voice problems in participation in daily situations and contributing environmental factors are pertinent to this geographical location. This provides scope to develop models for counseling and preventive treatment for voice problems in teachers.

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SLP-P25

Vocal Training Program to Facilitate Vocal Health in Teachers – A Single Case Report

Objective: Determinants of vocal health include enduring vocal quality with resistance to and recovery from vocal fatigue. This study assessed the outcomes of a comprehensive vocal training program in facilitating vocal health in a teacher with voice problem.

Methods/Design: Repeated measures single subject design on a 40 year old female school teacher diagnosed with hyperfunctional voice disorder (early vocal nodule) was carried out. The baseline measure pre and post vocal loading (pre training phase) included multiparametric voice assessment (Boominathan et al., 2014) and administration of Vocal Fatigue Index (Nanjundeshwaran et al., 2015). Vocal loading task included continuous loud reading of a standard passage for 30 minutes amidst white noise at 70dB(A). Following the baseline assessment, the subject attended 10 sessions of structured vocal training (training phase). Vocal training program included vocal health education, posture correction, stretching & warm up exercises, vocal exercises facilitating stability, flexibility and vocal endurance. To determine the outcome of vocal training, repeated measures were carried out (post training phase). The measures obtained from the pre training and post training phase were compared to evaluate vocal health.

Results: Baseline measurements (pre training) revealed severe deviation on Dysphonia Severity Index (DSI) and part I and III of Vocal Fatigue Index (VFI) post vocal loading task. Following 10 sessions of vocal training, the post vocal loading measures (post training) revealed a slight deviation in DSI and VFI. This indicated resistance to vocal fatigue after vocal loading and hence, the voice is deemed to be more enduring post vocal training.

Conclusion: Study measured aspects of vocal health in a single subject. Positive changes were observed in the subject following structured vocal training program suggesting improvement in vocal health.

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Analysis of Phonation Threshold Pressure, Contact Quotient, and Self-Perceived Voice Quality in Subjects with Behavioral Dysphonia and Normal Voices after Two Semi-Occluded Vocal Tract Exercises

OBJECTIVE: The purpose of the present study was to compare the immediate effects of tongue trills and cup phonation on subjects with behavioral dysphonia and healthy voice subjects using aerodynamic, electroglottographic, and self-perceived voice quality variables. **METHODS:** Thirty participants were included in this study. Fifteen of them were diagnosed with behavioral dysphonia and fifteen were healthy voice subjects. All individuals were random assigned into 2 groups: 1) tongue trill phonation, and 2) cup phonation. At the time of performing the aerodynamic and electroglottal measurements, a comfortable sustained self-selected frequency was controlled through a tuner so that there were no variations between pre and post exercises measurements. The measurements were made before and immediately after the three minutes exercises performance. For cup phonation, a standard 10 oz. styrofoam coffee cup (with a hole punctured at the bottom) was used. All participants underwent to aerodynamic, electroglottographic and self-assessment of voice quality with the visual analog scale. All samples were recorded digitally before and after voice exercises. **RESULTS:** Significant differences were found for phonation threshold pressure (PTP), electroglottographic contact quotient (EGG CQ) and self-perceived voice quality for both groups when comparing pre and post measures: PTP decreased, EGG CQ increased, and voice quality increased. No significant differences were observed when comparing both exercises and both groups. **CONCLUSION:** Semi-occluded vocal tract exercises such as tongue trills and cup phonation seems to produce both objective and subjective positive immediate effect on similar way. Therefore, for semi-occluded vocal tract exercises, the patient will define which exercise is most comfortable for him to apply in the clinic.

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Intensive Short-term Voice Therapy (IVT) for an Individual with Chronic Dysphonia – A Single Case Study

Objective: Intensive short-term voice therapy (IVT) focus on a structured rigorous practice over a short term to achieve specific goals. This study explored feasibility of a Comprehensive Voice Habilitation Program [CVHP] in an IVT framework for its immediate effect on voice quality.

Design: Case study

Method: A 37 year old female was diagnosed with chronic dysphonia consequent to chronic laryngitis with MTD (Grade II) and was advised to attend voice therapy. Client consented to undergo IVT that focussed on culture appropriate instructions on vocal hygiene, postural exercises, stretching exercises, yogic breathing exercises, vocal warm up, onset, and resonant voice exercises. A two hour daily session for four consecutive days was scheduled. Change in voice quality was estimated using GRBAS and acoustic analysis as outcomes measures of IVT. Vocal fatigue index (VFI) was assessed for signs of fatigue at the end of each day of IVT.

Results: Pre IVT, GRBAS revealed severe deviation in overall grade, breathiness and asthenia and moderate deviation in roughness & strain; acoustic analysis revealed increased fundamental frequency [F_0 – 286 Hz] and perturbation measures (Jitter- 1.08%; Shimmer- 12.3 dB). At the end of IVT, slight deviation was observed in overall grade, roughness, breathiness, strain and asthenia. Fundamental frequency was reduced [F_0 – 212 Hz] and was within normal limits. Improvement in jitter (0.46%) and shimmer (4.7 dB) indicated positive effect of IVT on voice quality related parameters. Scores of VFI did not reveal signs of fatigue in all three factors after IVT.

Conclusion: CVHP in an IVT framework can be used for treating for chronic dysphonia.

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Relationship between Vocal Acoustic Characteristics and Chronological and Bone Ages in Prepubertal Children

Objective: To verify the correlation between vocal acoustic characteristics and chronological age, bone age and height in prepubertal children.

Design: cross-sectional study

Methods: 80 prepubertal children, aged 4 to 11 years and without history of dysphonia, were included. The following parameters were evaluated: 1) vocal acoustic evaluation (values of the fundamental frequency [F_0], jitter, shimmer, glottal to noise excitation [GNE], and formant frequencies [F1, F2 F3 and F4] were extracted from the emission of the vowel /ɛ/); 2) chronological age; 3) radiographs of the left hand (bone age); and 4) anthropometric evaluation (height).

Results: For F_0, there was a moderate negative correlation with the bone age variable (r = -0.43) and weak negative correlation with the chronological age (r = -0.39) and height (r = -0.23) variables. There was also a weak correlation between the voice perturbation measures (jitter, shimmer e GNE), formant frequencies (F1, F2, F3 e F4), and the three studied variables.

Conclusions: There is no significant correlation between vocal acoustic characteristics and chronological age, bone age and height. The variable bone age was not significant to replace the chronological age and height variables in the investigation of the gradual decrease of F_0 in children.

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Dosage Dependent Effect of the Vocal Fry Technique in Subjects without Vocal Complaints

Introduction: The vocal fry is an exercise widely used in the vocal clinic, but the appropriate time to exercise execution is unknown.

Objective: To verify the dosage dependent effect of the vocal fry technique in subjects without vocal complaints.

Methods: 40 participants, 20 women and 20 men, aged 20-40 years, normal voice and no vocal complaints were included. Voices were recorded before (M0) and after the vocal fry exercise at the first (M1), third (M3), fifth (M5), and seventh (M7) minutes of performance. Voice samples (counting up to number 10 and vowel /ɛ/) were collected at comfortable pitch and loudness. The effects of the performances were evaluated by (a) self-assessment - self-reported vocal discomfort, rated on a numerical scale (1 to 10, with 1 = no discomfort, and 10 = maximum discomfort); (b) auditory perceptual analysis (counting numbers) - perceptual evaluation realized by two SLP, by consensus, considering the best source-filter balance, classifying them from best to worst (M0 as voice reference); and (c) acoustic evaluation (vowel /ɛ/) – parameters extraction of the fundamental frequency (F_0), jitter, shimmer, GNE.

Results: Phonatory discomfort gradually increased according to the time of execution in both sex, but the highest values were reported by men (p=0,001). In women, discomfort increased from M5 (p=0,001) and in men from M3 (p=0,021). Voices at M1 were considered the best of all moments for women (p=0,007), and M1 and M3 for men (p=0,017). F_0 decreased after M1 for both groups. At M7, male F_0 increased and returned to the initial value, in addition to increasing F_0 variability (p=0,031).

Conclusions: Vocal fry performance duration interfered with the vocal response of women and men without vocal complaints. For women, the ideal dosage seems to be one minute; for men, from one to three minutes. Dosage restrictions should be considered.

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Cross-cultural Adaptation of the Chilean Version of the Voice-Related Quality of Life (V-RQOL)

Objective: This present study aimed to accomplish the cultural equivalence of the Chilean version of V-RQOL protocol, through its cultural and linguistic adaptation.

Methods At first, a translation of V-RQOL into Spanish was performed by two bilingual speech therapists. Secondly, a back-translantion to English was performed by a speech therapist who did not participate in the previous stages . Then, a comparison between the original and the back-translation version of the test was conducted. The existing discrepancies were modified by a committee of five speech therapists, translating the name of the test into Spanish as "Medición de la Calidad de Vida en Relación a la Voz" (MCV-RV), with 10 questions and five answers: "None, not a problem", "A small amount", "A moderate (medium) amount", "A lot" and "Problem is as bad as it can be". For the cultural equivalence, it was applied to 15 individuals with voice problems. For each question, "Not applicable" option was added among the answer choices to determine questions that were not clearly understood by the tested population. Two of the assessed individuals had difficulty at answering two different questions, although it was necessary to modify the translation of just one of them. The final version of MCV-RV protocol was applied to five individuals with voice problems, not finding any hardship in understanding the questions properly.

Results The MCV-RV reflects the original English version, both in number and types of questions (including physical functioning and social-emotional aspects).

Conclusions A cultural equivalence of V-RQOL was achieved to create a Chilean Spanish version (MCV-RV). The validation of the MCV-RV for Chilean Spanish is currently in progress.

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Teaching Reliable Perception of Voice Qualities: A Review of the Literature

Objective: The proposed poster seeks to review the extant literature on educational interventions designed to improve the reliability of the perceptual evaluation of voice qualities.

Methods/Design: The data reported in this poster were collected through review of the extant literature.

Results and Conclusions: Perceptual evaluation of voice is one of the gold standard procedures for assessment of vocal function[1] and is fairly simple and cost-efficient relative to other methods of voice evaluation. Yet, perceptual evaluations of voice have been shown to be unreliable across the continuum of clinical experience.[2–4] At the same time, studies have shown that even brief listener training experiences can significantly increase both the intra- and inter-rater reliability of voice quality ratings.[5–12] Thus, formal training is an efficient and effective means of improving rater reliability for auditory-perceptual measures. This project will review these educational interventions from the voice literature[5-12] as well as detail the need for a large database to be used for educational purposes that is currently under construction (and funded by the Voice Foundation's Advancing Scientific Voice Research Grant).

Specifically, a widely available mechanism to support listener training does not currently exist. To provide these training experiences, an extensive database of voice samples exemplifying a broad range of salient voice qualities at varying levels of severity across various ages and sexes is necessary. Although databases of normal and dysphonic voice samples exist, they are either no longer available for purchase (e.g., Massachusetts Eye and Ear Infirmary Voice Database[13]), are not freely available to the public (e.g., databases built for research such as that created by Awan and Roy[14]), are not built with voice quality evaluation as a prime variable of interest,[15,16] are not in English,[17] or do not contain enough samples to allow for an in-depth training experience across a range of severities, ages and sexes (e.g., Voice Disorders: Simulations and Games[18]). Further, none which focus on voice, save the simulation and games website,[18] provide quality ratings for the voice samples. The paucity of a publicly available, in-depth, expert-rated voice quality database is a significant barrier to improving the reliability of perceptual voice evaluation through formal training in voice quality perception.

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Cross-cultural adaptation of the Argentinian version of the Vocal Tract Discomfort Scale (VTDS)

Objective: To present the cultural equivalence of the Argentinian version of the Vocal Tract Discomfort Scale (VTDS).

Methods: The scale was translated into Argentinian Spanish by two Argentinian bilingual speech-language pathologists, who knew the purpose of this research. Another bilingual Argentinian speech-language pathologist, who not participated in the previous stage, performed the back translation. Then the researchers compared the translations and produced a final version of the scale called *Escala de Disconfort del tracto Vocal* – EDTV. This version was administered to 31 individuals with muscle- tension dysphonia -MTD. The inclusion criterion was the presence of MTD dysphonia, regardless of type or degree. Exclusion criteria were presence of neurological, psychological, endocrinological, audiological and/or cognitive disorders that would not allow the comprehension of instructions of the scale. The option "not applicable" was added to each item of the protocol.

Results: No item was modified or removed from the scale during the process of translation and cultural adaptation. The structure of the Argentinian version of VTDS kept the same as the original version, with 8 symptoms and two seven-point scales of frequency and severity of the symptoms.

Conclusion: It was demonstrated the linguistic and cultural equivalence of the Argentinian version of the VTDS, called EDTV. The data for the EDTV validation is being collect.

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Spectral/Cepstral Analysis of Phonation in Parkinson's Disease Before and After Voice Treatment

Objective: To perform cepstral and spectral analyses of sustained vowels to acoustically characterize phonation in individuals with Parkinson's Disease (PD) before and after Lee Silverman Voice Treatment (LSVT). Previous studies have reported physiologic changes such as increased glottal closure, increased subglottal pressure and reduced electroglottographic open quotient following LSVT. Phonatory alterations of this type strongly predict that there should be an increase in the dominance of harmonic structure in the voice output spectra of patients with PD following LSVT, however, no studies have reported use of spectral/cepstral measures to quantify pre-to-post treatment changes in the acoustic spectrum or to demonstrate the increase in dominance of harmonic structure following LSVT.

Method: Ten adults with idiopathic PD were included in this study (seven males, three females). Ages ranged between 52 and 84 years (mean= 67.5, SD= 8.37). All participants exhibited hypophonia. Subjects continued using their regular anti-Parkinson medication throughout the study period. No additional treatment besides LSVT was provided and no subjects had received LSVT prior to the study. Patients underwent LSVT administered by an ASHA certified SLP who was also a certified LSVT provider. Subjects received standard administration of LSVT over 16 sessions during a four-week period. High quality audio recordings were obtained on three different days before and after LSVT. Each speaker was instructed to produce three repetitions of sustained vowel "ah" as steady and as long as possible. Recordings were collected in a sound booth using a head mounted condenser microphone positioned out of the breath stream, 4 cm from the speaker's lips. Signals were digitized directly to disc (Kay Elemetrics CSL 4300B; sampling rate of 44.1 kHz). Acoustic analyses were obtained using the KayPentax Analysis of Dysphonia in Speech and Voice (ADSV) software. Acoustic measures included Cepstral Peak Prominence (CPP), CPP Standard Deviation (CPP-SD), Low/High Spectral Ratio (L/H SR), and Cepstral/Spectral Index of Dysphonia (CSID). Reliability was high for all selected ADSV measures of sustained vowels ($r > .90$, $p < .001$) for both inter-analyst and intra-analyst comparisons.

Results and Conclusions: Data were analyzed using repeated measures ANOVA. Within subjects variables were Treatment Period (Pre-Tx, Post Tx), Recording days (days 1, 2, and 3 Pre-Tx and days 1 ,2, and 3 Post-TX), and vowel trials (1, 2, and 3 at each recording day). Alpha level = 0.05 was Bonferonni adjusted to 0.0125 for the four acoustic variables. All subjects increased vocal intensity following LSVT ($p < .05$). Two acoustic variables demonstrated statistically significant differences from pre-to-post LSVT: CPP ($p= .004$, $\eta^2 = .63$) and CSID ($p= .003$, $\eta^2 = .64$). The variables of L/H Ratio and CPP sd did not differ significantly from pre-to-post treatment. There were no statistically significant main effects or interactions involving days or trials. Improved phonatory periodicity as measured by CPP was observed following treatment. CSID also indicated improved voice quality post LSVT. Findings support the use of CPP and CSID as voice treatment outcome measures in PD following LSVT.

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Riedel's Thyroiditis and Cordal Paralysis: A Single Case Study

Objetive: Nowadays, cases of thyroid gland pathologies, such as Riedel's thyroiditis - which is chronic thyroid gland inflammation where the fibrous tissue replaces the glandular tissue and extends to adjacent structures, are published less frequently. Unfortunately, these patients usually present voice alterations due to the proximity of its structures to the larynx. The present case report aims to show the proccess of voice therapy on a patient who has undergone thyroid surgery. The patient has been diagnosed with aphonia.

Methods: The voice was evaluated through to clinical and acoustic procedures, using long-term average spectrum, f0 and intensity. Samples were compared before and after the realization of laryngeal digital manipulation exercises. Always keeping acoustic variables measured.

Results: It is determined that with laryngeal manipulation exercises, there are favorable changes in the short term, however, there is no transfer of what has been learned to other contexts. After 20 minutes of exercises, there is evidence of greater energy of the f0, greater intensity and a long-term average spectrum with greater amplification of its frequencies.

Conclusions: It is of great importance to develop these issues, especially in our region, since no significant improvements have been found in this unique case and many patients suffer from Riedel's thyroiditis. Therefore, it is important to know how to proceed and what is the best treatment to follow to improve the quality of life of patients and know, from a physiological and biomechanical point of view, which is the best and most appropriate procedures for patients. It is proposed to use motor sensory learning to make the comparison of long-term results possibly obtained.

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Subglottic Pressure and Pulmonary Function in Individuals with Parkinson's Disease

Introduction: Individuals with Parkinson's Disease (PD) manifest several symptoms including hypophony and hoarseness due to defective glottic closure and decreased subglottic pressure (SGP). In addition, individuals with PD exhibit multiple respiratory complications. These respiratory difficulties are consistent with a restrictive pulmonary pattern reported in PD and may be associated to reduced voice production due to limited pulmonary capacity and reduced airflow needed to vibrate the vocal folds. The purpose of this study was to determine the association between PSG and pulmonary function in individuals with PD.

Methods: Forty-two participants of both genders with diagnose of idiopathic Parkinson´s disease (stage I-III Hoehn and Yahr scale) in the "on dopaminergic" state were recruited in the study. Subglottic pressure (SGP), phonation threshold pressure (PTP), spirometric indices, maximum inspiratory pressure (MIP), maximum expiratory pressure (MEP), peak expiratory flow during reflex and voluntary cough and were taken on all participants in the study.

Results: A moderate but significant linear association were found between SGP and MEP ($r=0.38$; $p=0.013$), SGP and reflex cough flow ($r=0.40$; $p=0.012$) and SGP and voluntary cough ($r=0.31$, $p=0.051$). A low and non-significant relationship was found between SGP and MIP ($r=0.23$, $p=0.145$).

Conclusion: There is a direct relationship between SGP, expiratory muscle strength and airflow during voluntary and reflex cough. Improvements in expiratory muscle strength and expiratory airflow may have a positive impact in phonatory symptoms. Similarly, and increase in SGP may lead to improvements in cough airflow in individuals with PD

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Symptoms and Vocal Fatigue in Brazilian University Professors

Objective: To investigate vocal symptoms and fatigue in Brazilian university professors.

Methods: Observational, analytical, cross-sectional study including 235 university professors from the south and southeast regions of Brazil, of whom 103 were men and 132 were women, aged between 26 and 67 years, and employed at 39 institutions. All participants filled out a questionnaire identifying and investigating the presence of vocal complaint and occupation-related information. The participants were investigated with the protocols Voice Symptom Scale (VoiSS) and Vocal Fatigue Index (VFI), of which the first has been validated in the Brazilian population and the second has been translated and adapted into the Portuguese language. The data were statistically analyzed.

Results: The scores obtained in all VoiSS domains (limitation, emotional, physical, and total) indicated increased vocal symptoms consistent with those presented by dysphonic individuals. In the VFI, the average scores of the participants were higher than those presented by individuals vocally healthy in the three investigated factors - vocal fatigue and restriction, physical discomfort related to the voice, and recovery with vocal rest, indicating risk to vocal fatigue. Professors who self-reported vocal complaints presented more symptoms and fatigue, although the VFI scores in this group were lower than those commonly presented by dysphonic individuals. No association was observed between the scores in the VoISS and VFI protocols and the variables sex and type of institution (public or private). The correlations between the scores of both instruments and the variables age, time working as a professor, and weekly workload in the classroom were considered weak.

Conclusion: Brazilian university professors have increased vocal symptoms, which are functional, organic, and emotional in nature and independent of sex, age, and occupational-related information. The specific symptom of fatigue, which may be inherent to the teaching activity, is present and deserves attention by health professionals.

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Supraglottic Characteristics and their Relationships with Glottic Configuration and Vocal Quality of the Elderly

Objectives: (1) to identify the presence, degree and configuration of medial constriction during phonation; (2) to verify if there is a relation between supraglottic and glottic characteristics; (3) to verify if there is correlation between the glottic/supraglottic characteristics and the vocal characteristics of the elderly.

Methods: A retrospective, cross-sectional study with laryngoscopies of 60 elderly. A judge analyzed: bowing of vocal folds; salience of vocal processes and increase in the volume of vestibular folds during breathing; spindleshaped glottic chink and supraglottic constriction during phonation. Another, analyzed the general degree of vocal deviation, roughness, breathiness, tension and instability by means of a visual analogue scale. Intrarrater reliability (Kappa=substantial), the relation between glottic and supraglottic manifestations (Chi-square) and the correlation between the degrees of laryngeal characteristics and the perceptive-auditory parameters (Pearson) were analyzed.

Results: A medial constriction was seen in 97.7% of the elderly, 72.7% presenting convex, 14.5%, linear, and 12.7%, concave configurations; 47.2% presenting it in mild, 43.6%, in moderate, and 9.1%, in intense degree. Bowing of vocal folds was seen in 57% of the elderly, with a relationship between it and medial constriction in speech (p <0.01). The volume increase of vestibular folds was present in 81% and there was a relation of this parameter with medial (p=0.01) and anteroposterior (0.002) constrictions. There was a positive correlation between the glottic chink, and general deviation degree (p=0.036) and roughness (p=0.015).

Conclusions: The predominance results of mild and moderate degrees, as well as the predominant convex configuration, should be considered in studies on vocal aging. The findings reinforce the hypotheses that the elderly develop supraglottic compensation in face of glottic changes, owing to aging, and that the hyper-functional supraglottic behavior produces hypertrophy in vestibular folds. Nevertheless, the characteristic of incomplete glottic closure was the one associated with vocal deviations in the elderly.

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Fry Perceptions of the Effects of Vocal on Aspirational Careers in Prospective Job Markets

Objective:

The purpose of our study was to determine if presence of 3 levels of vocal fry 1) could be detected at by college students and employers and 2) would affect students' and employers recommendations of employment type.

Methods/design

The utterance "thank you for your time" was recorded at 3 levels of fry (low, moderate and consistent) by a man and a woman, resulting in a total of 6 recordings. Study participants were asked to select samples that included vocal fry. Subsequently, participants completed an online non-standardized questionnaire which asked them to sort recordings into the following categories regarding employment: general labor, law/law enforcement, management, medicine, sales, teaching, other, or do not hire.

Results and Conclusion

Toward purpose 1, male students more accurately identified vocal fry in male and female voice samples. Students and identified vocal fry in males more accurately than employers. However employers were more accurate than students in detecting vocal fry in the female voice samples. Both groups of participants selected samples with least amount of fry for occupations requiring higher levels of voice use and education, whereas occupations with requiring reduced education and voice use selected for samples with high fry. Thus, since ability to detect fry varied among participants but hiring decisions demonstrated a clear pattern, vocal fry may non-consciously affect perceptions of employability.

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Effects of Neuromuscular Electrical Stimulation Associated with Intensive Vocal Therapy in Elderly

Objective: To analyze the immediate and medium-term effect of the use of neuromuscular electrical stimulation (NMES) associated with vocal therapy on vocal rehabilitation in the elderly.
Method: Blind controlled randomized clinical trial. Twenty-one individuals with 60 years old or over were evaluated. They presented age-related vocal complaints. The participants were randomized and distributed in experimental (EG) and control group (CG). All of them received a intensive vocal therapy with progression of intensity, frequency and duration of the phonation time. There were twelve sessions of vocal therapy with 60 minutes each. The NMES was applied only in the EG. Self-evaluation of voice-related quality of life (VRQL), acoustic analysis and measures of maximum phonation times (MPT) were performed at pre-therapy (pre), immediate post-therapy (PI) and one month post-treatment (P1M). The comparison of the three moments of the data and the groups were performed by the ANOVA and Tukey tests.
Results: There was no difference between CG and EG. After therapy, comparing the results of Pre, PI and P1M, it was observed positive differences in the measures of VRQL for total score ($p = 0.02$) and social-emotional domain ($p=0.00$), acoustic parameters: Fundamental Frequency ($p=0.00$), Jitter Percent ($p=0.00$), Soft Phonation Index ($p = 0.00$), Coefficient of Amplitude Variation ($p=0.02$), and the MPT of vowel "a" ($p=0.04$).
Conclusions: There was no difference between the effects of the intensive vocal therapy with progression of intensity, frequency and duration of the phonation time with and without the use of NMES. Comparisons between the moments of evaluation showed positive changes in the PI moment in relation to the Pre, which remained in the P1M moment in the majority of the results. The changes occurred in relation to the measures of self-assessment, acoustic analyses and MPT, proving the efficiency of the therapeutic proposal.

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Factors to Predict the Impact of Voice Therapy on Vocal Fold Atrophy in Elderly

Objectives: In Japan, aging population over 65 yo reached 26.7 % in 2015. Social involvement of elderly is dramatically increasing. In this super-aged country, valid treatment against presbyphonia is urgently required. Among multiple factors to induce presbyphonia, vocal fold atrophy is one typical pathology to affect the diseased vocal quality. While various studies reported positive efficacy of voice therapy (VT) on vocal fold atrophy, effect of VT is variable between patients. To clarify the factors to predict the positive impact of VT on presbylarynx, we performed multidimensional analysis on the old aged patients who received VT against their vocal fold atrophy in this study.

Methods: Twenty-two patients (age, 70-83 yo; mean, 75.8 yo) who underwent VT for their on vocal fold atrophy between July 2016 and October 2017 were incorporated in this study. Vocal function (GRBAS score, videostroboscopic finding, acoustic/aerodynamic measurements, and VHI), physical characteristics(grasping power, respiratory function, BMI), mental characteristics(WHO SUBI), as well as personal characteristics (age, sex, past history, smoking history, duration of symptom, and vocal habits) were measured at their first visits. Vocal hygiene instruction and vocal function exercise were performed as therapeutic options for 2 months, and the impact of VT was assessed by measuring 8 parameters including perception (G score), videostroboscopy (glottic closure), acoustics (Jitter and Shimmer), aerodynamics/efficiency (range of vocal pitch/power, and MPT), and subjective rating by patient (VHI).

Results: Improvement in more than 3 parameters were observed in 16 patients. Number of improved parameters correlated (|correlation coefficient|>0.2) with several background factors of the patients including pretherapeutic VHI, age, duration of symptom, grasping power, BMI, and SUBI score.

Conclusions: This is the first study which assessed and proved the factors to predict the impact of VT on vocal fold atrophy in elderly. Future studies to involve the increased number of patients are warranted.

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The Effects of Three Heel Heights on Postural and Acoustical Measures of Male Musical Theatre Singers

Persian male warriors first wore high-heeled shoes to anchor themselves on stirrups while riding horses (Kremer, 2013). Louis XIV wore high-heeled shoes as a symbol of status and ordered that no one could wear red high heels or heels taller than his (Wade, 2013). Men singing opera and musical theatre may wear lifts in order to be taller than their female counterparts. Musicals including *Kinky Boots, Hedwig and the Angry Inch,* and *Rent* require men to sing in high-heeled shoes and boots. A few studies have been completed on the effects of high heels on postural and acoustical measures of female singers (e.g., Rollings, 2013, 2014, 2015); however, no studies with male singing participants have been completed.

The purpose of this study was determine the effects, if any, of 3 simulated high-heel conditions (0.0 in., 1.5 in., and 3.0 in.) on postural (head position, jaw opening) and acoustical (LTAS, dB SPL) measures of male singers ($N = 30$) in 2 conditions (silence, singing sustained [ɑ] and [i] vowels on each pitch from C3-F4. The results will be discussed in terms of advice that may be given to male singers performing in high heels, and the direction of future research in this area.

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Contemporary Commercial Music (CCM) Vocal Pedagogy: A Matter of Style!

The 20th century witnessed the rise of popular music culture, an art form that is still rapidly evolving and has significantly expanded the landscape of Contemporary Commercial Music (CCM) styles. Despite the increase in popularity of CCM styles, and the related increased demand for CCM vocal instruction, this particular group of singers continues to be overlooked in research studies. Consequently, a specific pedagogical approach, one that is able to compensate for this ever-evolving group of complex and diverse styles, has yet to be formulated. Ultimately, students of CCM aspire to become vocally fluent and artistically expressive across a broad range of styles. It has become problematic for voice teachers, who are often left largely to their own devices, to empower CCM students with a firm understanding of how to transmit those sounds in a healthy and artistically effective way.

Method: Forming part of a larger research study, this paper explores the challenges of teaching singers in CCM styles, from the viewpoint of a group of nine teachers who are prominent internationally in the field of CCM. The data was collected in interview with these teachers, who spoke primarily of three key areas relevant to training of singers in CCM: technical matters relating to style, artistry and the management of an ever expanding territory of music styles.

Conclusions: For the teaching of CCM to be style relevant to sustainable vocal production, teachers working with singers of CCM repertoire must recognize the elements, characteristics, vocal effects and nuances of each style and have an understanding of how these can be executed safely. The results of this investigation have particular implications for teachers and music institutions working with CCM singers, revealing the need for teachers to be educated and proficient on some of the basic aesthetic characteristics associated with CCM styles.

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Getting in Tune with How Singing Teachers Teach: Analyzing the One-to-One Lesson

Background: Classical singing is a complex and multifaceted skill that requires the amalgamation of multiple cognitive, perceptual and motor functions. The singer is required to achieve high performance development of a specific motor activity, much like the sports athlete. The teaching of classical singing is traditionally and characteristically known to rely upon anecdotal evidence rather than systematic and scientifically founded research. Research on the principles of motor learning has not yet been applied systematically to singing training.

Method: Twelve participants were recruited from two Australian conservatoria of music, including 4 singing teachers, and 8 students over the age of 18 years. Eight one-to-one singing lessons between the teacher and student were audio-visually recorded and analysed. The principles of motor learning were used to allow objective identification of teaching behaviour.

Results or main contribution
Key findings included (1) high use of instructional and feedback behaviours, (2) low use of motivation and perceptual training, (3) higher use of knowledge of results than knowledge of performance feedback behaviours, (4) high routine use of instruction, modelling and feedback behaviours each time a student attempted a task, (5) teachers spent more time talking than the student spent attempting tasks, and (6) a moderate number of teaching behaviours are not classifiable under the principles of motor learning framework.

Conclusions: This study provides recommendations for future research on objectively improving teaching and learning in this field.

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A Longitudinal Study of Intonation in a Cappella Quintet Singing

Objective: The skill to control pitch accurately is a key performance element in singing ensembles as it boosts musical excellence. Previous studies analysing single performance sessions suggest that singers in *a cappella* quartet tend to use a non-equal tempered tuning system for their intonation, rather than an equal tempered tuning. However, developmental aspects of intonation in music ensembles have not yet been investigated. The present longitudinal study observes the evolution of intonation between advanced singing students during their first term of study, following a newly formed singing ensemble from initial rehearsals to the performance stage.

Methods / Design: A semi-professional singing quintet was recorded using head-worn microphones and electrolaryngograph electrodes to allow fundamental frequency evaluation of the individual voices. The ensemble rehearsed two pieces composed for the study that offer representative pitch variations, during five practice sessions over three months. Singers practiced the same stimuli in a randomised order across sessions and performed three repetitions of the same pieces before and after each rehearsal. Audio and electrolaryngograph data of the repeated performances were collected and analysed. Intonation was then measured by extracting the fundamental frequency values from the electrolaryngograph signal using acoustic analysis software. Intonation before and after rehearsals was calculated and compared both within rehearsals (pre- and post-) and between rehearsals (rehearsals 1 to 5).

Results / Discussion: Results will be presented that indicate how the singers developed their pitching accuracy over time. Pitching skills are one core foundation of excellent choral singing and knowledge relating to how these develop over time with students studying singing has the potential to provide choir directors with strategies to use in their work.

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Survey of Warm-up Practices and Perceptions among Indian Classical Singers

Objective: Studies have highlighted the importance of having an adequate vocal warm-up exercise regime for prevention of vocal fold injury among singers. Singers have attributed a regular warm-up regime having a positive impact on their voice quality during singing. A recent pilot study in Western singers investigated the type, duration, and frequency of vocal warm-up as well as their perception towards it. Singing warm-up and riyaz is a common practice among Indian classical singers, however there is no published literature available on it. Such a survey will help in understand the existing vocal warm-up regime followed as well as what the singers perceive about its importance.

Method: A 30-item questionnaire was used comprising of questions on demographic details, vocal warm-up singing and non-singing based practices, perceptions about importance of vocal warm-up and perceptions about effects of vocal warm-up on voice.

Results and Conclusion: Fifty Indian classical singers with a mean age of 29 years and singing experience of 13 years were surveyed. 64% used vocal warm-up on a daily basis while remaining did it weekly. Among the singing based vocal warm-up, a combination of alankar, omkar and sargam practice was most commonly reported by the singers. The popular non-singing based warm-up exercises were breathing practice, humming and meditation. Overall, the singers had a positive perception of the importance of vocal warm-up. Notably, 94% agreed to the importance of having a vocal warm-up regularly before singing. Since most of the singers practiced vocal warm-up, they were able to appreciate its benefits in terms of more co-operative voice, ease in singing low and high notes, as well as more flexibility while singing. The findings of the present help in understating the existing vocal warm-up regime and perception of the singers. It will benefit while counselling singers regarding vocal hygiene, voice care and management.

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Vocal Tract Resets for Professional Musical Theatre Performers - An Introduction

Many teachers of contemporary commercial music guide their singers to perform various vocal tract manoeuvres during performance.

What is the purpose of a vocal tract reset?
1. They are useful for singers who need to access several vocal qualities during one performance.
2. They are a valuable way of maintaining vocal health over a long period of performance for a vocal role with a heavy vocal load.
3. They aim to minimise the load placed on a vocal cool down at the end of the performance and to enable singers to manoeuvre through a role with ease as they move from one vocal tract setting/vocal quality to another.

What are they?
There are four main groups;
1. General resets for the vocal tract.
2. Laryngeal position resets.
3. Jaw and Tongue resets.
4. Breath resets.

How do they work for the singer?
1. They are called resets which assumes that the singer has a 'home-neutral' vocal position that they know and therefore understand where they are resetting to.
2. They are bespoke to the individual singer, so singers performing the same role may use different resets and at different points in their performance to aid their progression through the role.

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A Focus on the Category of "Singer Type" within the Demographics of a SVS Practice in a Large Metropolitan City

This study closely examines the 'singer type' category from the Sound Singing Institute's demographics collection. The primary focus on one category is a follow-up of the previous demographics studies presented at the Voice Foundation Symposium in regard to the Sound Singing Institute's specific population. The subjects are all clients seen at the SSI from 1997 to the present, 2018. Materials and methods include: (1) collect data, (2) create an excel spread sheet, (3) compute results and (4) create statistical profiles to describe each category. All information reported was gathered at the initial evaluation. The categories in entirety include (1) age, (2) gender, (3) singer type, (4) genre, (5) group, (6) diagnoses, (7) post surgery, (8) post cancer treatment, (9) medical condition, (10) referral source, and (11) occupation. This presentation will elucidate categories 1-3 and 5.

'Singer type' includes (1) Performer, (2) Worship Leader, (3) Choral Director, (4) Music Educator-elementary, secondary, choral, band, (5) Choral Singer, (6) Vocal Performance (college/adult student), (7) Cantor, (8) Church Soloist, (9) Congregational Singer, (10) Music Therapist, (11) Bar/Bat Mitzvah Student, and (12) Recreational. Category 'Group' includes (1) Professional, (2) Avocational, (3) Student, and (4) Non-Singer.

It is necessary to examine the 'singer type' category in more detail. Often singers are involved in several 'singer type' categories such as a music educator/choral singer/performer. In order to have a clearer representation of who is seen at the SSI, each type will be separated and examined individually.

This study is relevant to a wide audience because programs of training the SVS are currently underway. A clear examination of 'singer type' seen in a major metropolitan city SVS practice will help to illuminate the breadth and preparation type needed.

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The Effect of Body Awareness Training on Singers' Vocal Function and Performance

Although many voice students understood cognitively that they should engage freedom and ease in the body while singing, but they lacked physiological sensory-based knowledge/body awareness to embody the cognitive notion to effect change (Malde, Zeller, & Allen, 2013). Will singers have better vocal function and performance after having body awareness training? With the support of the literature review, this researcher constructed a sixty-minute body awareness workshop based on the widely adapted teachings of Alexander Technique, Feldenkrais Method, Pilates Method, and body mapping as an intervention (IV) aiming to facilitate greater conceptual clarity and deeper sensory experiences of the body-mind coordination through movement to enhance ease and support for singing and moving. It is a basic difference question with one active IV (body awareness workshop). The two sets of hypotheses are intended to address the two DVs: singers' perceived vocal function and their performance rated by two external evaluators. Ten healthy adult singers participated in this quasi-experimental study. A dependent t-test was used to analyze pretest and posttest data. The participants perceived their vocal function as significantly better and their performance scores rated by external experts were significantly higher after the body awareness training. The study result echoed recent studies and teaching on singing acknowledging the value of body awareness for singers, and hopefully it will encourage singers to include the body awareness practice encompassing conceptual, somatic and conditioning dimensions into their warm-up routine for singing.

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Muscle Tension Dysphonia: Are Singers Getting the Help They Need? (Phase III)

Muscle tension dysphonia (MTD) is an occupational hazard for both professional and amateur singers. The demanding nature of the job is such that performers are frequently faced with situations that may contribute to the development of the disorder. As MTD can have a significantly negative impact on a performer's career and confidence, early detection and treatment is a necessity for the singing voice.

Our previous research, presented in previous years' symposia, provided data which helped us better understand both the challenges and progress in addressing MTD within the singing voice community. Professionals experience difficulty in identifying the aural signs of its manifestation in the singing voice, however, when singers did receive help, their condition generally improved. The results of both studies suggested that the largest obstacle to treatment continues to be a general lack of knowledge about MTD – its causes, its detection, its treatment.

Therefore, in the final phase of our semi-longitudinal study, we intend to survey the singing voice community – medical professionals included – to determine how the general knowledge about MTD for singers has advanced over the course of the previous five years. Additionally, interviewing professionals who work specifically with the disorder, we intend to review best practice strategies available and consider where there may remain room for further community awareness and education.

Findings are presented with the aim of contributing to current understanding of the level of MTD awareness in the singing community.

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Contribution of the Epilaryngeal Tube Narrowing and Vocal Tract Shape on Spectral Characteristics During Twangy Belting: a Computerized Tomography Study

Objective: This study investigates the possible contribution of the epilaryngeal tube narrowing and vocal tract shape on spectral characteristics during twangy belting voice production.

Methods: One male contemporary commercial music (CCM) singer was registered with computerized tomography (CT) while phonating: 1) a sustained vowel [a:] in a comfortable habitual pitch (B2) and loudness, using a speaking voice quality, 2) a sustained vowel [a:] at a high pitch (G4) and loudness, using a twangy belting quality, and 3) a sustained vowel [a:] in a comfortable habitual pitch (B2), using a twangy belting quality. The scannings were studied in sagittal and transversal dimensions by measuring lengths, widths and areas. Volumetric measures of the epilaryngeal tube were also obtained. To guarantee that the singer's performance was according to the musical genre, three blinded judges assessed audio samples of the vocal tasks performed.

Results: The total volume of the epilaryngeal tube decreased in both singing voice samples compared to speaking voice production, the change being greater at habitual speaking pitch using twangy belting style. The outlet of the epilaryngeal tube decreased in twangy belting at habitual speaking pitch. The inlet to the lower pharynx decreased for both singing voice samples compared to speaking voice production. Spectral energy showed an increase around 3500 Hz for the twangy belting sample at high pitch and an increase at 2000 and 3000 Hz for twangy belting at habitual speaking pitch.

Conclusions: The data revealed that compared to speech-like sample, the vowels sung in twangy belting quality are produced with a narrower and smaller epilaryngeal tube and a smaller cross-sectional area of the hypopharynx. It seems that a combination of a narrow epilaryngeal tube and pharynx contribute to a twangy voice quality. Acoustically, an increase of high frequency energy above 2 kHz should be expected.

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Novel Vocalization Model Using Human Larynx in Pyrrolidon-embalmed Cadaver

Background and Objectives: Natural shape and softness of vocal folds are indispensable to observe vocal fold vibration in experimental settings. Furthermore, flexibility of crico-arytenoid joint is required to assess the morphological and functional impact of phonosurgeries for educational purposes. However, conventional formalin-embalmed larynx (FEL) of human corps is not suitable for these purposes due to hardly fixed soft tissue and joints.

Recently, it has been reported that Pyrrolidon-embalmed cadavers could achieve tissue/joint flexibility comparable with that of fresh cadavers. Theoretically, both of laryngeal soft tissue and crico-arytenoid joint could be flexible enough to visualize vocal fold vibration and to examine the impact of phonosurgery in the Pyrrolidon-embalmed cadaver.

To assess the suitability of Pyrrolidon-embalmed human larynx (PEL) as a tool to examine the vocal fold vibration, high-speed digital imaging of vocal folds was performed in excised larynges with artificial air-flow. Furthermore, to validate the suitability of this model to observe the impact of phonosurgery, framework surgeries were performed.

Methods: 1) A high-speed digital camera system (10,000 fps) was used to visualize the vocal fold vibration. Images were recorded under artificial air-flow blew from subglottis. Procedures were performed on both PEL and FEL, and the recorded images were compared with each other.
2) Arytenoid adduction procedure was performed in a PEL using a 4.0 Nylon suture. Thyroplasty type I procedure was further performed using autologous fat.

Results: Regular vocal fold vibration similar to live human was visualized in PEL, while no vibration was observed in FEL. Furthermore, framework surgeries were successfully performed to observe the impact of phonosurgeries to adjust glottal closure.

Conclusions: This is the first study to show the utility of Pyrrolidon-embalmed laryngeal specimens to observe vocal fold vibration in experimental settings. Furthermore, feasibility of this model to be utilized for surgical educational purposes was shown.

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Quantifying Vocal Repertoire Tessituras through Real-Time Measures

Voice teachers use anecdotal evidence and experience when examining the tessitura of pieces they assign to their students and in determining the appropriateness of that repertoire for a particular student's development. Tessitura, however, is something that has until recently remained un-quantified by scientific methods. New technology now allows us to quantify the tessituras of standard vocal repertoire in real time using a voice dosimeter to measure frequencies (Hz) and vocal dose.

The purpose of this study was to examine the use of dosimetry-derived "tessituragrams" and Voice Range Profiles (VRPs) in selecting appropriate voice repertoire for college/university voice students. The following research questions guided this investigation: (1) How do dosimetry-derived tessituragrams of the same vocal selection compare when performed by at least three different singers?; (2) How do singer VRPs compare with their tessituragrams of a song or aria?; (3) How do singer and expert panel perceptions of a song's "fit" align with the overlay of singer VRPs with tessituragrams? Relationships between these data are discussed in terms of what tessituragrams can tell us about student repertoire selection and the tesstiuragram's potential as a tool for appropriate repertoire selection by singing pedagogues. This project was the outcome of the 2017 Van Lawrence Fellowship awarded to Dr. Schloneger.

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Acoustic Investigation of the Female Belt in Professional Broadway Actresses

Objective: Current research on the female belt voice has been limited to the range of C5, which is not representative of the current requirements on Broadway. Additionally, much belt research uses voice teachers or college students who do not, yet, have a record of being hired in leading Broadway roles; therefore, the actual commercial viability and longevity of the vocalism is questionable. The goal of the current study was to acoustically examine both higher and lower belt ranges in ten women who have performed belt roles on Broadway during the last decade. We hypothesized that singers would utilize different resonance strategies in these two ranges, supporting the theory that boosting the second harmonic is not the only viable acoustic strategy available to belters.

Methods/Design: We analyzed the long-term average spectrum (LTAS) of the middle stable portion of two belted pitches, one from a lower, more traditional belt song and the other from a higher, more contemporary belt song. The peaks in the LTAS corresponding to the first three harmonics (H1, H2, and H3) were extracted. The relative intensities of H1 to H2 and H2 to H3 were measured, as well as the alpha ratio (proportion of energy in the LTAS below 1 kHz compared to energy between 1 kHz to 5 kHz).

Results: Overall, no consistent resonance strategy was found either within individuals or across pitches. Some singers used an H2 boost, while others relied more on H3. Some of the singers changed strategies for the different belt ranges and styles of singing, while others used one harmonic strategy for all ranges.

Conclusions: Elite female belters use varying resonance strategies to create commercially viable belt sounds in different belt ranges.

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Water Resistance Therapy as Vocal Warm-Up Method in Contemporary Commercial Music Singers

Objective: Water resistance therapy (WRT) has been used in voice therapy and training. Several physiological effects have been linked to this type of semi-occluded vocal tract exercise. However, there is no data supporting the effectiveness of WRT as a vocal warm-up method for singers. The present study aimed to determine the effects of WRT as a vocal warm-up method in contemporary commercial (CCM) singers.

Methods: Twenty-two CCM singers performed 15 minutes of vocal warm-up. They were randomly assigned to one of two types of vocal warm-up: open vocal tract warm-up (OVT), using an open vowel [a:], and WRT at 5 cm of depth. Aerodynamic, electroglottographic, and acoustic measures, as well as self-perceived resonant voice quality, were assessed before (baseline), immediately after vocal warm-up (Post1), and immediately after forty minutes of vocal loading with body movements (Post2).

Results: Significant results were found when comparing baseline and Post 1. Subglottic pressure and inspiratory airflow duration decreased for both groups. OVT group showed a decreased SPL after warm-up. No changes in SPL were found for WRT group after warm-up. Furthermore, significant results were observed when comparing baseline and Post2. Subglottic pressure and inspiratory airflow duration decreased for both groups after vocal loading. OVT group showed a decreased expiratory airflow duration during singing and a lower electroglottographic contact quotient immediately after vocal loading.

Conclusions: Some objective outcomes suggest that WRT method is more effective as vocal warm-up than open vocal tract exercises, possibly avoiding an early stage of vocal fatigue, both after vocal warm-up and after prolonged vocal loading. Since outcomes in self-perceived resonant voice quality for both methods were similar but physiologic effects were different, it seems that vocal warm-up strategies could produce a placebo effect.

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Classical Singers' Voice Source Properties: A Longitudinal Study through Years of Higher Education

Objectives: In documenting the progress of singer education, attention has earlier been paid mainly to resonatory voice properties. However, phonatory characteristics may be more important, since they are crucial to a sustainable vocal technique. The aim of this longitudinal study was to analyze voice source changes during higher education of classical singers.

Methods: Recordings of audio, electrolaryngograph, oral pressure and airflow signals were made of male students at the beginning and after two years of training. *Messa di voce* were recorded while the singers repeated the syllable /pae/ at low, middle and high pitch. Oral pressure during the /p/ occlusion was accepted as an estimate of subglottal pressure (Psub). Voice source was analysed by means of inverse filtering and relations were analysed between Psub, maximum flow declination rate (MFDR), normalised amplitude quotient, dominance of the fundamental, closed quotient, contact quotient and sound pressure level.

Results and Conclusions: Differences were found in several parameters, including dynamic range and the correlations between MFDR and other flow glottogram parameters. In many cases, an increased similarity was found to correlations observed for professional singers. Thus, it seems possible to document in objective terms the progression of singers' education with respect also to phonatory properties.

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Singing in French: a Multicultural Marriage between Two Musical Systems

Phonetics analyses speech from two different points of view:
- segmental, i.e. the succession of vowels - acoustically musical sounds - and consonants.
- suprasegmental - prosody - which includes intonation, accentuation, rhythm, pauses and timbre and is mainly depicted by the 3 parameters that govern music: duration, pitch and intensity.
Consequently it is sensible to consider that a singer - independently from the semantic approach to poetry - is actually exposed to two different musical systems.
The French often consider their own language as non musical. In Song, diction is therefore either exaggerated or neglected. In either case, the artistry of the singer is losing intelligibility, musicality and its iconic French touch.

The constitution of the 2 musical systems differs considerably and deserves to be thoroughly analysed and contrasted from a phonetic, musical and neuroscientific point of view.
- A historical and theoretical review of the nature of our western tonal musical system initiated by Pythogoras can be lead in comparison with music from other cultures.
- There is much to be explored, historically and phonetically in the subtlety of the musical aspect of oral French, compared to the prosody of other languages like Italian or English. It is frequently ignored, especially accentuation which plays a role in every aspect of French pronunciation and it is taken for granted that the prosodic features are dissolved in the music of the song.

This is indeed true as far as pitch is concerned but intensity and duration can remain vivid in the singing of the text and the major remaining factor can be regarded as accentuation. Our metaphoric evocation of the marriage of the two musical systems, will highlight the major role played by accentuation in an intelligible, beautiful and moving diction, as well as in a rewarding vocal artistry, fully respectful of à sound breathing technique.

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All Tied Up: The Effect of Wearing a Necktie on Acoustic and Perceptual Measures of Male Solo Singing

The purpose of this study was to assess acoustically (long-term average spectra and multi-dimensional voice profile) and perceptually (participant perceived phonatory ease and expert listening panel) the effect of wearing a necktie on male singing in a solo vocal setting. No study to date has assessed the potential effects of wearing neckties in solo vocal settings. Among primary results: (a) statistically significant differences in spectral energy (0-10 kHz) between performances with and without a necktie, (b) increases in mean jitter and shimmer percentage measurements of singers with a necktie, (c) significant reduction in perceived phonatory ease when singing while wearing a necktie, and (d) listener preferences for singing without a necktie. Results were discussed in terms of limitations of the study, suggestions for future research, and implications for voice pedagogy.

Keywords: necktie, solo singing, long-term average spectra, multi-dimensional voice profile, perceived phonatory ease, expert listening panel

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Use of Lombard Effect On A Functional Voice Problem

Objective
The Lombard effect (LE) is a phenomenon in which speakers alter their vocal production in noisy environments. The LE has been shown to improve the quality of the voice. Although the LE can cause strain to the voice in a real environment, it has been shown to be useful in treating patients in the voice clinic. In this case report we used white noise stimulation to confirm a diagnosis of a functional voice disorder and quickly restore the normal voice in a dysphonic patient.

Methods/ Design
Case report: A 33 year old female presented with a chief complaint of dysphonia after an upper respiratory infection 9 months prior. Her voice never recovered, and she ended up quitting her job because of her voice problem. She was diagnosed by a laryngologist (AR) with a functional (nonorganic) dysphonia The LE was used by delivering white noise through a headphone. The voice was recorded simultaneously while reading The Rainbow Passage at a comfortable pitch and loudness. Her voice was restored using the LE during the voice evaluation. The patient had 1 subsequent voice therapy session to maintain normal voice quality.

Results:
After one therapy session using the LE, the patient was able to vocalize with normal voice, confirming the diagnosis of a functional voice disorder.

Conclusions:
LE is an effective tool that can be used to help confirm the diagnosis of and treat functional dysphonia.

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Overview of Current Term Usage for Contemporary Commercial Music and Other Non-Classical Stsyle

Background: The Lincoln Center for the Performing Arts Library has cataloged musical theater, jazz, rock, pop, Gospel, R&B, blues, country, folk and several other categories as separate, distinct styles of music. In 2000, the term "Contemporary Commercial Music" (CCM) was created to encompass these styles and draw attention away from the pejorative term "non-classical" music. The long held and widely used "non-classical" descriptor implied that music that was not "classical" was nothing, non-existent or unimportant. Since the vast majority of music worldwide is not classical, implying that these styles were "non" was not reflective of the nature of music as it actually existed at that time nor as it exists in the present.

Objective: This paper will present an overview of the most predominant terms describing the various styles previously called "non-classical." It will examine the commonly accepted understanding of those terms and the frequency of their use in international medical, scientific, clinical and academic disciplines as well as in the music marketplace. Because older generic descriptors such as "popular music," "popular cultures music," and "vernacular music" are still used in specific circumstances and because they carry within them a particular history, they will be compared to the newer term Contemporary Commercial Music, which has no previous associations or meanings, for the purpose of identifying current trends. As the new term is thought to be overtaking the older, less well-defined generic terms, determining how often and in what way it is used will provide a broader perspective on changing attitudes about the music itself.

Methods: Online and live research of terms, usage, definition, frequency, significance of authors or creators of various terms describing "non-classical" styles from a wide variety of periodicals, websites, libraries, and search engines of various types.

Results: Comparison and contrast of the term CCM to other terms, a list of degree programs or courses of study using any generic descriptor such as "non-classical" compared to those labeled as being CCM, a compilation of statistics using each term from most to least common or typical.

Conclusions: What term is used most frequently? Where are the various terms being used? What seems to be the trend regarding the labeling of these styles as a unified whole?

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Pedagogical Approaches to Registration and Belting in Contemporary Commercial Singing

An increasingly valuable skill for a teacher of singing is the ability to teach contemporary commercial (CCM) vocal technique. However, there are many pedagogical approaches to address the fundamental techniques of registration and belting. Major pedagogical methodologies offer varied, and sometimes contradictory approaches. Some voice teachers draw from several different methods, yielding an even wider range of approaches to teaching registration and belting.

Objective: To examine the pedagogical approaches to registration and belting used by exemplary teachers of contemporary commercial singing.

Methods/Design: 25 teachers of contemporary commercial singing were interviewed, including the founders of eight pedagogical methods. Additionally, eight university voice teachers, seven independent studio teachers, and two speech language pathologists who also teach singing were interviewed. Each teacher was asked to describe their approach to teaching registration, and their approach to teaching belting. The responses were open-ended.

Results and conclusions: Results varied widely. Some teachers regard work on registration as foundational to their pedagogical work, while others do not address registration at all. Belting approaches also varied. Some teachers provide clear "recipes" for achieving a healthy belt, while others avoid using the term altogether. Results from this study reveal opposing trends in CCM voice pedagogy in the areas of registration and belting.

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Closed Vowels and Their Effect on Classically Trained Female Closed Quotient (CQegg) Values

Introduction:
Professional classically trained singers strive to maintain a consistent ring, *squillo*, or singer's formant cluster in their tone regardless of pitch, vowel or register. Both the bright /a/ and its sister the darker /ɑ/ have been the bane of opera singers for generations. Special attention has always been paid to make sure these open vowels "stay in line", "keep calibrated", "don't fall back", or "maintain consistency" with the other more closed vowels. Voice pedagogues since the 19th century have, with marked success, used vocalises transitioning from closed vowels to more open to address this issue. The purpose of this research is to examine the Contact Quotients (CQegg) for the closed vowels /i/, /e/, /o/ and /u/ in the female head and middle registers of classically trained mezzo sopranos and sopranos and compare that with the CQegg of their /a/ vowel. As this is an extension of research involving the head register of classically trained tenors, it is hypothesized that similar results will occur.

Methods:
Twenty female singers who can successfully demonstrate the ability to navigate into their head register (passing through the *secondo passaggio*) will be utilized for this study. Data will be collected using a standalone microphone and an electroglottograph. These signals will be displayed and analyzed for spectrographic and CQegg values using VoceVista and Voce Vista Video Pro software. Each participant will be asked to sing an /a/ vowel on a comfortable pitch in the middle and head registers. Then, while sustaining that pitch, transition to the vowels /i/, /e/, /o/ and /u/. Resonance strategies will be monitored during the singing of these examples as it will be paramount that each subject remain in either middle or head register for the purpose of study.

Results and Conclusions:
A repeated measure ANOVA will be used to compare the CQegg and spectrographic data. Comparisons will be made between participants and between the /a/ and other vowels and between registers. These results will be discussed in light of previous studies reporting CQegg and spectrographic data from classically trained singers.

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The Utility of Vocal Function Exercises as an Adjunct Therapy for Laryngopharyngeal Reflux (LPR) Symptoms in Singers

Objective: Laryngopharyngeal Reflux (LPR) is a prevalent vocal pathology, affecting 20-40% of the population. Singers with LPR often experience dysphonia, pitch breaks, poor voice quality, prolonged warm-up time, and loss of range. Even after LPR symptoms have been medically treated, debilitating singing voice symptoms may persist. This outcome study investigates the utility of Vocal Function Exercises (VFEs), which have demonstrated utility for the treatment of other (speaking) voice disorders, for singers with LPR.

Method/Study Design: Thirty subjects with physician diagnosed LPR were recruited for this experimental design study and were randomly divided into treatment and control groups. Pre- and post-treatment measures were taken to determine treatment efficacy. Acoustic and aerodynamic measures included VRP, CPP, and CTP. Perceptual measures included the BORG effort scale and a Singer Specific Questionnaire (SSQ). These measures were correlated with participants' Reflux Symptom Index scores (RSI). Both groups met with the principal investigator weekly (over the course of six weeks) and the treatment group was instructed to complete a daily VFE protocol. Compliance was monitored through participant journaling and weekly measurement of their maximum phonation time. Descriptive statistics and inferential statistics were calculated to assess any primary measure trends present in the SSQ and secondary measure trends for the VRP, CPP and CTP.

Results: Data collection is ongoing. Findings and implications for the training and care of singers with LPR related voice symptoms will be discussed.

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Pathology Pathways: Actors Versus Music Theatre Singers

Objective: Care and management of professional voices in today's health care system remains controversial. It is common for professional.

The aim of this study is to provide insights into current practices between professional actors and professional music theatre singers related to vocal health and whether stage performers and music theatre singers vary their health care choices.

Actors perform in various size spaces like black box, Television studios and large theatres and have high demands in tying emotional demands of the spoken voice. Music theatre singers often perform in large performance spaces with demands to balance speaking voice, singing voice and dancing on a raked stage. Due to performance demands, music theatre singers may have more extensive training, but actors may have greater demands on projection without amplification.

Methods: Subjects were solicited via survey links to members of professional vocal and acting organizations. Singers and actors completed an online focused on situations and preference for voice care advice.

Results: The specific practices of singers and actors management of vocal health concerns may show contrasts between older and younger population within the actors and music theatre singers.

Conclusions: Among voice professionals, age and experience are stronger indicators for voice health choices than professional subcategory. While insurance availability and believed credibility of internet information may influence choices, the older professional likely comes from a different perspective on voice care and performance, and understand the importance of longevity of career. They are also more likely to glean information and knowledge from conferences, journals, and past experience. The younger professional may be more likely to consider the internet, blogs, colleagues for primary advice and information.

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Do Vocal Performers Maintain Training Program Post College Degree?

Objective: Academic programs seek to prepare their musical theatre students for a successful and viable career through use of a consistent discipline in the performing arts.

Within the discipline of performing arts, musical theatre singers are required to have skills in voice, acting and dance. At present, there appears to be no minimum curriculum standards to prepare musical theatre majors. The aim of this study is to determine whether training patterns for recent graduate vocal performers differ when not in an academic program.

During an academic program, aspiring professionals must adhere to participation in voice, acting and dance training in many Bachelor of Fine Arts (BFA) programs and are held to even higher standards for Master of Fine Arts (MFA). Our survey targets graduates of programs with comprehensive versus minimal academic preparation to meet the degree requirements for BFA or MFA.

Methods: Recent graduates of musical theatre programs will be identified through survey links to professional theatre organizations. Subjects will describe their current choices in training post-degree completion. Musical theatre graduates will be queried on their performing arts preparation prior to and during their academic program compared to their first four years following graduation.

Results: We project that subjects will follow a pattern more closely aligned with their past history of training and preparation outside of academic years rather than during their academic years. It is further hypothesized that subjects will seek to return to the more rigorous academic schedule when they have an upcoming important audition.

Conclusions: Those students who excelled in regular, repeated preparation of roles in college are predicted to maintain steady pattern of self motivated practice and career preparation.

Educational programs are recommended to address self-motivation during summer term breaks to more fully prepare their alumni for achievement for their performance beyond academia.

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Motor Learning Feedback in the Voice Studio: An Observational Study

Objective: Motor learning literature suggests that the frequency and timing of verbal feedback can greatly influence the acquisition of motor skills. High frequency feedback(HFF) is optimal for learners in an early/cognitive phase and low frequency feedback(LFF) for learners in the associative and autonomous phases. Delayed terminal feedback is optimal for all learners. Typical voice pedagogical practice may not be informed by this literature. The purpose of this preliminary study is to quantify verbal feedback in the singing voice studio and compare its use to established principles of motor learning.

Methods: Employing CAPTain coding software, 96 hours of video-recorded singing voice lessons (4 voice teachers x 6 students each x 4 sessions per student) were analyzed and coded. Measures included instances and duration of speech/singing of the teacher and student. These measures were subdivided into speech, singing, and feedback/non-feedback vocalizations. Feedback was coded as "concurrent" (while the task is being executed), "immediate terminal" (directly after a task is completed), and "delayed terminal feedback" (pausing a minimum of three seconds after a task is completed). The skill acquisition level of the student will be assessed via a questionnaire completed independently by both the student and their teacher. Descriptive statistics and inferential statistics will be calculated to assess trends.

Results: Data collection and analysis are ongoing.

Conclusions: Implications for the use of feedback in the singing voice studio and its relation to feedback usage in the kinesiology literature will be discussed.

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The Analysis of Choral and Bel-Canto Singing with Acoustical Features and EGG Measurement

Objectives: Voice ensemble is one of the most accessible and popular musical activities. We would like to investigate the relationship between the timbral quality and phonation of choral singing. The majority of singing voice research in western music focuses on bel-canto singing. The voice training of choral singing is based on bel-canto singing. However, the vocal quality of choral singing, that aims for a unified sonority of multiple singers, differs from bel-canto phonation, which aims for an outstanding presentation of a solo singer. In our research, we present the acoustical analysis and EGG analysis of choral and bel-canto phonations, in order to examine the contrast between the two phonations both physiologically and acoustically.
Methods: Three professional baritone singers who practice both solo and choral singing participate in the experiment. We ask them to sing in both choral and bel-canto phonations, and conduct audio recording and EGG measurement simultaneously. The acoustic features such as MFCC, Harmonic-to-Noise ratio, Jitter, and Shimmer are calculated. For the measure of physiological condition, we calculate glottal open quotient and dEGG.
Results/Conclusions: We are still analyzing the data; but we anticipate to observe the contrast in glottal open quotient, which is known to correspond to the breathy and pressed quality.

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Accurate Measurement of Closed Quotient in the Singing Voice

One of the aims in the studio instruction of singers is to establish a favorable adjustment of glottal contact, avoiding the "breathy" and "pressed" extremes. The instrument of choice for monitoring this adjustment noninvasively is the electroglottograph (EGG). From the EGG it is easy to locate the contacting/closing moment, but the less abrupt decontacting/opening moment is more elusive, casting doubt on the accuracy of the measurement. This study will consider the accuracy of two recently developed methods for measuring the contact quotient in the voices of male and female professional singers:

1) "Evaluating Timbre Spectrum and Glottal Open Quotient via Pitch-Synchronous Segmentation of Voice Signals," presented earlier in this symposium by C.Julian Chen

2) VoceVistaVideo, which extracts glottal contacting and decontacting information from a signal with the high repetition rate of 48 Khz.

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Frequency Range Measures in Carnatic Singers

Objective: Frequency range measures in singers reflect their physiological capacity, vocal flexibility, training effects, strengths and limitations in singing. Since this information is vital for pedagogic and clinical purposes, this study aimed to measure the frequency range in Carnatic singers while singing different aspects of vocal music.

Method/Design: Practice task (singing glide from lowest to highest note) and performance task (singing a song with vocal ornaments) were recorded from 55 trained Carnatic singers (40 females & 15 males). The auditorily verified portions of various vocal ornaments in Carnatic singing (*aalapanai, pallavi, anupallavi, charanam & niraval*) were coded as separate tokens. A total of 385 tokens were analyzed using PRAAT software for estimating frequency range in semitones during practice task (SFR_{prac}) and performance task (SFR_{perf}). Descriptive, ANOVA, Tukey HSD, independent –t, & Mann- Whitney U were used for statistical analysis.

Results: SFR_{prac} was higher than SFR_{perf} in Carnatic singers. During practice, singers explored their physiological range to improve their vocal ability. However, during performance they tend to maintain a comfortable singing range to have a flawless rendition. *Aalapanai (most creative portion)* had the highest frequency range (females: 22.96 ST, males: 24.57 ST) than other types of vocal ornaments in performance signing. Practice frequency range (SFR_{prac}) and performance frequency range (SFR_{perf}) were not statistically different across both sexes.

Conclusion**:** This study described subtle nuances in singing using frequency range measures. Its clinical and pedagogic importance will be discussed.

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The Association of Vocal Load with Vocal Pathology and Differences Across Singing Genres

Objective: To investigate the association of vocal load with vocal pathology and differences across singing genres.

Methods/Design: An anonymous online survey was sent out to about 1000 professional singers through convenience sampling to touring companies, opera companies, musical theatre companies, agents, directors and musical directors. Facebook and other social media were used to solicit participation in the study. We utilized means and standard deviations for continuous characteristics and frequencies and percentages for categorical characteristics and calculated p-values to assess whether differences were statistically significant.

Results/Conclusion: Among 238 participants, 32% currently perform in the classical style, 33% in the musical theatre style (MT), 15% sing both classical and musical theatre and 20% in other contemporary styles. Participants in the combined classical/MT group were most likely to have a career outside of vocal performance and continue to work in that career (78%) followed by other contemporary styles (64%), classical only (52%) and MT only (48%); p=0.01. Participants in the combined classical/MT group were most likely to have a history of any vocal pathology (39%) followed by classical only (31%), other contemporary styles (29%) and MT only (27 %); p=0.61. However, participants in the other contemporary styles group were most likely to have a history of more than one different type of vocal pathology (13%) followed by MT only (5%), classical only (3%) and combined classical/MT only (0%); p=0.04. Mean number of hours per week of singing was highest for the MT only group (16.4) followed by classical only (15.6), combined classical/MT (15.4) and other contemporary styles (11.5); p=0.07. Surprisingly, in our sample, vocal load was not significantly associated with vocal pathology across singing genres. Anecdotal evidence from the survey's written responses does lead to some interesting qualitative findings related to risk factors for vocal pathology.

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An Acoustical Comparison of Western Classical and Musical Theater Male Singers-in-Training

Background: While much attention has been directed to the female Musical Theater (MT) voice, relatively little focus has been given to the male MT singer as compared to his Classical counterpart, with even less attention directed to the male MT singer-in-training. Furthermore, recent literature indicates that singing voice research is in need of an expanded set of protocols for acoustic analysis. Spectral moments offer the potential to improve our understanding of the differences between various styles of singing.

Objective: The purpose of this study is to examine and compare the acoustical characteristics of male singers in training in both Classical ($n = 15$) and Musical Theater ($n = 15$) genres through a specific analysis of spectral moments (spectral mean, standard deviation, skewness, kurtosis).

Method/Design: This study attempts to replicate aspects of the methods used by Bourne, Garnier, and Samson (2016) in the *Journal of the Acoustical Society of America*. Collegiate male singers-in-training for MT or Classical genres were asked to sustain a note for three seconds at four frequencies up to their highest comfortable range. Each singer produced these notes on two vowels [e] and [ɔ] for a total of five times each per stylistic quality. Classical singers employed registrational and resonance strategies typical of operatic singing while MT singers used the stylistic qualities of belt/"contemp" and legit. The middle three tokens of each participant were analyzed and an LTAS of the middle one second of each token was extracted. A *Praat* script was then implemented to compute various spectral moments for each token.

Results: Results are reported in light of creating a clear picture of the spectral moments for both the MT and the Classical male singers-in-training in order to understand acoustically what is heard perceptually by voice teachers, conductors, and audiences. As data collection is ongoing, specific results are not reportable at the time of this writing.

Conclusion: By investigating spectral moments in relation to these two different singing styles, this study may bring to light potential acoustic correlates to stylistic differences between MT and Classical male singing and could provide a foundation for future study of the biomechanical and physiological causes of said stylistic differences. Pedagogical considerations could embrace this newer method of acoustical examination in light of resonance qualities and registration.

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The Effects of Visual and Auditory Learning Stimuli on the Perceived Execution of Three Sung Vocal Onsets

Objective: Singing at a basic level involves an auditory experience. For many the old adage 'seeing is believing,' rings true, but for vocalists 'hearing is believing,' might be a more apt description of reality. However, it is quite possible that voice teachers too readily rely on their ears. The purpose of this study was to determine whether visual or auditory learning stimuli are an efficient means of teaching sung vocal onsets (aspirate, coordinated, glottal).

Method: Participants (N=40) constituted singers (n=30) and expert listeners (n=10). I asked the singers to perform three vocal onsets (aspirate, coordinated, glottal) under two different learning stimulus conditions (visual, auditory), as well as fill out a questionnaire related to preference. Visual learning stimulus constituted three pictures showing spectrographs of the three vocal onset types, and Voce Vista software which allowed the singers to view their spectrograph as they performed the three onset types. Auditory stimulus constituted a recorded vocal model of the three onset types. I recorded total of 180 onset excerpts, and asked expert listeners to analyze 36 randomized onsets using a Visual Analogue Scale.

Results and Conclusions: Results indicated strong singer participant preference for auditory learning stimulus. Analysis of expert listener onset type agreement showed little difference in overall performance between the two learning stimulus modes with some singer participants even performing better in the learning stimulus mode that they expressed a lower preference rating for. Results indicate that vocal pedagogues should introduce vocal onset through an auditory means and then use a visual stimulus to offer further insight.

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Aerodynamic Characteristics of Growl Voice and Reinforced Falsetto in Metal Singing

Objective: Some vocal sounds would probably be categorized as pathological and hyperfuctional vocal qualities if they were produced by nonsingers during conversational voice usage. However, these sounds are typically used as expressive and stylistic vocal resources by some contemporary commercial music singers. Two of these vocal resources are the growl voice and the reinforced falsetto, which are commonly used in metal singing. The present study aimed to assess aerodynamic characteristics of vocally healthy metal singers during production of growl voice or reinforced falsetto.

Methods: Sixteen subjects who performed growl voice and seven subjects who perform reinforced falsetto as a voice resource during metal singing were included in the present study. All participants were asked to undergo rigid laryngeal videostroboscopy to confirm the absence of laryngeal pathology. Then, subjects underwent to aerodynamic assessment while performing growl voice or reinforced falsetto.

Results: Higher glottal airflow rate and subglottic pressure for growl voice samples compared to the speaking voice production (keeping the same F0) were found. Lower airflow rate and higher subglottic pressure for high pitch reinforced falsetto compared to naive falsetto were found.

Conclusion: It seems that growl voice is produced by decreasing vocal folds adduction and increasing subglottic pressure, which in turn, promotes an increased airflow rate. Reinforced falsetto is characterized by an increased vocal fold adduction and an increased subglottic pressure. The former being greater than the latter. Thus, a decreased airflow is observed. Likely a proper resonance strategy in reinforced falsetto and a decreased glottal adduction in growl voice could be the factors that contribute to the avoidance of voice problems in singers that use these vocal resources that are classically labeled as vocal abuse.

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Redefining the Singer's Formant According to Perceptual Qualities: Singer's Formant-like Peaks in Sopranos Singing Above C5

Voice pedagogy literature presents the Singer's Formant (F_s) as a characteristic of the male singing voice, absent in females above C5 (e.g. Bartholomew, 1935; Vennard, 1967; Sundberg, 1987; McCoy, 2005; and Bozeman, 2013). The term Singer's Formant Cluster (SFC) further genders this phenomenon by incorporating how male singers tune f_{R3}-f_{R5} to maximize intensity (Sundberg, 2003). Anecdotally, many classical sopranos find this exclusively male definition lacking, as it fails to capture the bright, buzzy, ringing qualities present in their voices. If perceptual qualities such as auditory roughness and absolute spectral tone color (Howell, 2017) define the male F_s, one may search for similar qualities above C5 in the soprano voice, albeit in a higher frequency range than found in men. This study explored the presence of such qualities (high intensity harmonics $>4f_o$) in the soprano voice in the pitch range excluded by the current definition of the F_s.

Following an encouraging pilot study ($n = 4$) of lyric soprano, graduate students at the New England Conservatory of Music (presented at the 2017 Society for Music Perception and Cognition conference), this study included more singers and a variety of *fächer*. Spectral and graphical analysis were performed on samples from an ascending scale (A♭4 to the singer's upper usable limit) to characterize the distribution of energy in the spectral peaks that elicited auditory roughness. Results were categorized by the intensity of such peaks relative to f_o, and structural properties of the peaks themselves. The authors believe that defining the F_s perceptually and searching for such qualities where they arise in the female voice—what is present rather than what is missing vis-à-vis a male voice—allows one to consider how these F_s-like peaks are characteristic of, rather than incidental to, the timbre of the soprano voice.

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Rebecca Worthington, GD, MM

A Review of Singing Voice Sub-system Interactions

In accordance with the myoelastic-aerodynamic and the source-filter theories, the human voice production system is typically described having three sub-systems: the respiratory system (the power source), the larynx (the sound source), and the oral and nasal vocal tracts (the sound modifiers). These sub-systems can interact during sound generation, where physiological action in one system has a direct mechanical consequence in another sub-system.

Here, three major such synergies are reviewed, creating a pedagogical model of voice sub-system interactions: (1) Vocal tract adjustments can potentially influence the behavior of the voice source via non-linear source-tract interactions; (2) the type and degree of vocal fold adduction controls the expiratory airflow rate; and (3) the tracheal pull caused by the respiratory system affects the vertical larynx position and thus the vocal tract resonances.

The pedagogical relevance of the presented model is discussed, suggesting, amongst others, that functional work on a particular voice sub-system may have side effects or benefits on other sub-systems, even when targeting a clearly defined and isolated physiological goal.

Reference:
Christian T. Herbst (2017). A review of singing voice sub-system interactions - towards an extended physiological model of "support". Journal of Voice, 31 (2), 249.e13--249.e19

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Towards an Extended Physiological Model of "Support"

The notion of "support" and the closely linked concepts of "*appoggio*" and "breath control" are central elements in singing voice pedagogy. They have received much scholarly attention in the past and present. Over several centuries, scholars have proposed a number of definitions, some of which contain apparent contradictions.

Several of these concepts are reviewed here, and their physiological and physical relevance is discussed in the context of the model of interactive voice sub-systems [1], as outlined in the previous presentation. In particular, I will discuss to which degree the respective definitions of "support" cover or neglect the three voice subsystems: the respiratory system (the power source), the larynx (the sound source), and the oral and nasal vocal tracts (the sound modifiers).

Based on this analysis, I argue that ostensible inconsistencies between various definitions of "support" can be resolved by putting them into the wider context of the subsystem interaction model presented here, thus offering a framework for reviewing and potentially refining some current and historical pedagogical approaches.

In a broader context, this presentation advertises the value of physically and physiologically informed approaches for singing voice instruction, paving the way for evidence-based voice pedagogy.

Reference:
[1] Christian T. Herbst (2017). A review of singing voice sub-system interactions - towards an extended physiological model of "support". Journal of Voice, 31 (2), 249.e13--249.e19

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IPA Hand-Jive: Using Gesture for Shaping and Voicing IPA Symbols

Learning the International Phonetic Alphabet and producing the sounds is often challenging for the beginning student of voice and speech for actors. Mastery of the system is critical for the study of the basic work and continues on into the advanced work including the study of accents and dialects.

While much of the training often relies on description of the actions of the articulators, imitation of the teacher or recorded sound, use of a mirror to see what the articulators are doing, I have found that engaging a series of gestures reinforces a kinesthetic connection to the production of each phoneme. The connections are supported with additional guidance and direction as needed.

In this experiential workshop, all the participants will be guided through these specific gestures and gain their own kinesthetic connection with the basic sounds of the IPA. To start, we will focus on the shape, production and voice of the vowels and diphthongs.

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Adapted Yoga Techniques for Voice Therapy and Singing Voice Rehabilitation

Voice clients often present with behavior patterns that negatively impact effective integration of respiration, phonation and articulation in their speech and/or singing. Improving voice production requires therapeutic approaches that can appropriately and effectively target a client's specific challenges. These may include structural weakness/tension/imbalance, sub-optimal respiration patterning, and symptoms of chronic stress.

Adapted yoga techniques can be effective holistic tools for addressing these challenges. They emphasize the integration of mindfulness - attention to sensory/emotional attributes - with training tasks in movement, breathing, and voicing.

Adapted *āsana* (moving in and out of or maintaining specific body postures) can strengthen weak muscle groups or facilitate relaxation and stretch of chronically contracted ("held") muscle groups. It can be especially helpful in developing optimal postural relationships of the head, neck, shoulders and torso.

Adapted breath work (*prānāyāma*) can be used to increase awareness and control of respiratory movement patterning, which can increase control of tidal volume and inhalatory and exhalatory flow rates. It is also a potent tool for managing negative stress response.

This interactive workshop will provide a brief overview of the tools of yoga, then demonstrate examples of adapted yoga (movement and breath work with focused attention) for use in voice therapy and singing voice rehabilitation.

Kenneth Tom, PhD, CCC-SLP, RYT, C-IAYT, Associate Professor Emeritus, California State University Fullerton, Department of Human Communication Studies

Connecting to the Negro Spiritual: Emotionally, Musically and Vocally

The arranged Negro spiritual has become iconic in the world of classical music. This music genre holds historical, cultural, sociological and developmental meanings. Negro spirituals speak of life and death, suffering and sorrow, love and judgment, grace and hope, justice and mercy. Their texts and rich music texture have no racial specificity; especially in terms of who can sing them.

This workshop will examine specific exercises for developing emotional expression for a deeper meaning of the text in a "hands on" experience. It will examine storytelling through varying dynamics, coloring of tone and varying the use of vowels and consonants. The workshop uses a hands on and skill building delivery style, interacting with participants and working with singers on spirituals to examine specific ways to connect emotionally and vocally, resulting in the singer presenting their song in a compelling manner.

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From the Studio to the Conference Call

Three common vocal problems facing executive voices and how singing teachers can translate solutions into business speak and get results.

Challenges:
Executives have usually never even thought about the importance of their voice even though they use it in their work more than many singers. Therefore they run into problems with being heard and understood, and often suffer from vocal fatigue. Vocal issues can impact their daily effectiveness or even their career success. That being said, most executives have little time to devote to developing their voices and may not be interested in studying singing.

Benefits:
Most executives are willing to try exercises that improve their ability to influence others if they can implement them easily and if the approach seems relevant to their business. They are also happy to learn about issues of which they were not aware as long as there is also a solution to implement. Voice professionals have those solutions in the studio, and can easily adjust them to be understood and applied by executives.

How to get results:
Using the results of work with hundreds of business people, we will discuss the top three vocal challenges that executives face in business today. Working individually and in pairs, we will explore vocal studio exercises that answer those issues, as well as how to discuss them so that executives will listen.

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Head/Neck Massage and Relaxation Techniques for Voice Therapy and Overall Health/Wellness

Objective: Laryngeal massage and Head/Neck exercises and self-massage have been used to successfully help singers and other artists. In therapeutic practice, they have been used by physicians and other health care providers to relieve the symptoms of vocal strain (asthenia) and vocal fatigue. Mathieson et al showed positive evidence for laryngeal manual therapy . . . in the treatment of hyperfunctional voice disorders. Roy states that "Manual Circumlaryngeal Techniques serve as powerful diagnostic and treatment tools."
In the teaching studio, they have been used to help with excess muscle tension in the head and neck, to aid in balanced alignment, and as tools for warm-up and cool-down. Combining the expertise of a voice teacher/singing voice specialist and an ENT surgeon, with input from an Alexander Technique specialist, a licensed massage therapist, and a licensed physical therapist, this workshop will demonstrate a series of massage and self-massage techniques and relaxation exercises for the head, neck, and laryngeal areas, providing a theoretical rationale for their efficacy.

Method: Leaders will demonstrate and instruct workshop participants in techniques of laryngeal massage, head/neck massage, self-massage, and in head/neck exercises intended to improve alignment and increase relaxation and optimal functioning for singers and other artists. A take-away handout will be available for participants. Theoretical rationale for the techniques and exercises will be included.

Results: Participants will observe demonstrations of and try out massage and exercises that can be applied in their areas of expertise. They will be able to ask questions, so they can utilize these techniques in individual teaching studios and practices.

Conclusion: With demonstration and discussion of laryngeal and head/neck massage and exercises, this workshop will share and encourage the use of safe and helpful massage techniques and exercises that can be utilized by participants with students and patients.

Deanna McBroom, MM, Professor of Voice, Director of the Voice Program, Singing Voice Specialist, College of Charleston , Medical University of South Carolina

Lucinda Halstead, MD, Associate Professor, Medical Director, Evelyn Trammell Institute for Voice & Swallowing, Dept. of Otolaryngology HNS, Medical University of South Carolina, MUSC 550, 135 Rutledge Ave, Charleston, SC 29425

What the Fach? Voice Dysphoria in the Transgender and Genderqueer Singer

The Oxford dictionary defines *dysphoria* as "A state of unease or generalized dissatisfaction with life." We understand that *gender dysphoria* means that this dissatisfaction is with one's gender. Based on my work with singers in this population, this presentation will explore the phenomenon of *voice dysphoria* as it relates to transgender and genderqueer singers. One's vocal identity may not be in sync with their perceived or presented gender. As voice teachers we may be asked to work with an individual who is not only uncomfortable with their gender, but also with their voice as it relates to that gender. Questions will be raised and discussed about how we may need to adjust the way we think about teaching these singers beyond the binary.

Voice dysphoria may happen to any singer who undergoes a *Fach* change in their training. We have all experienced mezzos who become sopranos or baritones who become tenor, for example. How much more uneasiness might be experienced by the transgender or genderqueer singer who may or may not be able to separate their voice and their gender in a non-binary way? Consider the successful operatic baritone who is a transgender woman. Or the transgender man who cannot adapt to the tenor or baritone voice which evolves after testosterone treatment. I will explore singers who are making these non-traditional choices.

My initial research presentations about working with transgender singers did not go into detail about issues that might be present with a genderqueer student. The term genderqueer may not be familiar to everyone, but these individuals may feel that they are neither male nor female, or both male and female, or some combination of the two. This would mean anything that falls outside of the binary cisgender normative designation of gender. As a singing teacher, this raises many questions about how to work with and categorize these singers and how to prepare them for auditions into academic programs and competitions.

Loraine Sims, DMA, Associate Professor, Edith Killgore Kirkpatrick Professor of Voice, Voice Studies Division Chair and Vocal Area Coordinator, Louisiana State University

The Power of the Psoas Muscles for the Speaker

Access, relax, and incorporate psoas muscles in vocal production. Discover the power of psoas muscles in providing vocal support. Explore the relationship between proper use of the psoas muscles and ease in rib-expansion. Exercises range from gentle to physically challenging: exercises for all levels of flexibility and strength. Please wear comfortable clothing and bring a short piece of memorized text (not mandatory). Participate and/or observe.

Donna Snow, MFA, BA, Associate Professor, Voice & Acting, Dept. of Theater Temple Univ, Tomlinson Theater, 1301 W. Norris St., Philadelphia, PA 19122

Practical Application of the Electroglottograph (EGG) in Singing Instruction

Of the major components of the singing voice -- power source, vibrator, and resonator -- the action of the vocal folds is the most difficult to access and measure. The electroglottograph (EGG) offers what is easily the most practical means of observing that action non-invasively. However, because 'reading' the EGG signal is challenging, and because the details of vocal-fold action are the locus of such a large part of individual variation among singers, singing voice science suffers from a severe lack of data and information from which to draw generalized, helpful rules.

The purpose of this workshop is to present some basic information about what the EGG signal can reveal in assessing the vocal "material" that comes with the individual singer, as well as providing feedback in the training that occurs in the voice studio.

Note: Since displayed feedback from non-invasive signals will play an essential role in guiding and evaluating the efforts of the singer subjects, an exception to the rule against use of audiovisual aids is requested, as has sometimes been granted in past symposia.

Donald Gray Miller, PhD, MM, Groningen Voice Research, Groningen, The Netherlands

Strategies and Techniques for Addressing Tongue Tension in Singing

Tongue tension is one of the most common and pertinent aspects of vocal technique. The location of the tongue and the interrelatedness of its musculature enable it to potentially impact the function of the jaw, velum, pharynx, and larynx. As a result, a pedagogical approach that focuses directly on the tongue can have a wide-ranging impact on technical outcome. This workshop will include: (1) an extensive handout detailing approximately forty specific methods that are effective in remediating tongue tension in singing, (2) demonstration and practice of techniques with the audience, and (3) identification of tongue issues and application of strategies through master class singers.

Note: In 2011, I presented a similar workshop for the Voice Symposium. Since that time, I have developed a significant number of additional strategies that are particularly effective and generally yield immediate results.

Carla LeFevre, DMA, Doctor of Musical Arts, Professor of Music, School of Music, Music Building, University of North Carolina at Greensboro, Greensboro, NC 27412

Spending the Interest, Not the Principal: Vocal Pacing During Voice Rehabilitation and Beyond

Singers are vocal athletes, and like athletes, must maximize range, endurance and coordination but avoid crossing the line into overuse or strain. This is especially critical when recovering from a vocal injury. Historically, vocal healthcare providers have recommended "voice rest" as part of the regimen for recovering from a vocal injury, but what is the appropriate amount of rest? How does a singer keep their voice in shape, and still observe adequate "rest" to allow for healing?

In this workshop, the instructor will explore a number of processes necessary to ensure that the voice is receiving adequate exercise during rehabilitation, but in a manner that supports the healing of the injury. The information covered in the workshop will also be applicable to prevention of voice injury. These principles will be explored primarily via hands-on demonstration with singers, but also through case examples and audience interaction. Topics explored will include:

- Principles of wound healing and tissue change during exercise
- What we know about vocal rest so far
- Counseling/educating singers about vocal pacing
- What is marking? How do you do it? When do you do it? How do you teach it?
- Vocal demands vs. actual amount of singing voice use
- Strategies for unloading non-productive or unnecessary voice use and prioritizing vocal demands
- Strategies for optimizing vocal practice time
- Vocal warm-up vs. technical practice
- "Tailoring" vocal exercise routine based on the singer's injury, singing style and experience
- Application of skills learned in vocalizes to repertoire

Leda Scearce, MM, MS, CCC-SLP, Clinical Associate Faculty, Duke University School of Medicine, Director of Performing Voice Programs and Development, Duke Voice Care Center

Consider the Source: Exercises and Techniques to Develop Efficient Glottal Closure

Some beginning voice students display considerable breathiness that may appear to be hard to remedy. Voice teachers continue to work breath intake and "support" as a means to remedy this breathiness; however, the student may still remain breathy and may have a difficult time sustaining a long sung phrase. Similarly, more advanced students often suffer from an overly pressed closure with symptoms of neck, tongue, and jaw tension. The student may work months, sometimes years to no avail, to release these tensions through a variety of tongue, jaw, and neck exercises.

Anatomically, the muscles pertinent to closure include the lateral cricoarytenoids, which pull the vocal folds together, and the interarytenoids, which close the back portion of the glottis. The vocal folds cannot vibrate efficiently if they are not brought together in an appropriate manner (Titze, 2000), and the ability to efficiently close the glottis determines much of subglottal pressure and what voice teachers often term "breath support" (Cottrell, 2010). Similar to the embrouchure of other instrumentalists, the glottal closure meters the breath. Therefore, a closure that is too loose or too pressed produces an undesirable tone quality that could easily be altered by simply adjusting the glottal closure.

This workshop will explore a large variety of vocal exercises that establish efficient glottal closure with singers of all vocal styles. We will begin by discussing an optimal closure that is neither pressed nor breathy and how to elicit that closure from singers of all experience levels. We will then discuss how glottal closure and vertical fold depth can change based on the vocal style being performed and optimal techniques for establishing a closure appropriate for belt/mix vocal styles. The workshop will utilize vocal exercises that aim to directly influence the vocal mechanism and its coordination. This workshop will include information relevant to all experience levels and encourage active audience participation and interaction.

Amelia Rollings, Ph.D., M.M., Assistant Professor of Musical Theatre Voice, Western Kentucky University, 1906 College Heights Blvd. #71086, Bowling Green, KY 42101-1086

Self-Care for the Vocal Health Professional: Strategies and Practice in How to Care for Your Voice and Body While in the Midst of Helping Others

This experiential workshop will explore strategies of vocal and physical self-care that can be employed in both voice teaching and voice therapy settings. Using the Lessac System, participants will draw on familiar events to access and recognize the kinesthetic vibratory sensations inherent in a healthy resonant speaking voice. We will explore how the pleasurable feeling of resonance can serve as a relaxing and energizing tool to maintain vocal health, stamina, and ease. We will then use principles from the Alexander Technique to practice the skill of attending to your student or client while effortlessly monitoring yourself and making choices about your own vocal and physical use. Ultimately, we will practice applying these tools to everyday teaching and therapeutic situations. This workshop will be particularly useful for vocal educators and therapists who are called upon to use their voices for many hours a day while focusing on the vocal needs and progress of the people they help.

Diane Gaary, M.F.A., Temple University, Philadelphia, PA, Arcadia University, Glenside, PA, and Westminster Choir College, Princeton, NJ

Up and Out –Finding the Spine in Acting

This workshop will allow participants to explore imaginative and kinesthetic ways to integrate voice and the Alexander technique to allow for more vocal and physical freedom. Participants will examine ways to fully embody text or song without forcing vocally or constricting physically.

Participants will be encouraged to use imagination and humor to find more vocal and artistic expression.

Participants are also welcome to bring material for presentation to work on in the class.

Please wear loose fitting clothing and soft shoes or stocking feet to be able to move and do floor work.

Janet Madelle Feindel, MFA, Professor, Voice/Alexander Technique, Carnegie Mellon University, School of Drama, Purnell Center, Pittsburgh, PA 15213

MPT of /s/, /z/, and /z/ a Clinical Goldmine

Maximum phonation time (MPT) is a commonly used indicator of respiratory efficiency in voice assessment. The s/z ratio, comprised of the MPT of /s/ compared to /z/ was suggested by Boone (1977) to assess glottal incompetence. Subsequent studies of MPT (vowels and /s/, /z/) in children and adults found a high level of variability in MPT within and across subjects, rendering attempts at establishing meaningful norms virtually impossible. As a result MPT as a tool to differentiate normal from disordered voices has lost favor.

However, a great deal can be learned clinically by observing patients performing the MPT of /s/, /z/ and /a/. The results of a recent study of MPT of 221 patients referred for voice therapy indicated significance in the differences between /s/, /z/ and /a/. Pairwise comparison showed significant difference between in MPT on /z/ and /s/ (p-value = 0.014), and on /s/ and /a/ (p-value < 0.001). No statistical significance was found in MPT of /z/ and /a. In 20% (44/221) of the patients the /s/, /z/, and /z/ were essentially equal in duration. However for 28%, (62/221) the S was longer than the voiced /z/ and /a/; in 18% (39/211) the semi-occluded sounds were longer than the open vowel /a/. Each pair suggesting that different mechanisms were at play - either semi-occlusion or voicing.

Observation of the patient and close attention to the quality of the sounds can provide valuable clinical information as to the patient's respiratory phonatory coordination, or use of compensatory tension.

This workshop will explore these relationships, relate them to common respiratory patterns seen in patients and discuss strategies for developing a meaningful therapy plan based on these findings.

Marina Gilman, MM, MA, CCC-SLP, Speech Language Pathologist, Emory Voice Center, Department of Otolaryngology Head and Neck Cancer Emory University

The Voice Teacher as Fitness Trainer: Adapting Principles of Sports Science to Optimize Laryngeal and Articulatory Efficiency

Elite athletes rely on the expertise of athletic trainers for achieving balanced length/tension relationships throughout major muscle groups and cultivating full range of motion through their joints. Many of the techniques that can help a pitcher develop a 100 mph fastball or a gymnast perform an effortless handspring are highly applicable to the muscles and joints responsible for vocal range, registration and articulation. This workshop will demonstrate the use of Corrective Exercise principles to alleviate tension and restore balanced strength and flexibility throughout the vocal mechanism. Participants will explore techniques for improving laryngeal and articulatory coordination in the context of a voice lesson or practice session.

Claudia Friedlander, DMA, Voice Teacher & Fitness Trainer, Weill Music Institute of Carnegie Hall, 154 W. 57th St., New York, NY 10019

Beyond Park and Bark

Emotional expression of text during a choral performance appears to be a struggle for many choristers, often resulting in what has been referred to as a "Park and Bark Performance." While a choir may perform with precision and present an aurally pleasing concert, lack of facial and/or body expression often produces an uneven experience for audience members.

Objective: This workshop will provide attendees with effective strategies for engaging students' entire bodies by incorporating improvisational theatre games into choir rehearsals.

Viola Spolin (theatre pedagogue) developed a series of improvisational games designed to teach theatre students how to engage audiences by using their entire bodies on stage. Drawing from their personal experiences integrating these games into university choir rehearsals, the presenters will lead participants in improvisation activities aimed at improving one's awareness of their entire body as an expressive tool. These games proved effective in improving university choir members' ability to express musical text and strengthening their feelings of social identity within the choir. All workshop participants will actively participate in singing, playing structured improvisational games, and providing active feedback to each other. At the conclusion of the workshop, attendees will also receive an information sheet with a recommended schedule of games along with strategies for successful integration into the choral rehearsal.

Danielle Bridges, BM, Student, University of Central Arkansas, 201 Donaghey Ave., Conway, AR, 72035

Sheri Cook-Cunningham, PhD, Assistant Professor of Music Education, University of Central Arkansas, 201 Donaghey Ave., Conway, AR, 72035

MythBusters for Singers

How you sing and *how you sound* is a direct result of *how you think* about singing.

What thoughts or concepts do you (and/or your students) believe about your (your/their) singing?

Do you believe that…
- High notes are out of your range?
- Singing is difficult?
- You can't get enough air into your lungs to sing a phrase?
- Powerful singing means a powerful push?

These are myths - *a belief, idea or story that has no basis in fact* – and can be busted so the truth of natural technique guides singing.

Discover With MythBusters for Singers. . .
- How to help your students discover the myths they believe about singing
- Strategies to stop these crazy myths from controlling the voice
- Truths to replace the myths

MythBusters for Singers helps you implement…
- Singing free and easy
- Singing powerfully without strain
- Breathing with ease

Sally Morgan, BA, CEO of Sally Morgan Voice, 15 W 139 St #14M, New York, NY 10037

Meeting the Mood: Transforming the Vocal Warm-Up

When entering the voice studio or clinic, singers often demonstrate particular moods. A variety of emotions ranging from frenzied to fatigued can influence the lesson environment, increasing physical tension and mental stress for both student and teacher/clinician.

LifeForce Yoga offers a system of evidence-based practices for anxiety, depression, and trauma. When incorporated into the warm-up, these techniques can help balance the student's disposition, while at the same time providing an effective tool for establishing focus, breath, and vocalization.

This workshop will provide simple breathing, sound, and physical techniques for calming anxiety and energizing lethargy. Participants will learn how to "meet the mood" of their students and incorporate mind-body balancing strategies into their existing warm-up sequences.

Megan Durham, MM, Cert. SVS, RYT, LFYP; Muhlenberg College, DeSales University, & Moravian College Voice Faculty; Affiliate of Bethlehem, ENT 3445 High Point Blvd, Bethlehem, PA 18017

Troubleshooting Vocal Function Exercises: What to Do When the "/ol/" Won't Buzz

Vocal Function Exercises (VFEs), developed by Dr. Joseph Stemple, CCC-SLP, have been both scientifically and clinically proven as an excellent therapeutic tool in a variety of populations (normal voices, singers, presbylarynges patients, patients with phonotraumatic lesions, teachers, etc). Despite the wealth of studies outlining their efficacies, many voice therapists do not use them in their daily clinical practice. The biggest hurdle facing clinicians may be the "dreaded buzzy /ol/," due to a lack of confidence in teaching this technique or insecurity in their own ability to perform it.

This workshop will aim to help clinicians gain confidence in teaching traditional VFEs, while also embracing the many ways VFE technique can be slightly modified if the "buzzy /ol/" just won't work. We will discuss and demonstrate our favorite tips and tricks for mastering and teaching "buzzy /ol/" and go over the several semi occluded vocal tract postures that can be substituted. Participants should leave feeling confident in performing and teaching VFEs regardless of their patients' skill level.

Carly S. Cantor, MS, CCC-SLP, Voice Pathologist, Singing Voice Specialist, Columbia University, Voice and Swallowing Center

Kimberly Duncan, MA, CCC-SLP, Speech-Language Pathologist/Voice Pathologist, Columbia University Voice and Swallowing Institute

Watch Your Tongue! Ultrasound & Physioacoustic in the 21st Century Voice Studio

Have you ever watched and/ or consciously paid attention to your tongue when you talk or eat? Since the Nair's collaborative research of the *Low Mandible Maneuver and Its Resonential Implication for Elite Singers* (JoV 2016), Angelika Nair has pioneered the use of the ultrasound (US) in the voice studio as a way for students to study their own tongue behavior during phonation. Using US, the tongue can be seen in real time on the screen as the singer sings, which makes it a powerful tool in the voice studio.

However, being able to maneuver the tongue more deliberately is not only useful for singers but also actors, clinical settings and the language classroom. The tongue is one of the most malleable organ in our body and solely comprised of muscles, which enables it to retract and extend at the same time. As fascinating as this is, it is also one of the main reasons – because of the interconnection with the entire vocal tract, why it is so difficult to deliberately maneuver it without resulting in rigidity in both the tongue and the larynx.

Even within our automated speech template, oral sensory awareness and perceiving the precise position of our tongue is often a challenging task, creating tension that greatly affects phonation and resonance for both singing and speaking. Thus, it requires a slow development of precise motor sensory skills of tongue movements to build awareness and subsequently ensure an intentional relaxed control. In turn, this control enables the singer/ speakers to create maximum and consistent resonance in all phonemes – ensuring intelligibility and tone throughout, but also to use the changes within the tongue for timbre and/ or stylistic reason, such as belting and screaming.

By working with US and imagery derived from US, Angelika Nair has found a regiment of exercises combined with step-by-step instructions and pedagogical tools that help accelerate the learning of various vocal strategies (physioacoustic) and improve the multitudinous challenges of sensory awareness, flexibility and control within the tongue. Yet, tension in the tongue is not only due to the tongue. Which is why additional focus will be payed to other body mechanics, such as head, neck and jaw, by starting with proper body posture. Exercises and strategies combined with principles from various methods of conscious control and awareness in movement (Tai Chi, Qigong, Alexander Technique) will help free the tongue, body, mind and ultimately the voice.

Angelika Nair, PhD, Vocologist (NCVS), Pro Voce LLC, Voice Faculty, Drew University, 36 Madison Ave., Madison, NJ, 07940

How to Help Your Patient Who Can't Breathe or Stop Coughing

Introduction Speech-language pathologists (SLPs) who specialize in voice disorders are increasingly evaluating and treating patients across the life span who present with non-pulmonary, non-neurological airway disorders – specifically paradoxical vocal fold motion disorder (PVFMD) and non-specific chronic cough (NSCC). Prior to receiving an accurate diagnosis, these patients have been subjected to extensive medical and pharmacological treatment and interruptions in their school, sports, and/or work routines. When the patient enters the SLP's office they (and their accompanying family member) are anxious and skeptical. This requires the SLP to be adept and expedient in administering treatment techniques.

Objective/Method Although both PVFMD and NSCC affect the laryngeal airway, behavioral treatment strategies for these disorders are different. The purpose of this workshop is to teach attendees therapy techniques for controlling and/or eliminating NSCC and PVFMD by having the attendees perform the techniques and then teach them to one another. Each disorder will be addressed separately. Specifically, attendees will learn to effectively:
1) Explain each disorder to the patient (regardless of age) so that the patient (and family member) is/are receptive to treatment.
2) Teach the most salient behavioral techniques for each disorder, based upon motor learning and exercise physiology principles.
3) Use materials and strategies for each disorder that benefit both declarative and procedural learning.

Results/Discussion During the past 20 years my clinical work and research have focused on understanding and treating disorders of PVFM and NSCC. I have presented papers, posters, and lectures on these topics in several venues including ASHA Conventions and Voice Foundation Symposiums. My latest research involves developing and piloting a short-term intensive treatment following treatment fidelity principles, for athletes with PVFMD. The results for 11 participants revealed statistically significant post-treatment quantitative objective (respiratory resistance) and subjective (Dyspnea Index and Borg Dyspnea) results, that were maintained 6 weeks after treatment ended. NSCC is a diagnosis based upon excluding other diagnoses. Less is known about the effectiveness of SLP-provided behavioral therapy in part because of the ethical dilemma of a no-treatment control group (Haydour et al., 2014). My data for 30 pediatric/adolescents/teens with NSCC revealed that following two treatment sessions, 77% of the participants experienced complete resolution of their cough (Gallena & Kerins, 2014). It is incumbent upon the SLP to provide effective treatment for NSCC, so that evidence-based therapies can be established and the medical profession will value our role in treating this disorder.
Conclusion I am excited to share treatment techniques for PVFMD and NSCC that I have used and refined over many years of working with patients with these disorders.

Sally Gallena, PhD, CCC-SLP, Assistant Professor, Dept. of Speech-Language-Hearing Sciences, Loyola University MD, 4501 N. Charles St., Baltimore, MD, 21210

"Sing for Life": Strategies for Singing after 50

Description:
This interactive workshop will introduce vocal, physical and mindfulness exercises that keep the older voice vital and appealing. Topics include initiatives that improve vocal quality, stabilize vibrato, and increase range and stamina in older singers. Strategies for accurate tuning despite hearing loss will be addressed. The practices to be demonstrated have proven their worth for solo and choral singing circumstances. The exercises and singing activities have also been used to strengthen speaking and singing voices of patients suffering from Parkinson's disease, COPD and other degenerative conditions while enhancing a sense of general well-being.

Learning Outcomes:
Participants will develop a deeper understanding of what to expect vocally, physically, and spiritually when singing or speaking after the age of 50. Useful exercises will be described and practiced. Repertoire choices and performance strategies are included in the workshop materials. The application of the exercises to the vocal needs of persons suffering from PD, COPD and other degenerative conditions will conclude the session.

Brenda Smith, DMA, Associate Professor of Music, University of Florida, Gainesville, FL, Co-Founder, "Sing for Life"

Understanding and Using Rehearsal and Performance Space Acoustics as a Solo or Choir Singer

Objective: To provide background understanding and guidance on the acoustics of rehearsal and performance spaces in a form that is applicable to solo and choir singers.

Methods/Design: Room acoustics is a science that is well established but not necessarily well known by vocal performers since it is essentially a 'hidden' facet of rehearsal and performance spaces. The basic physical paths taken by sound in a space will be introduced and illustrated by inviting participants to be the sound sources. Then consideration will be given to physical features within the space that the workshop happens to be placed within (the larger the better), and how they affect the overall listening experience of performer, conductor and listeners alike. The sound heard in various parts of the space will be explored using impulse responses (e.g. unison hand claps by participants) and a choral input (simple chords and perhaps a round) by some workshop participants while everyone else listens in various parts of the space with opportunities for participants to swap around so that everyone can listen.

Results: The expectation is that listeners will perceive changes within the space that are indicative of the acoustic properties of the space and how it would be to listen to a performance or perform within the space.

Conclusions: The intention is that participants will improve their understanding of the acoustics of spaces and how that knowledge can be used in their singing rehearsal and performance work to good effect.

David M. Howard, FREng, PhD, BSc (Eng), Head of Department, Department of Electronic Engineering, Royal Holloway, University of London

Body Awareness Training for Singers and Voice Teachers

The aim of the workshop is to facilitate greater body-mind connectivity and ease of voice production for singers. Chen's teaching strategies will aid voice teachers in their ability to "see" and identify inefficient body alignment of their students, and have practical ways to assist them in overcoming these types of challenges. It will also help voice teachers to gain more comfort and confidence in applying touch to guide their students for placement adjustment and tension release mechanism.

The workshop will begin with an introduction to key verbal cues that Chen devised to help participants quickly and effectively access a more efficient body alignment. Participants will engage in mindful meditation and hands-on partner bodywork designed to bring the participant "home" to his/her body. A series of gentle yet full-body stretching and conditioning exercises will be introduced to liberate the body from conscious or unconscious tension holding patterns while appropriately warming up the physical and energetic systems of the body. This work will enhance breath support, freedom in the head-shoulder relationship, and ease in the hip sockets, knees, and ankles. It prepares the singing body to be energized, present, free and ready to sing!

Ting-Yu Chen, MFA, Dance Division Chair, Associate Dean for Student Affairs, Professor of Dance, Shenandoah Conservatory, 1460 University Dr., Winchester, VA 22601

French Pronunciation in Song

This 55 minute workshop will develop in 2 parts:

1) During the first 15 minutes, I will present my points of view on the different aspects of French pronunciation, its specificity and difficulties, in relation with vocal technique. A proper use of French phonetics allows the continuity of the speech to be suitably emphasized by the breath according to musical standards. I will clearly underline the importance of accentuation in the language which is very often neglected in the study of proper lyric diction. This contribution therefore claims to be a complement and not a new version of the handbooks found all over the world.

2) The second part could develop as a masterclass or practice by 4 students or volunteers. 4 pieces of French vocal music (baroque, romantic opera, melodies and modern French chanson) will be sung and I will propose my ideas and advice to make the text intelligible, aesthetically satisfactory to a French ear and faithful to the style of the piece.

There exist so many rules in French pronunciation that they prove almost impossible to apply. Singing teachers try either to follow laws that don't always exist in practice or imitate old singers who are supposed to own the truth. Both position are respectable and can be sources of real insight. Nevertheless, the most reliable tool is to master the phonetic nature of the spoken language insisting on the 2 levels: segmental - succession of phonemes - and suprasegmental - prosody: intonation, rhythm, intonation, timbre... I consider it as the genesis of beautiful singing, achieved by adapting its fluidity, brightness and mobility to the requirements of music.

Jean-Yves Bosse-Vidal, MA, Singing Teacher, Researcher in Artistic Phonetics, AFPC
EVTA-France

LaxVox Voice Therapy Technique

Objective: LaxVox Voice Therapy Technique (LVVT) is a direct technique for general use which is adapted easily both by the patient and the therapist. The procedure automatically balances the functions included in voice production. It also gives a multichannel biofeedback and creates holistic cognition of the complex vocalizing process.

Methods: The Lax Vox devices provide an artificial elongation of vocal tract and backpressure by water resistance and work as a semi-occluded vocal tract exercise. Acoustic formant changes due to artificial elongation, enhanced inertance and massage effect of bubbling and backpressure are the main physical mechanisms. LVVT has a multidimensional multilevel treatment strategy and a dynamic algorithm; there are no exercise templates which fit for all. The clinician has an action plan and uses various predefined exercises in order to formulate the treatment program of an individual patient.

Results and Conclusions: In Pedagogical Vocology, it is useful for the singers for specific demands such as blending the registers, vocal warm-up and cool down, and developing a resonant and an effective voice. LVVT helps to find the primal sound and can be used for glottal closure and onset/glottal attack deficiencies, muscular development (Sostenuto, portamento, staccato, Messa di Voce, etc.) and balancing the loudness. In Clinical Vocology LVVT is a therapy of choice for various functional and organic voice disorders such as muscle tension dysphonias, vocal fold nodules, habitual and psychogenic dysphonias-aphonias, unilateral vocal fold paralysis, puberphonia, and presbiphonia. For phonosurgical applications, it is also an effective method for pre- and post-operative voice therapy. Each participant will find opportunity to practice LVVT exercises with a pocketVOX device which will be provided free during the workshop.

Ilter Denizoglu, MD, MSc, PhD candidate, MedicalPark Health Center, Department of Otorhinolaryngology – HNS, Unit of Clinical Vocology, Izmir, Tukey

Use of a Vortex Whistle for Measures of Respiratory Capacity and Control

This workshop will focus on a demonstration of the vortex whistle as a low-cost device by which airflow may be measured. The vortex whistle provides a tone which has a frequency proportional to the airflow moving through the whistle. We will demonstrate custom software that is able to capture the frequency of the vortex whistle tone and result in measures of both airflow and volume in a relatively "automatic" and user-friendly manner.

Along with our demonstration of the vortex whistle and accompanying software, we will provide a demonstration of how measures of respiratory measures of volume (e.g., Vital Capacity – VC; Forced Expiratory Volume in the 1st Second – FEV1) and respiratory airflow (e.g., mean airflow as estimated via the Phonation Quotient - PQ) can be easily obtained using a low cost computer to provide important information regarding respiratory capacity and control in the voice disordered patient.

This workshop will provide the following:

- A brief review of the diagnostic value of measures of VC, FEV1, and PQ with the voice disordered patient.
- A brief review of research which has established the validity of the vortex whistle.
- Extensive demonstration of the use of the vortex whistle and our accompanying software that generates a flow contour and the subsequent integration of the flow curve that results in a measure of volume.
- Demonstration of patent instructions and recording technique necessary to result in valid and reliable measures of airflow and volume.

Shaheen N. Awan, PhD, Professor, Speech Pathology, Bloomsburg University of PA, Centennial Hall,

400 East Second St., Bloomsburg, PA 17815-1301

Jordan A. Awan, MS, PhD Candidate, Penn State University

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Vocal Production and Proprioceptive Movement

The workshop will allow participants to engage in effective vocal production and communication of language through the exploration of simple proprioceptive exercises to unlock psycho-physiological blocks. Participants will also gain an awareness of physical tensions and inhibitors that directly relate to a performer's pattern of chronic muscular tensions, which result in the loss of breath support, breath replacement, and clear articulation during the communication of language.

Tamiko Washington, MFA, Associate Professor of Theatre, Chapman University, One University Drive, Orange, California 92866

Applying Prosody of Language Strategies to Enhance the Dramatic Delivery of a Song and Facilitate the Discovery of Appropriate Vocalisms in Various Musical Theatre and Contemporary Styles

Merging melody and lyric may prove to be a challenging task to many musical theatre and contemporary singers, and the lack of this amalgamation may result in a less than optimal performance, both from a vocal as well as a dramatic standpoint. This workshop was designed to help singers discover the nuances found in the text and choose specific subtexts that can contribute to communicating the dramatic circumstance at play with a clearly defined intention by:

· employing monologuing strategies
· exploring various options of operatives that can be applied to a particular sentence
· establishing a circumstance to be employed during performance
· discovering possible subtexts that can aid the plot to be carried forward
· filling in the moments of vocal hiatus/vocal silence with truthful dramatic intention

These strategies have the potential to:

· help singers communicate their circumstances through song effectively
· allow the singer to fully connect to the text and his/her 'other' throughout the song
· facilitate vocal coordination as well as breath management
· contribute to the ease of phonation when finding the appropriate vocalism that will best represent the emotional language of the text
· promote expressivity in musical lines/phrases that matches the inflection and pacing of the text

This workshop will be in masterclass style and can accommodate from 2 to 4 singers.

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Irene Bartlett, DMA, Queensland Conservatorium, Griffith University, Australia,

French Pronunciation in Song

This 55 minute workshop will develop in 2 parts:

1) During the first 15 minutes, I will present my points of view on the different aspects of French pronunciation, its specificity and difficulties, in relation with vocal technique. A proper use of French phonetics allows the continuity of the speech to be suitably emphasized by the breath according to musical standards. I will clearly underline the importance of accentuation in the language which is very often neglected in the study of proper lyric diction. This contribution therefore claims to be a complement and not a new version of the handbooks found all over the world.

2) The second part could develop as a masterclass or practice by 4 students or volunteers. 4 pieces of French vocal music (baroque, romantic opera, melodies and modern French chanson) will be sung and I will propose my ideas and advice to make the text intelligible, aesthetically satisfactory to a French ear and faithful to the style of the piece.

There exist so many rules in French pronunciation that they prove almost impossible to apply. Singing teachers try either to follow laws that don't always exist in practice or imitate old singers who are supposed to own the truth. Both position are respectable and can be sources of real insight. Nevertheless, the most reliable tool is to master the phonetic nature of the spoken language insisting on the 2 levels: segmental - succession of phonemes - and suprasegmental - prosody: intonation, rhythm, intonation, timbre... I consider it as the genesis of beautiful singing, achieved by adapting its fluidity, brightness and mobility to the requirements of music.

Jean-Yves Bosse-Vidal, MA, Singing Teacher, Researcher in Artistic Phonetics, AFPC
EVTA-France

LaxVox Voice Therapy Technique

Objective: LaxVox Voice Therapy Technique (LVVT) is a direct technique for general use which is adapted easily both by the patient and the therapist. The procedure automatically balances the functions included in voice production. It also gives a multichannel biofeedback and creates holistic cognition of the complex vocalizing process.

Methods: The Lax Vox devices provide an artificial elongation of vocal tract and backpressure by water resistance and work as a semi-occluded vocal tract exercise. Acoustic formant changes due to artificial elongation, enhanced inertance and massage effect of bubbling and backpressure are the main physical mechanisms. LVVT has a multidimensional multilevel treatment strategy and a dynamic algorithm; there are no exercise templates which fit for all. The clinician has an action plan and uses various predefined exercises in order to formulate the treatment program of an individual patient.

Results and Conclusions: In Pedagogical Vocology, it is useful for the singers for specific demands such as blending the registers, vocal warm-up and cool down, and developing a resonant and an effective voice. LVVT helps to find the primal sound and can be used for glottal closure and onset/glottal attack deficiencies, muscular development (Sostenuto, portamento, staccato, Messa di Voce, etc.) and balancing the loudness. In Clinical Vocology LVVT is a therapy of choice for various functional and organic voice disorders such as muscle tension dysphonias, vocal fold nodules, habitual and psychogenic dysphonias-aphonias, unilateral vocal fold paralysis, puberphonia, and presbiphonia. For phonosurgical applications, it is also an effective method for pre- and post-operative voice therapy. Each participant will find opportunity to practice LVVT exercises with a pocketVOX device which will be provided free during the workshop.

Ilter Denizoglu, MD, MSc, PhD candidate, MedicalPark Health Center, Department of Otorhinolaryngology – HNS, Unit of Clinical Vocology, Izmir, Tukey

Use of a Vortex Whistle for Measures of Respiratory Capacity and Control

This workshop will focus on a demonstration of the vortex whistle as a low-cost device by which airflow may be measured. The vortex whistle provides a tone which has a frequency proportional to the airflow moving through the whistle. We will demonstrate custom software that is able to capture the frequency of the vortex whistle tone and result in measures of both airflow and volume in a relatively "automatic" and user-friendly manner.

Along with our demonstration of the vortex whistle and accompanying software, we will provide a demonstration of how measures of respiratory measures of volume (e.g., Vital Capacity – VC; Forced Expiratory Volume in the 1st Second – FEV1) and respiratory airflow (e.g., mean airflow as estimated via the Phonation Quotient - PQ) can be easily obtained using a low cost computer to provide important information regarding respiratory capacity and control in the voice disordered patient.

This workshop will provide the following:

- A brief review of the diagnostic value of measures of VC, FEV1, and PQ with the voice disordered patient.
- A brief review of research which has established the validity of the vortex whistle.
- Extensive demonstration of the use of the vortex whistle and our accompanying software that generates a flow contour and the subsequent integration of the flow curve that results in a measure of volume.
- Demonstration of patent instructions and recording technique necessary to result in valid and reliable measures of airflow and volume.

Shaheen N. Awan, PhD, Professor, Speech Pathology, Bloomsburg University of PA, Centennial Hall,

400 East Second St., Bloomsburg, PA 17815-1301

Jordan A. Awan, MS, PhD Candidate, Penn State University

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Vocal Production and Proprioceptive Movement

The workshop will allow participants to engage in effective vocal production and communication of language through the exploration of simple proprioceptive exercises to unlock psycho-physiological blocks. Participants will also gain an awareness of physical tensions and inhibitors that directly relate to a performer's pattern of chronic muscular tensions, which result in the loss of breath support, breath replacement, and clear articulation during the communication of language.

Tamiko Washington, MFA, Associate Professor of Theatre, Chapman University, One University Drive, Orange, California 92866

Applying Prosody of Language Strategies to Enhance the Dramatic Delivery of a Song and Facilitate the Discovery of Appropriate Vocalisms in Various Musical Theatre and Contemporary Styles

Merging melody and lyric may prove to be a challenging task to many musical theatre and contemporary singers, and the lack of this amalgamation may result in a less than optimal performance, both from a vocal as well as a dramatic standpoint. This workshop was designed to help singers discover the nuances found in the text and choose specific subtexts that can contribute to communicating the dramatic circumstance at play with a clearly defined intention by:

· employing monologuing strategies
· exploring various options of operatives that can be applied to a particular sentence
· establishing a circumstance to be employed during performance
· discovering possible subtexts that can aid the plot to be carried forward
· filling in the moments of vocal hiatus/vocal silence with truthful dramatic intention

These strategies have the potential to:
· help singers communicate their circumstances through song effectively
· allow the singer to fully connect to the text and his/her 'other' throughout the song
· facilitate vocal coordination as well as breath management
· contribute to the ease of phonation when finding the appropriate vocalism that will best represent the emotional language of the text
· promote expressivity in musical lines/phrases that matches the inflection and pacing of the text

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