Towards Objective Voice Assessment: The Diplophonia Diagram

Objectives: Diplophonia is a common and often misinterpreted symptom of disordered voice and needs objectification. It was hypothesized that diplophonia is produced by two distinct oscillators, which yields a profound physiological interpretation. Based on that hypothesis, an audio signal processing algorithm for the detection of diplophonia is proposed, tested and validated. Its performance is compared to the clinical standard parameter Degree of Subharmonics (DSH).
Study design: Prospective.
Methods: 50 dysphonic (28 diplophonic and 22 dysphonic without diplophonia) and 30 euphonic subjects were included in the study. From each subject up to five sustained phonations were recorded during rigid telescopic high-speed video laryngoscopy. 185 phonations were split up into 285 segments of distinct voice qualities. In accordance to the clinical group allocation, the considered segmental voice qualities were 1) diplophonic, 2) hoarse without diplophonia and 3) euphonic. To analyse the segments, an analysis-by-synthesis procedure was proposed. The Diplophonia Diagram is a scatter plot that relates the one-oscillator synthesis quality SQ1 to the two-oscillators synthesis quality SQ2. Multinomial logistic regression was used to distinguish diplophonic from non-diplophonic segments in the Diplophonia Diagram.
Results: Diplophonic segments could be well distinguished from non-diplophonic segments in the Diplophonia Diagram, because two-oscillators synthesis is more appropriate to imitate diplophonic signals than one-oscillator synthesis. Detection of diplophonia using the Diplophonia Diagram clearly outperforms the DSH by means of positive likelihood ratios (56.8 versus 3.6).
Conclusions: The diagnostic accuracy of the newly proposed method for detecting diplophonia is superior to the DSH approach, which should be taken into account for future clinical and scientific work.

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Learning without Errors: An Application of Error-Reducing Paradigm in Speech Intensity Control

Abstract

Purpose: Errorless learning is defined as a learning procedure where individuals are limited from making mistakes as they learn a new skill during practice. An example of errorless learning is start practicing from level with less difficulty and gradually increasing the difficulty, with the aim to minimise errors during training. Although the errorless learning paradigm has been investigated in different disciplines, there are only handful of literatures available in the application of the errorless paradigm in speech motor learning. The purpose of the study was to examine the effects of errorless learning in the manipulation of speech intensity control.

Methods:
Forty-nine vocally healthy participants were required to sustain a vowel sound in either an *errorless learning* condition or a *errorful learning* condition. The speech intensity (in decibels measured at 30 cm) was captured using Soundswell's computerized real-time phonetogram. Participants were required to match their speech intensity to a clinician-assigned reference line indicated on the computer screen. In the errorless learning condition, participants maintained a prolonged vowel sound starting from a low to high speech intensity for each block. Whereas, in the errorful learning condition, participants sustained vowel sound at speech intensity in a random order for each block of training. An immediate retention and transfer test was administered after the acquisition phase.

Results
In the immediate retention test, participants in the errorless learning condition were able to produce vowel significantly louder compared to those in the errorful learning condition. On the contrary, there was no significant difference in speech intensity between the two learning conditions for the passage reading and conversation task. In the transfer test, errorless group were able to adjust their speech intensity significantly faster to the target clinician-assigned, untrained speech intensity level compared to the errorful group.

Conclusion: The errorless learning paradigm is more a effective learning paradigm in training speech intensity, providing learners with a louder speech intensity compared to the errorful learning group.

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Review: Role of Reactive Oxygen Species and Anti-oxidant on the Vocal Fold

Objective: Reactive oxygen species (ROS) is well known to contribute in aging, tissue damage, cancer, and death. The roles of ROS and anti-oxidant on wound healing, scarring, and aging of the vocal fold are important in consideration of maintenance of the vocal fold mucosa and function. The current knowledge on this aspect was reviewed.

Methods/design: literature review.

Results: There have been several studies to explore the role of ROS and anti-oxidant on the vocal fold. Vocal fold injury model in rats was used to examine the role of ROS during wound healing, and it was revealed that ROS was extensively increased in the vocal fold mucosa from day 1 through day 3 after injury, and the vocal folds were finally scarred. Application of anti-oxidant, astaxanthin, around the period of injury caused less production of ROS and less scar formation of the vocal fold. Aging model of rats was used to examine the contribution of ROS, and the results indicated that ROS significantly increased in aged vocal fold mucosa, which was accompanied with reduction of hyaluronic acid and excessive collagen deposition, while aged rats fed with astaxanthin showed less ROS, less collagen deposition with restoration of hyaluronic acid. A clinical human trial was performed to examine the role of anti-oxidant on protection of the vocal fold during vocal loading. The results indicated that the phonatory function was worsened after vocal load, but this effect was reduced by administration of anti-oxidant before vocal load.

Conclusions: Although there have been few evidence on the role of ROS and anti-oxidant for the vocal fold, it is suggested that ROS has negative effect on the vocal fold, and anti-oxidant may have positive effects on the maintenance of the vocal fold during wound healing, vocal abuse, and aging process.

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Establishment and Analysis of False Vocal Folds Hypertrophy Model in Excised Canine Larynges

Objective:
(1) To determine an injection material suitable for creating a model of false vocal fold hypertrophy.
(2) To investigate the role of false vocal folds medialization in phonation and the acoustic impact of ventricular disease by establishing a false vocal folds hypertrophy model.

Subjects and Methods: Control, degree I and degree II false vocal folds hypertrophy were simulated in ten excised larynges via fructose injection of 0.1 ml for degree I and 0.25 ml for degree II. Mean flow rate, fundamental frequencies, formants, and sound pressure level were measured during phonation with a subglottal pressure of 1.5kPa or 2.5kPa.

Results: The high permeability, stability, and viscosity of fructose solution can maintain the structural stability of the false vocal folds and reduce leakage. When the subglottal pressure was controlled at 1.5kPa or 2.5kPa, the degree of false vocal fold hypertrophy significantly influenced the distribution of the formants, the fundamental frequencies, and mean flow rate in excised canine larynges. Increases in the degree hypertrophy were associated with decreases in fundamental frequency and increases in mean flow rate. In degree II false vocal fold hypertrophy models the sound pressure level and the format 1were significantly higher ($P < 0.05$) than in normal models.

Conclusion: Hypertrophy of the false vocal folds has a significant influence on the distribution of sound energy and is associated with changes in sound quality.

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Vocal Tract Changes Associated with Messa di Voce Exercises in Different Vocal Registers?

Introduction: It has been shown before that vocal tract shape might be adjusted with respect to vocal registers. Furthermore, dynamic MRI data suggest that vocal tract shape also varies for different loudness conditions. The question of how much the vocal tract adjustments due to loudness are dependent on vocal register is unclarified.

Material and Methods: 12 professional opera singers (6 male, 6 female) were asked to sing a messa di voce (gradual crescendo and decrescendo on sustained pitch) on the pitch of D4 (294Hz) (1) in modal and second in (2) falsetto for the males or head voice for the female, respectively. The vocal tract profiles were recorded using dynamic real-time MRI with 24fps. Furthermore, from the dual optical microphone system the audio signal was recorded and, after removing the scanner noise, analyzed concerning sound pressure level (SPL).

Results: The data show that vocal tract changes (such as lip opening, jaw opening, pharynx width, vertical laryngeal position) with increasing loudness were greater for the modal register in comparison to the higher register for both genders. Furthermore, it could be observed that for a given SPL, the vocal tract shape differed between the crescendo part and the decrescendo part during the messa di voce.

Conclusions: Vocal tract shapes with regard to loudness are dependent on the vocal register.

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Vocal Fold Oscillation Patterns in Professional Singers' *Passaggi*

Introduction: Proper navigation of the frequency range where registration events typically occur (*passaggio*) is an important aspect of professional singing. However, laryngeal dynamics concerning the *passaggi* are not yet understood in detail.

Material and Methods: In a first study, 7 professional opera tenors were asked to sing glissandi (a) from modal to falsetto register and (b) from modal to stage voice above the *passaggio* (SVaP) across their *passaggio* regions. In a second study, 10 professional soprano singers were analyzed with respect to their first and second *passaggio* regions. The singers were recorded with high-speed technology at 20,000 frames per second using trans-nasal endoscopy. The segmented glottal contours were analyzed with phonovibrograms and custom algorithms. Simultaneously recorded electroglottographic signals were subjected to sample entropy analysis. In the female singers, the audible presence of registration events was assessed by expert raters.

Results: During the *passaggi*, voice signals suggested registration events in many cases. The EGG sample entropy showed maxima during the glides, and vocal fold vibration analysis revealed abruptly changing patterns in some of the subjects. In the tenors, sample entropy maxima were found for both transitions to falsetto and SVaP. In the female participants, laryngeal events were found for both *passaggi* (upper and lower). The maximum EGG sample entropy correlated with the extent of perceivable registration events as rated by the experts. Furthermore, the sample entropy was associated with variation of the glottal area derived open quotient.

Conclusion: In all analysed *passaggi* laryngeal events were present, indicating a need for laryngeal adjustments.

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Comparing Chalk with Cheese – The EGG Contact Quotient Has Only Limited Relation to the Closed Quotient

The electroglottographic (EGG) contact quotient (CQegg), an estimate of the relative duration of vocal fold contact per vibratory cycle, is the most commonly used quantitative analysis parameter. The purpose of this study is to quantify the CQegg's relation to the closed quotient, a measure more directly related to glottal width changes during vocal fold vibration and the respective sound generation events.

Thirteen singers (six females) phonated in four extreme phonation types, while independently varying the degree of breathiness and vocal register. EGG recordings were complemented by simultaneous videokymographic (VKG) endoscopy, which allows for calculation of the videokymographic closed quotient (CQvkg). The CQegg was computed using five different algorithms, all used in previous research.

All CQegg algorithms produced CQegg values that clearly differed from the respective CQvkg, with standard deviations around 20 % of cycle duration. The difference between CQvkg and CQegg was generally greater for phonations with lower CQvkg. The largest differences were found for low-quality EGG signals with a signal-to-noise ratio (SNR) below 10 dB, typically stemming from phonations with incomplete glottal closure. Disregarding those low-quality signals, the best match between CQegg and CQvkg was found for a CQegg algorithm operating on the first derivative of the EGG signal.

These results show that the terms "closed quotient" and "contact quotient" should not be used interchangeably. They relate to different physiological phenomena. Phonations with incomplete glottal closure having an EGG SNR below 10 dB are not suited for CQegg analysis.

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The Effect on Pitch of Varying Timbre in the Context of Choral Singing

Objective: This work sets out to explore the effect of changing the timbre of sung sounds on the perceived pitch and fundamental frequency of notes sung by individual singers and on the overall intonation in choral multi-part singing.

Methods/Design: Tuning in choral singing is a basic requirement that affects the listener experience. Changing the fundamental frequency of vocal fold vibration is the main way of changing the perceived pitch and this is well established as the main pitch control mechanism. Less well understood is the effect that changing timbre can have on the perceived pitch; an effect that is very small, but nevertheless important, compared to changing changing fundamental frequency, but one that is very important to the overall perceived choral blend. In the context of choral singing, timbre is varied primarily by vowel changes relating to the text/lyrics. Here, experienced individual singers alone and singers within an auditioned vocal quartet are recorded using up to four close microphones and four electrolaryngographs to enable the fundamental frequency of their sung notes on different vowels to be measured without acoustic interference.

Results: There is a measurable change in fundamental frequency when singers sing different vowels at a set musical interval against a pitch reference, albeit a small one. These results will be explored in relation to data on how listeners report the pitch of different vowels in terms of which are sharper/flatter when sung to the same fundamental frequency.

Conclusions: There is a timbre related effect on the perceived pitch of sung notes in the context of solo and choral quartet (one to a part) singing. The results suggest that this is a small effect but matters relating to choral intonation and choral blend tend to involve small changes and it is postulated that this is an important aspect of choral pitching that is rarely mentioned and poorly understood.

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The Role of Musicianship in Vocal Error Correction as Subjects Plan to Change F0

Objective: Previous studies using pitch-shifted voice feedback have demonstrated reflexive responses to correct for errors in vocalization. Well-trained musicians have shown differential reflexive vocal responses compared to those of non-musicians. Our goal was to explore how planning to change F0 modifies reflexive mechanisms of voice control between groups of varying musical training.

Methods/Design: Sixteen healthy participants (eight musically trained: Mean=10.13 years, SD=4.73; eight with limited training: Mean=1.5 years, SD=1.69) were instructed to (1) hold a steady F0 or (2) raise their F0 in response to a visual instruction (planned change). Following the instruction, a pitch perturbation ($\pm$50 cents, 200 ms) was presented 300 ms before subjects executed the change in voice F0. Mixed ANOVAs tested the differences in reflexive and volitional response magnitudes and latencies between the two groups.

Results: Downward perturbations (-50 cents) elicited larger compensatory responses overall ($F(1,14) = 12.635$, $p = 0.003$), and upward perturbations (+50 cents) elicited faster compensatory responses than downward perturbations when participants planned to raise their F0 ($F(1,14) = 5.4967$, $p = 0.035$). The untrained group produced smaller compensatory responses ($F(2,28) = 5.866$, $p = 0.007$) and demonstrated an effect of planning, as seen by significantly longer reflexive peak latencies in the raise compared to steady F0 task ($F(1,14) = 5.795$, $p = 0.030$); this effect was not observed in the trained group. Groups did not differ on the volitional peak response magnitude, but greater training produced faster volitional response latencies ($F(1,14) = 6.948$, $p = 0.020$).

Conclusions: As subjects planned to raise F0, smaller reflexive responses to upward than to downward pitch perturbations were observed. Trained participants demonstrated larger reflexive responses, shorter volitional latencies, and no effect of planning on reflexive measures. The results suggest that musical training alters neural mechanisms involved in planning to change voice F0.

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Aerodynamic Characteristics of Syllable and Sentence Productions for Normal Subjects

Objective: Aerodynamic measures of air pressure and airflow rate are often used to determine the goodness of fit for treating voice disorders with behavioral voice therapy or proceeding on to surgery. These measures are usually take during a series of syllables Conversational speech is not the same as a series of syllables that can be affected by the rate of speaking and the amplitude of the voice in this sampling procedure. This study will examine the potential differences in the estimated subglottic pressure and airflow rate in conversational speech measures and syllabic measures of normal speakers.

Methods/Design: Prospective Study. Measures of estimated subglottic air pressure and mean airflow rate were obtained from a group of 20 adult normal speakers using the Phonatory Aerodynamic System. The measures were obtained by having each person repeat a series of /pa/ syllables and a sentence into a facemask (Pentax Medical) with a pressure sensing tube between the lips. Subjects were instructed to speak at a comfortable effort level. No subjects reported a history of a voice disorder and all volunteered to perform the task.

Results: Measures of estimated subglottic pressure were significantly higher for the speech production samples than for the syllable production samples of normal subjects. From the data collected to this point (n=20) mean airflow rate varied but was generally unchanged for the group.

Conclusions: Normal adult subjects speaking at a comfortable effort level tended to increase subglottic air pressure and airflow rates when repeating a seven-syllable phrase. The effects of speaking in a mask may affect speech effort levels. Conversely, sentence production may reflect a more representative measure of subglottic pressure than syllable production.

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Voice Spectrum Variation Across the Voice Range, Differentiated by Phonation Type

The acoustic spectrum of the voice is highly variable in speech and singing, due to many sources of variation. Averaging techniques, such as the long-time average spectrum (LTAS), are conventionally used to reduce the impact of articulation in uncovering properties of the voice source. However, without accounting for variations that are coupled to fundamental frequency f_o and sound level SPL, the LTAS still obscures much information. The spectrum can instead be averaged cell-by-cell on the voice range profile plane, resulting in a 'spectral VRP'. When a sufficient volume of data is collected, some hitherto unseen trends are resolved.

Spectral data over the entire voice range was collected from three categories of subjects: untrained (N=16) and trained (N=12) females as well as trained males (N=7). The phonation type was controlled for throughout, such that the spectral VRPs were separate for chest/modal/M1 and head/falsetto/M2. Subjects produced VRPs of both phonation types, as ensured by a precise protocol. The VRP data contained the intra-subject-averaged narrow-band spectrum in every cell (one semitone × one dB) for that combination of f_o and SPL . Then, the spectral VRP data was averaged across subjects, still within categories. No adjustments were made for personal voice range; data from different subjects was simply accumulated per cell.

From the averaged spectrum sections, eight scalar metrics were derived and computed per cell: (1) absolute level of the fundamental, (2) power ratio of higher harmonics to the fundamental, (3) number of the strongest harmonic N_{Hmax}, (4) power ratio of N_{Hmax} to all other harmonics, (5) spectrum balance (high-to-low band power ratio), (6) spectrum slope above 3 kHz, (7) spectrum centroid below 2 kHz, and (8) level difference L_{H2}-L_{H1} between the two lowest harmonics. The results for these eight metrics were then visualized over the VRP plane, both the ensemble averages and per subject. The complete corpus of data is in publication. Here, we will highlight only two of the interesting trends that emerged, and discuss how these agree with standard models of voice production, or not. Firstly, the notion that vocal tract resonances have a major influence on voice sound level was not seen to be corroborated by the data. Secondly, the level of the second harmonic was often unexpectedly high at low SPL, an observation that could be attributable to non-linear and often subject-specific effects.

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Glottal Inverse Filtering when Source and Filter are Interactive

The efficacy of glottal inverse filtering (GIF) to obtain glottal flow from oral pressure was studied computationally when source and filter are interactive. A Fiber-Gel finite element model of vocal fold tissue vibration was used to generate source signals. A one-dimensional wave reflection algorithm was used to solve for acoustics in the vocal tract. Several test signals were generated in the presence of source-filter interaction at various fundamental frequencies, lung pressures, and vowels for both males and females. Linear Predictive Coding (LPC), and Quasi Closed Phase (QCP) based algorithms were used to inverse filter the oral pressure signals to obtain the glottal flow pulses. The efficiency of the algorithms was tested for their recovery of maximum flow declination rate (MFDR), peak glottal flow, and removal of formant ripple. The algorithms were also tested for their average absolute relative errors of the Normalized Amplitude Quotient, the Quasi-Open Quotient, and Harmonic Richness Factor. The results indicate that both algorithms performed well when the source-filter interaction is minimal. The performance of both algorithms deteriorated when the source-filter interaction was high resulting in subharmonics, large MFDR, and formant ripple.

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Synchronization in Singing Duet Performances: the Roles of Leadership and Visual Contact

Objective: Temporal synchronization between members of a singing ensemble represents a key performance goal as it fosters musical excellence. Previous studies, often analysing instrumental rather than singing performance, show that synchronisation is maintained through iterative micro-timing adjustments due to expressive interpretations and noise during the cognitive-motor processes. 'However, how temporal synchronization evolves during vocal ensemble performances in relation to the various elements that may affect it (such as leadership, visual cues, room acoustics, and structure of the music score), remain mostly unexplored. This study investigates the effect of the visual contact and the musical roles of Leader and Follower on temporal synchronization between singers during vocal ensemble performances.

Methods / Design: Fifteen singing duets performed a two-part piece, mostly homophonic in texture, which was composed for the study. Four conditions were applied in a randomised order: with and without visual contact, and with a designated Leader or Follower. Each condition was presented three times and the singers performed four repetitions within each condition, resulting in 12 performances of the piece in each condition. Data were acquired using electrolaryngograph electrodes and head mounted microphones to allow fundamental frequency evaluation of the individual voices through acoustic analysis software. Temporal synchronization was then analysed by extracting onset times from the fundamental frequency values through an automated algorithm. The averaged asynchronies of the 4 conditions and correlations of the sequence of interonset intervals for each performance condition and singing duo were calculated and compared.

Results / Discussion: Initial results show a complex pattern of Leader-Follower relationships rather than a clear separation of roles, and suggest that the Leader-Follower relationships might facilitate interpersonal coordination during ensemble performance, whilst the effect of visual contact might depend on who is designated the role Leader.

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Changes in Glottal Open Quotient as a Result of Thirteen Oral Semi-Occlusions

Objective:
The use of semi-occluded vocal tract (SOVT) exercises as habilitative and rehabilitative tools has grown substantially in the past two decades. As the use of these exercises have grown, so too has the number of variations of the exercises themselves. The current study examined the effect 13 phonatory gestures generally considered to be SOVT gestures had on glottal open quotient, compared to open vocal tract phonation, /a/ and compared to each other.

Methods:
Using electroglottography, researchers recorded the open quotient (Q_o) produced by 20 subjects (10 female and 10 male) on the following gestures: a thin stirring straw between the lips (3.5 mm internal diameter, 14.1 cm length), a drinking straw between the lips (6 mm internal diameter, 19.5 cm length), a long curved straw immersed in water (5 mm internal diameter, 1 cm external diameter, 36 cm length, 7 cm depth in water), an /u/ vowel, a bilabial fricative /β/, voiced fricatives /v/, /z/, and /ʒ/, nasal consonants /m/ and /n/, a lip trill, a raspberry, and a tongue trill. These same occlusions have previously been rank-ordered according to the intra-oral pressures they induce.

Results:
Q_o measures varied considerably between subjects and between occlusion, but did not track perfectly with the intraoral pressure rankings previously published.

Conclusions:
These data add to a handful of studies that have been conducted investigating the effect of SOVT phonation on glottal configuration. They suggest that, while on oral occlusion does effect glottal Q_o, this effect is not wholly explained by changes in steady pressure in the supraglottic airway. Changes in acoustic (oscillatory) pressures in the airway may also be impacting glottal closure and contact.

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Text-Mining Classical Singers' Social Media for Health Information

This study uses supervised and unsupervised machine learning techniques to data-mine 14 years of conversations found on an online message board dedicated to classical singing. A web-scrape yielded a text corpus of 712,609 messages across 85,588 conversations exchanged among approximately 20,000 users. This study seeks to better understand how singers discuss health topics with one another: recommendations for or against health behaviors, symptom complaints, remedies, and when and how to seek out healthcare providers. Latent Dirichlet Allocation (LDA) is a popular method that was used to discover the latent topics in a text corpus too large to effectively read and code manually. By applying this process recursively, a hierarchy of health complaints and needs is revealed; for example, sensations in the vocal tract are discussed more frequently than musculoskeletal pain, which in turn is more prevalent than discussions of health insurance. The findings of this study provide healthcare professionals and music-educators with insight into the lay-language of health communication among professional singers, and reveal the hierarchy of self-perceived health-needs among classical singers through the novel analysis of naturally occurring data.

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Analysis of Phonation and Air Flow in Excised Canine Larynges with Bilateral Vocal Cord Paralysis after Different Four Stages Operation

Objective: By analyzing the change of the speech signal and air flow from excised canine larynges with bilateral vocal cord paralysis between four stages operation, this study would provide theoretical basis to select appropriate operation type for the patient with bilateral vocal cord paralysis.

Methods: The vocal folds were closed to simulate bilateral vocal cord paralysis from ten excised canine larynges. Four unified standard ladder operation stages for the bilateral vocal cord paralysis were performed on excised canine larynges in turn, repectively. The first stage was posterior transverse cordotomy, the second stage was medial arytenoidectomy, the third stage was subtotal arytenoidectomy, and the fourth stage was total arytenoidectomy. The sound pressure level, signal to noise ratio, the average airflow rate and the maximum glottal area under the high speed photograph after the four stages operation were collected and analyzed, respectively. Student-Newman-Keuls was used for statistical analysis. Statistical significance was accepted at a p value of less than 0.05.

Result：The first stage did not significantly increase the maximum glottal area, but it significantly increased the average airflow rate. The second stage significantly increased the average airflow rate and the maximum glottal area without affecting the phonation. The third stage significantly increased the average airflow rate and the maximum glottal area, but the phonation was obviously getting worse. The fourth stage significantly increased the maximum glottal area, but not increased the average airflow rate. The sound pressure level didn't show statistically significant difference between the four stages of the operation.

Conclusion: The operation stage for the patients with bilateral vocal cord paralysis may be individualized, and the balance between phonation and air flow may be comprehensively considered. Medial arytenoidectomy is better than posterior transverse cordotomy in improving breathing. Subtotal arytenoidectomy has great influence on phonation. In this case, the operation stage should be carefully chosen for the patients who have high demanding for phonation. Total arytenoidectomy doesn't improve breathing significantly, but increase the incidence of cough and other complications, and should be deliberatively considered.

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Reexamination of the Spectral and Cepstral Components Used in the Prediction of Dysphonia Severity

Purpose: Research by Awan, Roy, and Dromey (2009) resulted in a multidimensional formula incorporating spectral and cepstral measures that provided an acoustic estimation of dysphonia severity for the "Rainbow Passage" that corresponds to perceived dysphonia severity reported using 100-pt. visual analog scales (e.g., the CAPE-V). This and associated formulas by Awan and colleagues have been collectively referred to as the *Cepstral Spectral Index of Dysphonia (CSID)*. However, replication the original findings that led to the *CSID* is necessary since (a) previously reported findings may be specific to the subjects utilized in the original study, and (b) the number of variables and their relative weightings used in previously reported multiple regression formulas may also vary with different samples. Therefore, the aims of this study were the following: (a) to confirm the degree of correlation between the original CSID for the "Rainbow Passage" ($CSID_R$) and listener perceived judgments of dysphonia severity with a larger, more diverse sample; (b) to utilize stepwise multiple regression to reexamine the number of variables, their relative weightings, and the degree of correlation between a revised spectral cepstral formula for the "Rainbow Passage" ($RevCSID_R$) and ratings of dysphonia severity; and (c) to assess whether correlations between acoustically predicted severity and listener perceived severity using original vs. newly revised formulas differed significantly.

Method: This study included voice samples composed of 332 typical and voice disordered adults. Acoustic estimates of dysphonia severity for recordings of the second and third sentences of "The Rainbow Passage" were calculated utilizing the *Analysis of Dysphonia in Speech and Voice (ADSV)* program using measures of the Cepstral Peak Prominence (CPP), the Low/High Spectral Ratio (L/H Ratio), their respective standard deviations, and CPP F_0. In addition, each voice sample was rated for *Overall Severity, Roughness, Breathiness,* and *Strain* using a perceptual ratings computer program incorporating a 0-100 point visual analog scale (VAS) similar to the CAPE-V.

Results: Similar to the original $CSID_R$ formula, a revised $CSID_R$ determined using stepwise multiple regression incorporated CPP, LHRatio and LHRatiosd in the prediction of perceived dysphonia severity. While the current study showed that information pertaining to subject gender may also add significantly to the prediction of auditorily perceived dysphonia, the correlations computed between auditorily perceived severity and a revised $CSID_R$ vs. the original $CSID_R$ were nonsignificantly different (r = 0.792 vs. 0.786, respectively), and the two formulas correlated with one another at r = 0.99.

Conclusions: The $CSID_R$ formula has been applied across several previous studies incorporating various etiologies, severities, and genders. When correlated with the 332 continuous speech samples included in this study, the original $CSID_R$ yielded a similar and nonsignificantly different correlation with perceptual ratings vs. the $RevCSID_R$. This finding suggests that a modification of the relative weightings and/or variables of the original formula is unnecessary, supporting the external validity of the $CSID_R$, and therefore, its use as a robust clinical tool for objectively classifying dysphonia severity.

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Sensitivity of Source-Filter Interaction to Specific Vocal Tract Shapes

A systematic variation of length and cross-sectional area of specific segments of the vocal tract (trachea to lips) was conducted computationally to quantify the effects of source-filter interaction. A one-dimensional Navier-Stokes (transmission line) solution was used to compute peak glottal airflow, maximum flow declination rate, and formant ripple on glottal flow for Level 1 (aero-acoustic) interactions. For Level 2 (tissue movement) interaction, peak glottal area, phonation threshold pressure, and deviation in f_o were quantified. Results show that the ventricle, the false-fold glottis, the conus elasticus entry, and the laryngeal vestibule are the regions to which acoustic variables are most sensitive. Generally, any narrow section of the vocal tract increases the degree of interaction, both in terms of its length and its cross-sectional area. The closer the narrow section is to the vocal folds, the greater the interaction.

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Acoustic Predictors and Bio-inspired Modeling of the Perceived Vocal Breathiness of Sustained Phonations and Continuous Speech

Objective: Compare the perceived vocal breathiness of sustained phonations and continuous speech over a wide range of dysphonia severity to evaluate similarities and differences using acoustic measures and a bio-inspired model of vocal breathiness. While laboratory measurements of vocal breathiness typically rely on the production of sustained vowel phonations, clinical assessment of vocal breathiness often uses more prolonged and more complex vocalizations. Connected speech involves a greater range of dynamic laryngeal function and may be more sensitive to deficits associated with complex cognitive and neuromuscular challenges typically involved in natural speech. Connected speech also may correspond more closely with perceived handicap and may represent more relevant treatment targets than sustained vowels.

Methods: We recently collected adapted a breathiness matching task to index the perceived breathiness of 5 male and 5 female talkers on the basis of a sustained /a/ production and the 2nd sentence of the Rainbow passage. The samples spanned a wide range of dysphonia severity. Several acoustic measures included cepstral peak and autocorrelation were used to characterize the acoustic properties of the stimuli and the pitch strength model of breathiness was used to predict perceptual performance..

Results: Results were similar among the two stimulus types. Breathiness perception was similar among the two stimulus types. This similarity corresponded to correlations among multiple acoustic measures. The pitch-strength model was able to capture variation in breathiness among the different talkers (i.e., severity range).

Conclusions: Despite a variety of differences among sustained phonations and continuous speech, the perception of breathiness for these stimulus types was quite similar as were acoustic measures and the predicted results of the pitch-strength model. . This work represents a critical step in advancing studies of voice quality perception from single vowels to running speech. Work supported by NIH DC009029.

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The Effect of the Auditory Feedback on Vocal Effort and Fatigue in Virtual Room Acoustics

Introduction: Vocal effort, a physiological classification that accounts for changes in voice production effort as vocal loading increases, has been quantified in terms of Sound Pressure Level (SPL). Elevated vocal effort, particularly over extended periods of voice production, may have implications on potential vocal fatigue risk factors.

Objectives: This study quantified vocal effort changes due to a variety of virtual room acoustics conditions.

Methods: Thirty-nine subjects were recorded while reading a text. Each participant was asked to read in 18 different simulated room conditions: 3 reverberation times (RT = 0.4 s, 0.8 s, and 1.2s); 2 noise conditions (background noise at 25 dBA and Babble noise at 61 dBA); and 3 auditory feedback levels (-5 dB, 0 dB and 5 dB). These conditions were presented to the subject in a random order. For each condition, the subjects quantified their perception of vocal fatigue on a visual analogue scale.

Results: Babble noise and the order of task presentation resulted in participants vocalizing at an elevated vocal level (SPL) and reporting high vocal fatigue. Additionally, the vocal level increased when the reverberation time and the auditory feedback level decreased. These results further clarifying how vocal effort and fatigue changes within various conditions.

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Voice and Silence Accumulated by Teachers in Classrooms with Different Reverberation Times

Introduction: Teachers have an elevated risk of voice issues compared to the general public. How a teacher talks, e.g. lengths of voicing periods and occurrences of vocal breaks, may indicate why one teacher experiences less problems than another. Specifically, the duration distribution of these periods of silence and voicing by teachers teaching in classrooms could have implications on potential vocal fatigue risk factors and would be useful information for the clinicians who treat them.

Objectives: The purpose of this study was to examine and quantify the relationship between the distributions of accumulated voice and silence durations and the teaching environment reverberation time (RT).

Methods: Twenty-two primary school teachers were monitored over 1 or 2 workdays with the Ambulatory Phonation Monitor. The classroom reverberation times ranged between 0.58 s and 1.58 s, with a median equal to 0.9 s. Teachers were grouped based by those with low classroom low reverberation time (0.58 s < RT < 0.90 s) and high reverberation time (0.90 s ≤ RT < 1.58 s).

Results: Teachers who instruct in classrooms with lower reverberation times, for silence durations between 0.2 s and 10 s) had a higher occurrence of shorter silence accumulation compared to those in high RT classrooms. Higher reverberation time conditions implicate higher voicing accumulations and higher accumulations in the silences typical of turn taking in dialogue. These results suggest that vocal fatigue and recovery may relate to reverberation time, and how poor acoustics can be considered a risk factor for occupational voice users.

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Speech Adjustments for Room Acoustics and Their Effects on Vocal Effort

Introduction: Vocalist adjust their speech and vocal efforts due to communication intent, communication partner, and communication environment. How a person adjusts their voice may have implication on vocal fatigue and recovery from heavy vocal use.

Objectives. The aims of the present study are: (1) to analyze the effects of the acoustical environment and the voice style on voicing time and fundamental frequency (mean and standard deviation), while taking into account the effect of short term vocal fatigue; (2) to predict the self-reported vocal effort from the voice acoustical parameters.

Methods. Ten male and ten female subjects were recorded while reading a text in normal and loud styles in three different rooms (anechoic, semi-reverberant and reverberant) and with/without an acrylic glass panels 0.5 m from the vocalist (which increased external auditory feedback). After each condition (normal/loud, 3 rooms, with/without panel), subjects marked a visual analogue scale to quantified their perception of speaking effort.

Results. (Aim1) In the loud style, voicing time, mean fundamental frequency (and standard deviation) increased. The voicing time was higher in the reverberant room compared to the other two rooms. Both genders tended to increase fundamental frequency in less reverberant environments, while a more monotonous speech was produced in rooms with greater reverberation. All three voice parameters increased with short-term vocal fatigue. (Aim2) A model of the vocal effort to acoustic vocal parameters is proposed. The vocal level (SPL) contributed to 66% of the variance explained by the model, followed by the fundamental frequency (30%) and the modulation in amplitude (4%).

Conclusions. The results provide insight into how voice acoustical parameters can influence vocal level and vocal effort. In particular, vocal effort increased when vocal level and fundamental frequency increased and when the amplitude voice modulation decreased.

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Reproducibility of Voice Parameters: The Effect of Room Acoustics, Background Noise, and Equipment

Introduction: Computer analysis of voice recordings is an integral part of the evaluation and management of voice disorders. In many practices, voice samples are taken in rooms that are not sound attenuated or sound-proofed, with different levels of sophistication of equipment. Background noise will likely affect the recordings, and therefore, their analyses. Variation in background noise at the time of recordings can make it difficult to interpret treatment outcomes. In addition, variation in equipment and environment make it difficult to reliably compare outcomes at various sites making multi-institutional studies difficult. It is possible that some acoustic measures are less sensitive to such variability than others.
Objective: The objective of this study is to compare various acoustic outcome measures taken from samples recorded in a sound-proofed booth to those recorded in more common clinic environments, as well as with different caliber microphones.
Methods: Female and male subjects were recorded while reading a text and producing sustained vowels in a highly controlled environment. The collected speech material was reproduced by a Head and Torso Simulator and recorded in 3 clinical rooms and in an anechoic room with a Class 1 microphone. Following ISO 3382, the characterization of these rooms was performed in terms of reverberation time, early decay time, and clarity. In addition, the background noise in the clinical rooms was assessed with a sound level meter over two samples of 10 minutes. Several different microphones were used as well for comparison.
Results: Recent measures (e.g. pitch strength, CPP, AVQI) as well as more traditional measures (e.g. spectral slope, jitter, shimmer) were calculated from the samples. This discussion will present those measures which are more robust (less sensitive) to room acoustic differences, background noise, and microphone quality.

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Temporal Segmentation of Laryngeal High-Speed Videoendoscopy in Connected Speech

Objective: This study describes an automatic algorithm for temporal segmentation of laryngeal high-speed videoendoscopy (HSV) data to be implemented for analysis of connected speech.

Methods: A custom-built flexible fiber-optic HSV system was used to record a "Rainbow Passage" production from a vocally-normal female. A gradient-based algorithm was developed to generate a motion window acting as a filter following the spatial location of the vibrating vocal folds. Statistical analysis was done to extract the glottal area waveform and the fundamental frequency. For the purpose of reference, the vibration of the vocal folds was tagged visually from the HSV data.

Results: Comparison of the automatically-extracted glottal area waveform to the visually-tagged vibratory data showed excellent agreement. In addition, the fundamental frequency contour was found to be in accordance with the increases and decreases in the frequency of vibration.

Conclusions: Temporal segmentation of HSV data during connected speech can be successfully achieved using the gradient-based algorithm presented here. The temporal segmentation is the first important step toward analysis of HSV in connected speech. This would facilitate the development of next generation HSV-based clinical voice assessment techniques.

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Effect of Lung Volume Instructions on Voice Onset using Vocal Attack Time

Objective: To investigate the effect of different lung volume instructions on voice onset as measured by vocal attack time (VAT) in young healthy adult speakers.

Study Design: Experimental within subjects design.

Methods: Simultaneous acoustic and electroglottographic (EGG) recordings were obtained for forty-three female subjects while producing a sustained /a/ vowel when provided with breathing instructions to use resting expiratory level, habitual level and high lung volume levels. Vocal attack time was computed automatically with a Matlab® script using acoustic and EGG signals. Breathing instruction responses were observed and recorded using respiratory induction plethysmography (Inductotrace).

Results: The median VAT values were shortest in the high condition, longer in the habitual condition and longest in the resting expiratory level condition. Significant differences were found in 84% of subjects between the high and resting expiratory level conditions and the high and habitual conditions ($p < 0.001$, $z = -4.009$). Effect size was large ($r = 0.61$). A retention effect of high lung volume on a habitual washout condition was also observed ($p = 0.014$, $z = -2.463$, $r = 0.38$).

Conclusions: Findings support the hypothesis that voice onset as measured by VAT is affected by different lung volume instructions. Instructions for high lung volumes result in significantly shorter VAT compared to instructions relating to habitual and resting expiratory level lung volumes. This effect may be retained in subsequent voice onsets.

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Receiver Operating Characteristics (ROC) Curves Analysis for Descending Threshold Values in Automated Electroglottographic Events Detection

Objectives: In a previous pilot study (JoV 2016), we proposed an automated method to extract inflection events (IE) in EGG signals and to classify them according to their location (ascending portion or descending portion of the signal). Our goal is to optimize the method and to improve its performance. To this end, in the present work, we perform a receiving operating characteristic (ROC) curves analysis for each threshold used to detect IE in the descending portion.

Methods: From a mathematical point of view, the events of our interest in the EGG signal correspond to inflection points in the curve. Therefore all the IE (ascending or descending portions of the signal) meet two criteria: (1) The first derivative (dEGG) is null or "close to zero"; (2) The second derivative changes from positive to negative or *vice versa*. To settle the meaning of "close to zero" we fixed thresholds values for the ascending and descending portions of the signal (UpTh and DwnTh respectively).
As is well known, the validity of a dichotomous test compared with the gold standard of a given diagnostic test can be determined by performing a ROC curve analysis for different parameter values. The receiver operating characteristic (ROC) curve is the plot that displays the full picture of trade-off between the sensitivity and (1- specificity) across a series of cutoff points. In the case of our Automated Electroglottographic Events Detection Method, ROC curves are obtained and discussed and here the parameter corresponds to the threshold used to detect IE in the descending portion (DwnTh).

Results: We assembled 2x2 contingency tables for each of the 7 DwnTh used to evaluate the diagnostic performance of the method previously proposed. ROC curves are presented for validation of relative tradeoffs between benefits (true positives) and costs (false positives) of the adjustment of the DwnTh in order to reduce the user-dependence in the analysis and make it more similar to a screening method. A comparison of the results obtained for 7 parameter possibilities is presented by means of the ROC curves.

Conclusions: The analysis of the obtained ROC curves allow to assert that it is possible to perform an automatic quantification of the EGG signal, helping the clinician or researcher in intensive time consuming human screening. This may be useful in different research lines of correlation of vocal fold pathology and EGG signal shapes.

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The Flute Inside-Out: Tracking Laryngeal Movements in Flute Playing

Objective : Understanding the physiology of flute playing is limited by lack of empirically-derived information. This study aimed to observe selected laryngeal and pharyngeal mechanisms during performance of specific musical tasks. The performers played a specific protocol which demonstrates musical skills such as range, articulation, dynamics and vibrato.

Method: Fiberoptic video-nasendoscopy images were collected from 3 males and 3 females, aged 26 to 60 years. Each participant played essential musical tasks: vibrato, softest and loudest tone, single tonguing, double-tonguing and legato (no tonguing). Video images were rated by an experienced SLP as to arytenoids adduction, true and false vocal fold adduction, pharyngeal space closure, laryngeal height degree, and epiglottis movement.

Results: Consistent laryngeal/pharyngeal movements could be observed across participants and tasks. The glottal aperture was regularly modified by abduction and adduction of the vocal folds across tasks and the arytenoids were consistently recruited in tasks such as vibrato, and dynamics across participants.

Conclusions: This study reveals that laryngeal/pharyngeal participation in flute playing is not limited to vibrato production, or specific techniques such as singing and playing or flutter tongue. The larynx plays a major role in producing flute tone and dynamics and should be considered by pedagogues, performers and health specialists.

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Resonance Bandwidth and Vocal Fold Vibration

Objective
Under certain conditions voice breaks or voice instabilities occur, which can be assumed to be caused by interaction between the vocal tract resonator and vocal fold vibration. The likelihood of such interaction should be increased if the bandwidths of the vocal tract resonances are narrowed. Such narrowing of the bandwidths can be achieved by artificially lengthening the vocal tract by a hard-walled tube. Nasalization, on the other hand, can be assumed to widen the resonance bandwidths, since the nasal tract is a heavily damped resonator.

Method
Repeating an experiment of Kågén and Trendelenburg (1937) nine singer subjects sang five pitch glides, from their lowest to their highest pitch, on the vowel /ae/, while holding a 70 cm long tube tightly against the lips. In a second condition the subjects repeated the pitch glides while nasalizing the vowel. In a third condition, the subject sang the pitch glides into an identical tube, the resonances of which were damped by a small piece of cotton inserted into the open end. The number of instabilities in terms of register breaks, pitch jumps and other abrupt voice changes were analyzed.

Results
The cotton dampening widened the bandwidths of the first and second resonance, which appeared at 120Hz, from 8Hz to 79Hz. Voice instabilities were most frequent when the subjects phonated into the empty tube, and most instabilities happened when the fundamental coincided with the first or the second resonance of the tube-vocal tract resonator. Thus, dampening the tube resonances with cotton and nasalization reduced the number of instabilities. However, the number of instabilities differed greatly between subjects, and in some subjects the number of register breaks did not vary between conditions.

Conclusions
The results support the assumption that voice instabilities are likely to occur when the fundamental coincides with a formant and that this risk can be reduced by attenuating the vocal tract resonances and by nasalization.

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Emotion Expression in Singing Voice Source Characteristics and Emotional Coloring Used by Three World-Renowned Male Singers

Background
Emotional coloring is an important, if not the most important property of sung performance. Yet, little research has been done to elucidate the phonatory and resonatory means that singers use to color their vocal delivery in the shades of many subtle emotions.

Method
Three highly experienced professional male singers sang scales on the vowel /ae/ in a neutral and in ten different emotional colors (Neutral, Sadness, Tender, Calm, Joy, Contempt, Fear, Pride, Love, Arousal, and Anger). Voice source parameters and formants were analyzed by inverse filtering and the deviations from the neutral versions were determined for each color. In addition the variation of long-term-average spectra were analyzed.

Results
Singers differ greatly with respect to the vocal means used for differential emotional coloring. However, among the colors studied, Sadness and Anger were consistently diametrically opposed with regard to both voice source and formant properties.

Conclusions
The results clearly show that singers use different methods to create an emotional color using specific combinations of both phonatory and articulatory means. Further research is needed to disentangle the underlying mechanisms.

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The Vocal Tract Organ

Objective: To design and implement a new musical instrument based on measured vocal tract shapes of informants for individual vowels (essentially, a modern 'Vox Humana' organ stop).

Methods/Design: The Vocal Tract Organ is a new musical instrument that emerged from work on the synthesis of natural sounding voices using 2-D and 3-D digital waveguides to solve the acoustic pressure outputs from vocal tract shapes based on magnetic resonance images of human subjects. Life-sized vocal tract models were created for a variety of vowels by means of 3-D printing, and these can be placed atop a loudspeaker through which a signal approximating to the acoustic output from the larynx is delivered. In the current version, up to 6 note polyphonic outputs can be produced played via a MIDI (musical instrument digital interface) keyboard. In addition, it has an alternative joystick-based controller that enables the pitch of individual voices to be controlled independently.

Results: The Vocal Tract Organ has been used in four concerts with music specially composed for it so its practical application has been tested successfully. It has been received at these events with critical acclaim. A smaller version, based on a linear systems approach to the design has been prototyped successfully and this will be described.

Conclusions: The Vocal Tract Organ has the potential to be used as a replacement for a pipe organ 'Vox Humana' stop and discussions are under way with a pipe organ company. Its immediate advantage is that is produces an acoustic output that is much closer to a human vocal output. In addition, the vowel can be readily changed perhaps by means of additional stops.

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Speaking Machine with Arbitrary Pitch Contours

Objective: Since late 18th century, starting with Kempelen and Wheatstone, building mechanical devices to produce human voice has been a perennial research project for engineers and physiologists alike. A successful speaking machine would clarify the human voice production mechanism; help the diagnosis of voice disorders; and find appropriate treatments. However, to date, all such devices can only produce a sustaining voice with a fixed pitch. The production of programmable life-like speech was not yet achieved. Therefore, the usefulness of the existing devices is limited.

Methods/Design: The key element of a speaking machine with arbitrary pitch contours is a new type of artificial voice folds, where each glottal opening moment and each glottal closing moment can be programmed to an accuracy of a small fraction of a millisecond. Therefore, voice of arbitrary pitch contours, arbitrary open quotients, including vocal fry and individual glottal stops, can be produced. Using computer programming, speech and singing voice of arbitrary design can be produced.

Results: After years of trial and error, a working design of programmable vocal folds is experimentally demonstrated. It uses a thin-wall silicone tubing to mimic the vocal folds, which can be opened and closed by a moving-coil magnetic actuator. The advantage of the moving-coil magnetic actuator is its small mass (about 1.5 grams), strong force (many newtons), and therefore a high response frequency (greater than 10 kHz). The actuator is controlled by a Raspberry Pi miniature computer, using Python as programming language. Complete sequences of glottal closings and openings are demonstrated. With an external tubing to mimic the vocal tract, voice signals are generated.

Conclusions: It is relatively easy to control the shape of the artificial vocal tract by step motors because its slow motion. Therefore, using computer programming, complete and arbitrary human voice can be generated using a mechanical device, including speech and singing.

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Regenerative Effects of Basic Fibroblast Growth Factor on Restoration of Thyroarytenoid Muscle Atrophy Caused by Recurrent Laryngeal Nerves Transection

Objectives:

Vocal fold atrophy which follows after unilateral vocal fold paralysis (UVFP) is caused by thyroarytenoid (TA) muscle atrophy. Medialization procedures such as type I thyroplasty, arytenoid adduction, and vocal fold injection are currently popular treatments for hoarseness due to UVFP. However, hoarseness still remains in some cases because of the progressive reduction in the mass or tension of the denervated TA muscle. Thus, it is desirable to promote reinnervation of the TA muscle, in addition to the medialization procedure. Basic fibroblast growth factor (bFGF) has been reported to have potential effects on muscular and nervous regeneration.

This study examined the regenerative effects of basic fibroblast growth factor (bFGF) on restoration of thyroarytenoid muscle atrophy caused by recurrent laryngeal nerves transection

Materials and methods:

The right recurrent laryngeal nerves (RLN) of Sprague-Dawley rats were transected.

After 4 weeks, different concentrations of bFGF (200 ng/50μL, 100 ng/50μL, 10 ng/50μL or 50μL of saline only) were injected into the right vocal fold of each rat for 4 times. Larynges ware harvested for histological and immunohistochemical examination 4 weeks post-final injection.

Results:

The TA muscle area was significantly larger in the bFGF-treated group compared with the sham-treated group. The number of nerve terminals and acetylcholine receptors (AchRs) significantly increased in bFGF-treated group.

Conclusions:

Conclusion: The current results suggest that local application of bFGF for TA muscle atrophy has the potential to improve vocal fold atrophy.

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Investigation of Flexible High-Speed Video Nasoendoscopy

Objective: High-speed videolaryngoscopy is widely-used in voice practices as a complement to videostroboscopy, especially when it is desired to visualize non-symmetric and non-periodic vocal fold vibration, or voice onset and offset. Because of the requirement for greater illumination at higher frame rates, the high-speed exam is usually performed with a rigid transoral laryngoscope. Although it is possible to obtain high-speed video images with a flexible fiberoptic nasoendoscope, the results are often disappointing because of the inability to provide adequate lighting inside the larynx. This paper will present the results of a systematic exploration of the feasibility of flexible high-speed videolaryngoscopy using simple tools and techniques to supplement readily available clinical equipment.

Methods: The KayPENTAX Model 9710 Color High-Speed Video Endoscopy System was used with a PENTAX flexible fiberoptic nasolaryngoscope and a new supplemental light fiber bundle to perform high-speed examinations of healthy vocal folds. Variables of the investigation included camera frame rate, camera sensitivity (color head vs. black-and-white head), optics (camera lens focal length), light coupling, nasoendoscope outer diameter, and endoscopy technique (visually perceived distance of distal tip of scope from the glottal plane).

Results and Conclusions: With the use of a prototype supplemental light fiber bundle and the optimization of the settings on the KayPENTAX Color High-Speed Video Endoscopy System, high quality video images of healthy vocal folds were consistently obtained. A discussion of the other factors considered include patient comfort, practicality, expense, and ease of use by the clinician.

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Thyroid Deformation during Singing: A 3D Analysis on Professional Singers

Objective: While young professional singers can easily sing in very high pitches, elder singers often complain about having to exert substantially more laryngopharyngeal force in order to reach the same high pitch than in their early days. In literature, however, it is explained by various factors having an impact on the singing apparatus. Aim of this study was to analyse the thyroid deformation (and thereby stiffness) during singing as a potential reason of the phenomenon.

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®. By superimposition of the different 3D images, different positions of the thyroid became visible. The distance of the posterior border of the thyroid was measured in all the examinations.

Results: All laryngeal cartilages could be visualised three dimensionally. There is a significant correlation between the grade of deformation and age ($r = 0.8$, $p < 0.001$). Furthermore, there is another significant correlation between frequency and the grade of thyroidal deformation ($r = 0.46$, $p < 0.001$)

Conclusions: We conclude that age leads to a stiffening of the thyroid cartilage. The stiffness can impact the resonance space and thereby likely lead to a higher tension of both laryngeal and pharyngeal muscles. Elder singers sense this lack in elasticity as a substantially greater effort when singing high pitches or even in failure doing so.

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3D Analysis of the Movement of the Arytenoid Cartilage after Montgomery Thyroplasty Type I

Objective: Thyroplasty Type I (TP I) is a standard procedure for unilateral vocal fold paralysis (UVFP). In some cases, the paralysed VF is lowered due to an anteromedially rocked arytenoid cartilage. Aim of the study was to analyse the functional effect of the Montgomery implant on the arytenoid cartilage during TP I.

Methods/design: 25 patients with a UVFP as a result of a deep vagus lesion underwent TP I surgery. Pre- and postoperatively, laryngoscopy and a HRCT scan of the larynx were performed. The DICOM data from the scans were rendered and 3D-visualized with the software MIMICS®. By superimposition of the different 3D images, the implant induced arytenoid cartilage movement could be visualized. The length of the vocal fold (anterior commissure – vocal process) was calculated pre and postoperatively.

Results: Intraoperatively, the closure of the glottal gap was monitored acoustically. Postoperatively, all patients showed a complete glottal closure. All laryngeal cartilages could be visualised three dimensionally. Depending on the size of the implant, two movements can take place: on the one hand, the arytenoid cartilage can be pushed posteriorly and superiorly on the shoulder of the cricoidal joint facet, and, on the other hand, the vocal process can be rotated in a medial and superior position. As a result, the vocal fold will be elongated and elevated.

Conclusions: Depending on the Montgomery implant size, it is possible to reach (1) a medialisation and (2) an elongation of the vocal fold. Therefore, a preoperative CT-Scan seems to be necessary in order to evaluate the correct implant size

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Unilateral Cricoarytenoid Joint Ankylosis in Rheumatoid Arthritis

Objective: To report the second case in the literature of unilateral vocal cord paralysis in a patient with rheumatoid arthritis.

Methods: A case report.

Results: A 53 year old male previously diagnosed with rheumatoid arthritis presented to the Voice Unit with history of dysphonia and aspiration with no obstructive respiratory symptoms. Perceptual evaluation revealed grade III dysphonia with marked breathiness. Laryngeal video-stroboscopy showed a fixed right vocal fold in the paramedian position with incomplete closure of the vocal folds during phonation. High resolution Computerized Tomography of the larynx revealed ankylosis of the right cricoarytenoid joint. Patient underwent right vocal cord injection laryngoplasty under local anesthesia using the transoral fiberoptic injection technique as an office procedure. A total of 0.7 cc of Restylane (Hyaluronic acid, stabilized 20mg/ml) was injected lateral to the vocal process following which the patient had marked improvement in his voice quality. The maximum phonation time increased from 3 seconds to 10 seconds.

Conclusion: Rheumatoid arthritis is a systemic disease that affects all synovial joints including the cricoarytenoid joint causing unilateral vocal cord paralysis. Change in voice quality and history of aspiration should alert the physician for possible unilateral cricoarytenoid joint involvement. Early intervention with injection laryngplasty is recommended.

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Apoptosis in Vocal Cord Polyps

Objective: To examine the degree of apoptosis and mitosis in patients diagnosed with vocal cord polyps.

Methods: A total of 61 slides were chosen from 51 patients diagnosed with vocal cord polyps were included in the study. Polyps were histologically diagnosed by the presence of intense fibrous deposition, hemorrhage, vascular proliferation, iron and vascular thrombosis. Another 41 slides were chosen from the normal vocal cords of 26 patients who had laryngectomies. Only patients with full history, paraffin block and hematoxylin and eosin stained sections were included in the study. The stained sections were retrieved on all 102 slides and reviewed by two pathologists (IK & GT). Apoptotic and mitotic cells were counted per millimeter square in the vocal cord epithelium (H & E staining).

Results: There was a significant difference in the mean of apoptosis between patients with polyps and controls (7.84 ± 5.817 vs. 0.59 ± 0.774 respectively with a p-value < 0.05). There was also a significant difference in the mean of mitosis between patients with polyps and controls (6.02 ± 3.905 vs. 0.83 ± 1.070 respectively with a p-value < 0.05).

Conclusion: Patients with vocal cord polyps have a higher rate of apoptosis compared to controls reflecting a higher proliferative activity in the vocal fold epithelium.

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Hemilaryngeal Microsomia: An Anatomic Variant

Objective: To describe a congenital laryngeal structural variant, Hemilaryngeal Microsomia (HLM), and correlate identification on physical examination with computerized tomography scan (CT) and laryngoscopy findings.

Setting: Tertiary Care Center

Patients: Six patients presenting with hoarseness to a tertiary care otolaryngology office. These patients had asymmetrical thyroid cartilage prominence on palpation during physical examination. A diagnosis of hemilaryngeal microsomia was made. All patients underwent laryngostroboscopy and CT scan. Four control patients with normal thyroid cartilage anatomy on physical examination, CT, and stroboscopy results were included for comparison.

Results: Disparities in thyroid cartilage angles correlated with documented physical examination findings for 6/6 HLM patients. On CT scan, the average difference in left and right thyroid laminar angles was $30.2º \pm 18.3º$ in HLM patients versus $4.00º \pm 1.63º$ in control patients ($p = .023$). Strobosocopic findings also correlated with HLM. The arytenoid cartilage was anteriorly or medially displaced on the microsomic side in 6/6 HLM patients. Three patients had anterior placement of the vocal process resulting in shortening of the vocal fold on the microsomic side of the larynx.

Conclusion: HLM is a congenital structural anomaly of the larynx that may be palpated on physical examination. HLM on exam can be correlated with asymmetry found on CT scan and endoscopy. There is no evidence that the structural features of HLM were causally related to voice symptoms, but the findings in HLM may lead to misdiagnosis. A larger study is indicated to confirm laryngeal structural differences between patients with HLM on physical examination and the general population. Whether or not abnormalities of thyroid cartilage shape, such as HLM, may affect surgical or clinical outcomes remains to be studied.

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Voice Feminization: Motivations and Barriers to Transition

Introduction: Increased awareness and societal acceptance of the Transgender community has highlighted the necessity for improved understanding of the healthcare needs and access barriers specific to this patient population. One area of limited understanding involves the clinical management of the transgender voice. To date, factors motivating or deterring transgender patients from seeking treatment, perceptions of voice therapy and/or voice-modifying surgeries, and willingness of transgender patients to undergo such interventions all remain poorly understood.

Methods: A Web-based survey was disseminated to online forums and Transgender community websites. All individuals identifying as Transgender were invited to complete the survey.

Results: Preliminary data were provided by N=25 Trans women including demographic information, voice use in professional/personal settings, prior interventions, preferences regarding interventions, and willingness to pay (WTP). Several emerging themes were appreciated. Barriers to access included lack of family support (30%), cost (78%) and lack of knowledge regarding how/where to obtain services (50-67%). Of those interested in changing their voice, 16% had professional voice training while 68% utilized online resources/personal experience alone. The majority preferred one-on-one (73.7%) training spanning weeks to months (68%) compared to web based, time intensive courses. 90% were willing to travel up to 50 miles to obtain services. Regarding WTP for services, 58% were willing to pay between $20-50 per session for specialized voice therapy. When stratified by age, patients under 40 y/o were less likely to be willing to pay for surgical intervention (39% vs 83%).

Conclusion: Our pilot data suggests that respondents are lacking basic information regarding available services but are equally open to both behavioral and surgical options. The willingness to pay data provides insight regarding the extent to which respondents desiring voice change are open to using their personal resources to do so.

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Laser Adjustments for Transgender Pitch Surgery

Objectives: procedures using the KTP and CO_2 lasers are being developed to adjust vocal cord pitch and to correct abnormalities after other vocal cord pitch surgeries, particularly male to female transgender individuals.

Methods: individuals who had undergone vocal cord pitch surgery, such as feminization laryngoplasty and vocal cord webbing and had residual vocal abnormalities such as asymmetry or looseness of the vocal cords, were treated with a laser (often KTP but occasionally CO_2) to tighten the looser of their asymmetric vocal cords.

Results: in addition to reducing vocal roughness or diplophonia, the laser tightening tends to raise the speakers pitch. Tightening has since been performed bilaterally in some individuals in order to give them additional pitch increase.

Conclusions: utilizing the KTP laser in the office, vocal cord asymmetry can be corrected and pitch can be increased by about 1/2 to 1 semitone with a treatment. Utilizing a CO_2 laser under general anesthesia, vocal cord tension asymmetries can be corrected and pitch can be raised by an estimated 1/2 to 1 1/2 semitones with a treatment.

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Feminization Laryngoplasty

Objectives: Feminization Laryngoplasty is an evolving surgical technique with the aim to raise both the fundamental frequency of the voice and the resonant frequency of the vocal tract in male-to-female transgender patients. It is designed in an attempt to address possible shortcomings in quality, longevity, as well as complications of existing procedures.

Methods: Feminization Laryngoplasty consists of removal of the anterior thyroid cartilage to collapse the diameter of the larynx with the added benefit of removing the protruding profile of the Adam's Apple more extensively than the existing procedure of "Tracheal Shave". Removing the anterior vocal cords shortens, possibly thins and allows further tensioning of the vocal cords with the goal of raising the comfortable speaking pitch. Shortening the false vocal cords narrows the supraglottis and may alter resonance. With the removal of the superior margin of the thyroid cartilage, the vertical dimension of the larynx is shortened and the larynx can be suspended higher in the neck via thyrohyoid elevation with the goal of shortening the pharynx and altering resonance towards more feminine overtones.

Feminization Laryngoplasty may be used as an approach to reattach and retighten vocal cords after the complication; vocal cord detachment, which may occur as a complication during a "Tracheal Shave."

Results: Feminization Laryngoplasty surgically attempts to create a feminine voice quality in male to female transgender patients, as an alternative to existing procedures of anterior commissure advancement, cricothyroid approximation, vocal fold webbing and laser vocal fold tightening. Benefits include a generally well camouflaged incision, elevated comfortable speaking pitch, elevated lowest speaking pitch and resonance may be altered in the direction of female vocal quality.

Conclusions: Risks and limitations of the procedure include the need for an external incision, potential infection and airway compromise in the immediate postoperative period. Upper limits of the vocal range may be lowered and the upper range may have a tighter quality. Uneven tension may cause roughness of the voice requiring additional procedures. Comfortable speaking volume and maximum volume tend to be reduced.

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Serious Systemic Diseases with Laryngeal Disorders as First Symptoms

Objective: In this conference of 2015, we reported cases of hypothyroidism, myasthenia gravis, and mucous membrane pemphigoid whose first symptoms were laryngeal disorders. Recently, we experienced additional cases whose first symptoms of their systemic diseases were vocal problems. The purpose of this report is to present these cases with educational importance to warn all the multidisciplinary voice care team members, not to have the biased view to pay attention only in the larynges.
Methods/Design: Case reports.
Results: Case1, 39 y.o. female, rheumatoid arthritis (RA). She visited our institution with hoarseness for eight months. Her vocal quality was G1R1B0A0S0, and laryngoscopy detected bamboo nodes like findings in bilateral vocal folds. She was consulted to rheumatology division. Blood test represented high level of rheumatoid factor (RF), and anti citrullinated peptide antibody (ACPA) to suggest RA morbidity. Case 2, 44 y.o. female, dermatomyositis (DM). She visited our institution with hoarseness and cough for 6 months. Her vocal quality was G2R1B0A0S1, and laryngoscopy presented redness of bilateral vocal folds, edema of right arytenoid, and white coat of right supraglottis. Oral aphtha, skin erythema, and arthralgia appeared in 1 month, and she was consulted to rheumatology division, and diagnosed as DM. Improvement of her laryngo-pharyngeal symptoms were observed after steroid and immunosuppressant medication 5 months after diagnosis. Case 3, 68 y.o. male, cortical cerebellar atrophy (CCA). He visited our institution with hoarseness. His vocal quality was G2R2B2A0S0, and laryngoscopy revealed golottal insufficiency due to vocal folds atrophy to require voice therapy. Speech pathologist (S.M.) noticed dysarthria and ataxic gait. Brain-MRI showed cerebellar vermis atrophy, and he was consulted to neurology division and diagnosed as CCA. Conclusions: Systemic diseases should always be kept in mind as one of the pathologies to induce laryngeal disorders.

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Validation of the Laryngopharyngeal Reflux Color and Texture Recognition System Compared to pH-Probe Monitoring

Objective/Hypothesis: The objective of this study was to determine the validity of our laryngopharyngeal reflux (LPR) diagnostic system from our previous study (Witt et al.14) against the results of a standard pH probe monitoring. We hypothesized that subjects with abnormal pH probe results demonstrate color and texture abnormalities that would be classified as LPR according to artificial neural network (ANN) analysis.

Study Design: Retrospective analysis.

Methods: Eighty-two subjects, including 18 pH-positive, 11 pH-negative, and 53 control subjects were tested for LPR through multichannel intraluminal impedance 24-hour pH (MII-24pH) monitoring. Laryngoscopic images of all subjects were obtained. The hue and texture values of seven areas of interest, including true vocal folds, false vocal folds, arytenoids, and interarytenoid, were quantified using a hue calculation and two-dimensional Gabor filtering. These served as inputs for the ANN. This was used to classify images through pattern recognition, and a receiver operating characteristic (ROC) analysis was performed to determine the effectiveness of the diagnosis.

Results: Classification accuracy for the combined hue and texture was 87.40%, with an area under the ROC curve of 0.910.

Conclusion: Although a previous study conducted classification based on RFS, this study suggests that color and texture analysis may be used to classify images based on the results of pH probing, a more objective approach for diagnosis. Additional studies should include more subjects to produce an even more accurate reading, and will use the color/texture analysis tool to test and confirm this application in a clinical setting.

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Five Cases of Cricoaritenoid Joint Fracture Revealed by Three Dimensional Computed Tomography

Here we report our examination, using three-dimensional computed tomography (3DCT), of five patients with posterior cricoid cartilage fractures without mucosal disruption. Endoscopically, the affected arytenoids were immobile and seemed to be fixed in the paramedian position. Three of the patients were injured while engaging in karate, another was injured during a rugby match, and the final patient was injured because of traffic accident. We used regular CT to confirm fractures in all five cases. However, the details were unclear; thus, we performed 3DCT. This revealed that the fracture lines in the posterior cricoid cartilage extended to the cricoarytenoid joint in all patients, perhaps explaining the arytenoid immobility. One patient exhibited cricoarytenoid joint fixation. Although we recommended wait-and-see observation, this patient requested surgery to improve the voice. We performed type I thyroplasty under local anesthesia, but the outcome was suboptimal. The remaining four patients underwent conservative treatment, and their voices remained unchanged. We suspect that the fractures were pressure-induced; the posterior portion of the cricoid cartilage may have been compressed against the anterior portion of the cervical spine from front to back.

It is difficult to confirm whether cricoid fractures extend to the cricoarytenoid joint using regular CT alone; in this context, 3DCT is useful. It is difficult to improve the voice when treating laryngeal traumas involving cricoarytenoid joint fractures because the arytenoid is immobile.

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Awake Office-Based Surgery for Vocal Fold Lesions and Injection Laryngoplasty Using a Curved Needle via a Thyrohyoid Approach

Objective: To introduce a simple, safe procedure for office-based surgery for vocal fold lesions and injection laryngoplasty and to evaluate the surgical results treating vocal fold cysts using this procedure.

Methods: This procedure is performed under a laryngeal endoscopic view under topical anesthesia. A 23G needle bent at two points, about 1~1.5 and 2~3 cm from the tip, is inserted into the larynx 2~3 mm above the superior thyroid notch. The needle can reach every part of the vocal fold, from anterior to posterior, in all directions. This procedure is useful for both injection and incision of vocal fold cysts or nodules. Using needle incision, we treated 82 patients with vocal fold cysts by opening the lateral cyst wall. The short-term voice recovery and medium and long-term recurrence rates were evaluated.

Results: We have performed over 1500 injection laryngoplasties using this procedure for unilateral vocal fold paralysis and atrophy, or botulinum toxin injection for adductor spasmodic dysphonia. Since January 2012, surgery for vocal fold lesions has been performed in over 400 cases, including the removal of vocal fold polyps, nodules, and cysts. There were no severe complications and the success rate was nearly 100%.We only experienced 2 patients (2.4%) of cyst recurrence which was seen at 2 weeks and 6 months after operation. Except for this one recurrence case at 2 weeks, every other patient's voice improved by their first visit (2-4W after surgery).

Conclusions: This method is very simple and useful, with no technical or medical failures. Vocal fold cyst opening using this method achieved rapid voice recovery and has a very low recurrence rate.

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What Determines Successful or Unsuccessful Trial Vocal Fold Injection Augmentation?

Objective: Trial vocal fold injection (TVFI) is often employed diagnostically for patients with subtle glottic insufficiency to explore voice and other complaints. Success of TVFI was originally reported through VHI-10 scores and subjective patient outcome. Clinical experience demonstrates that the time to and length of peak benefit of the trial augmentation is variable; thus it is unclear if subjective report is enough to confirm TVFI success or if other objective measurements can be obtained reliably to support the patient report. The aim of this study was to compare successful to unsuccessful TVFI patient groups. We hypothesize that patients with subjectively reported success will also have significant improvements in VHI-10, phase closure, subglottic pressure and glottic airflow 2 weeks after trial augmentation.

Methods/Design: Retrospective review. Subjects included had subtle glottic insufficiency with elliptical or complete but short phase closure from paralysis, paresis, and/or atrophy demonstrated on laryngovideostroboscopy. All subjects underwent per-oral, office based TVFI with carboxymethylcellulose. Subjective report of patient outcome as successful or unsuccessful was recorded. Measurements of baseline and 2-week post-injection VHI-10, subglottic pressure, airflow and percent of the closed phase of the glottic cycle (via frame by frame analysis).

Results: 23 subjects met inclusion criteria. 15 (65%) reported a successful subjective improvement of their symptom while 8 (35%) were unsuccessful (only partial improvement or no improvement). The VHI-10 demonstrated a significant improvement and percent of the closed phase approached significance in the successful group. There was no significant difference in any other objective measurement between the successful and the unsuccessful groups or between pre and post measures within a group.

Conclusions: Subjective patient report of trial injection outcome including use of VHI-10 may be the most reliable means of determining success. No objective measure evaluated could demonstrate significant improvement between the cohorts despite a 65% subjective success rate.

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The Efficacy of Injection Laryngoplasty in the Management of Laryngeal Nerve Paresis

1. Background

The diagnosis of Superior and Recurrent Laryngeal Nerve Paresis/Palsy remains elusive due to the variability of its clinical presentation. Patients complain of a wide range of vocal disabilities including vocal fatigue, inability to project and loss of vocal range on the basis of varying degrees of glottal insufficiency. To complicate matters, there are also different patterns of reinnervation which may be inadequate, incomplete and even dysfunctional (synkinesis). Therefore, paresis can often be difficult to diagnose and distinguish from innocent vocal fold asymmetry. The condition is often missed unless the clinician carries a high index of suspicion. A heightened awareness along with improved diagnostic ability with videostroboscopy and laryngeal electromyography, has resulted in an increased pick up rate for this condition. Once the diagnosis has been confirmed, patients can be offered a treatment options like injection thyroplasty aimed at improving glottal incompetence.

2. Methods

The objective was to establish if injection thyroplasty is effective in these patients.

An analysis was done on a pilot group of adult patients with recurrent and/or superior laryngeal nerve paresis who presented to the clinic over a period of 5 years. After obtaining a detailed history of the patient's presenting complaint, a thorough clinical examination was performed including both flexible and rigid endoscopic videotroboscopic examinations. Laryngeal EMG studies were then carried out on patients with suspected paresis to confirm the diagnosis and further define the exact nature and extent of the paresis. The patients included in the study went on to have injection thyroplasty with Radiesse Gel or Radiesse Voice (CaHA).

3. Results

The patients response to injection laryngoplasty was analysed by comparing pre and post videostroboscopy examinations, as well as treatment objective measures of vocal function including acoustic and aerodynamic measurements and voice questionnaires (VHI, GCI & QLI).

4. Conclusions

Most patients responded well to the injection laryngoplasty with varying degrees of improved vocal function. Besides providing evidenced based research into the efficacy of the treatments we offer our patients, we also hope to provide further insight by comparing treatment outcomes in patients with isolated Superior Laryngeal Nerve paresis vs patients with combined Recurrent and Superior Laryngeal Nerve paresis with regards to clinical presentation and response to treatment.

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Clinical Feasibility of Three Days Voice Rest after Vocal Fold Surgery – Preliminary Report

Objectives: Patients are commonly requited to avoid voice use for limited time period after phonomicrosurgery to avoid mechanical damage to the wound and to produce the best surgical impact. However, optimal period of voice rest has been controversial and multiple durations of voice rest have been used depending on surgeons' experiences.

Recently, a prospective randomized study reported that 3days of voice rest (3-days group) could produce better vocal outcome after vocal fold surgery compared with 7-days group. Thus we adopted 3 days as a routine period to reqire complete voice rest after phonomicrosurgery. In this preliminary report, we present our system to approach patients who undergo phonomicrosurgery. Furthermore, subjective and objective impact of surgery on the patients under this system were evaluated.

Methods: Patients who underwent phonomicrosurgery for vocal fold polyp or vocal fold nodule using microflap technique in our institution since April 2016 were incorporated in this study. Our protocol consisted of 1) preoperative vocal hygiene instruction, 2) complete voice rest for 3 postoperative days (POD), 3) relative voice rest using confidential voice for limited time during 4 POD to 7 POD, and 4) no severe restriction of voice use after 8 POD. Compliance of our protocol were surveyed 2 weeks after surgery. To assess the impact of surgery, stroboscopic finding, GRBAS score, aerodynamic measurements, acoustic analyses, VHI, and V-RQOL were measured and compared with preoperative data at 2, 6, 12, and 24 weeks after surgery.

Results: Five patients were incorporated, and our protocol was understandable for these patients and was mostly followed after surgery. Postoperative vocal evaluations revealed satisfactory vocal improvement in these patients.

Conclusions: Our protocol was considered practically acceptable and feasible for the patients who undergo vocal fold surgeries. Future studies including more number of patients with multiple vocal fold diseases are warranted.

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Fundamental Frequency and Other Vocal Measures Before and After Osteopathic Manipulations

Introduction: Many vocal health issues correspond with a primary or secondary problem of laryngeal muscle tension. Systemic muscle tension--and specifically tension in the larynx--profoundly impacts voice production. Therefore, stress reduction is a common part of therapy plans for patients seeking treatment in voice clinics. Additionally, many professional vocalists use muscle relaxation techniques and body awareness methods as part of voice training and performance preparation. However, the direct effects of these techniques on the voice is still ambiguous, partially due to the lack of understanding of the underlying physiological basis for the techniques. Nevertheless, osteopathic manipulative medicine, with goals that have some overlap these body awareness techniques, does have an evidence base which may be applicable.

Objective: The objective of this study was to directly measure the effects of osteopathic manipulative medicine of the upper extremity, neck, and face on short-term changes in vocal production.

Methods: Of the fifty-one patients (Iquitos and Lima, Peru) recruited, 15 were controls and 36 had active pathology (swallow dysfunction, audible changes in vocal quality, or positive history of neck pain, cerebrovascular accident, degenerative disease, traumatic brain injury, spinal cord injury, or musculoskeletal disorder). Patients were asked to produce steady vowels (/i/ & /a/) before and after osteopathic manipulative medicine intervention of the upper extremity, neck, and face. Multiple acoustic metrics were computed for all recordings: e.g., F0, Pitch Strength, entropy measures (rpde, dfa, ppe), perturbation (jitter, shimmer), spectral measures (spectral slope, alpha ratio, energy between 1-3kHz).

Results: Estimates of fundamental frequency and the other acoustic measures illustrated significant change from pre- and post-intervention (e.g., fundamental frequency increased in Females after manipulations, while it decreased in Males). Full details of the results, including gender differences, will be discussed.

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Cervical Spine Disability in Correlation with Subjective Voice Handicap in Patients with Voice Disorders: A Cross-Sectional Study

Objective: Neck pain has been described as risk factor for the development of voice disorders. In turn pain in the back cervical region and shoulder girdle may be caused by inappropriate vocal behavior, potentially leading to increased tension and muscle tension dysphonia (functional dysphonia). This work investigates if there is a correlation between neck and voice disorder related subjective symptoms in patients with voice disorders.

Methods/Design: In a cross-sectional study adult patients with a primary complaint of benign organic or functional voice disorders were selected from the database of the Department of Phoniatrics and Speech Pathology, University Hospital Zurich, Switzerland. Outcome measures were the Voice Handicap Index-9 international (VHI-9i) and the Neck Disability Index (NDI). Spearman rank-order coefficient (r_s) was used to assess the correlation between VHI-9i and NDI for the total sample and for subgroups after disorder type and gender.

Results: 100 patients (50 organic/ 50 functional), 59 women and 41 men, with a mean age of 50.01 years (SD=16, range=24-87) were included. Mean overall VHI-9i was 13.93 (SD=7.81, range=0-31) and mean NDI 6.07 (SD=7.71, range=0-43). 36.5% (n=15) of the men and 40.7% (n=24) of the women had mild to moderate neck pain. 5.1% (n=3) women showed severe disability. There was a mild correlation between both questionnaires (r=.220, p=.02), which was stronger in patients with organic (r=.297, p=.03) as compared to functional (r=.148, p=.30) disorders. Men had a stronger agreement between both questionnaires (r=317, p=.04) than women (p=.192, p=.14).

Conclusions: In patients with functional and organic voice disorders there was a mild agreement between voice and neck related symptoms. More than one third of voice patients had mild to severe neck muscle dysfunction, which may contribute to the development or persistence of a voice disorder. Therefore, cervical and shoulder muscle dysfunction should be considered during voice assessment and treatment.

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Vibratory Characteristics of Diplophonia Studied by High Speed Video and Vibrogram Analysis

Introduction: Diplophonia is an unusual voice characteristic in dysphonic patients. It can present with polyp, atrophy, paresis, scar or functional disorders. Its vocal fold vibratory patterns have not been well characterized.

Material and Methods: Twenty subjects with diplophonic voice quality were studied by high HSV. Diplophonia were due to medical causes. (vocal fold paresis n=7, vocal atrophy n=5, polyp n=5, and scar/sulcus n=3). The diplophonia segment of the HSV was trimmed into 100 milliseconds segments and analyzed using multi-slice digital videokymography (DKG). The DKG tracing was analyzed qualitatively and then transformed into a vibrogram for Fast Fourier Transform frequency analysis.

Results: All subjects had vibratory abnormalities on HSV that explained the diplophonia. None could be resolved by stroboscopy. One can stratify diplophonia as symmetric or asymmetric based on involvement of one or both vocal folds. Scar and atrophy showed more symmetric subharmonics with diplophonia, triplophonia, or quadriphonia all being possible. Some subjects had membranous folds showing anterior and posterior independent oscillators. Asymmetric causes of diplophonia are more common in patients with polyps and paresis. The cause may be due to two different oscillation frequency of each vocal fold. Additional oscillators from mass lesions, false folds, and chaotic vibrations from only one portion of the membranous can create quasi-periodic vibration that contribute to phase interaction that results in selective amplification then degradation of the glottal cycle. Of interest is the frequent presence of inter-harmonic energy peaks above the dominant fundamental frequency in many subjects with subharmonic peaks.

Conclusion: Patients with diplophonia have vibratory abnormalities of the vocal folds that can be better analyzed by HSV. Frequency analysis of the vibrogram from DKG can resolve the vibratory abnormality into symmetric vs. asymmetric causes and can document the region of the vibratory spectrum that are affected.

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Hyuronidase (HAase)in the Management of Laryngeal Masses: The First 11 Cases

Introduction: Hyuronidase (HAase)is a FDA approved product commercially available for degradation of hyuronic acid (HA). It is indicated as subcutaneous injection for improved drug absorption, lysis of hematoma, and in treatment of inadvertent over-injection of HA in facial plastic applications. HAase as an off-label use of product may be applied in laryngology for: laryngeal hematoma, polypoid corditis, and inadvertent over-injection of HA.

Material and Methods: HAase has been used in three different applications twelve times in eleven patients. All patients were informed as to the off -label use of this medication and signed informed consent. Two patients were professional singers with hematoma of the vocal folds taken for emergent hematoma evacuation. Four patients had HAase placed after over-injection of HA for treatment of vocal fold paresis. Five patients had HAase placed into the contralateral vocal fold at the time of bilateral polypoid corditis treatment with the non-surgical site injected with HAase. Between 10-30 units were used in the office or in the operating room.

Results: None of the patients suffered any abnormal side effects. Two patients done in the office were considered ineffective possibly due to dosing or placement issues. Three of the four patients with HA over-injection showed rapid reduction in the over-injection within 7 days. The professional singers all showed rapid hemosiderin absorption after HAase treatment without loss of mucosal wave. All five patients with Reinke's edema had satisfactory voice results and objective reduction in the polypoid corditis without further return to the operating room. One patient elected to undergo additional injections in the office setting.

Conclusion: HAase is a potentially exciting new medication that can be applied in the office and operating room setting for adjunct treatment of polypoid corditis, hematoma and over-injection of HA.

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Socioeconomic Variables of Patients with Spasmodic Dysphonia

Objective: To characterize the socioeconomic variables of spasmodic dysphonia (SD) patients, and to determine the impact of socioeconomic variables (including median household income, ethnicity, and employment status) on voice outcomes in patients being treated with botulinum toxin.

Methods/Design: A retrospective review of all SD patients being treated with botulinum toxin for the past 10 years was conducted. Patients for whom the necessary data were available were included. Demographic data and socioeconomic variables of these patients were characterized with descriptive statistics. Univariate analysis was conducted to determine if socioeconomic variables impacted voice outcomes.

Results: A total of 40 patients diagnosed with SD were reviewed. Average age among patients was 60.6 ± 12.3 years, with males representing 25% of patients. Ethnicity was recorded as 81.6% Caucasian and 18.4% non-Caucasian. Median household income was $75,244.61 ± $25,759.21. Employed patients represented 72.5% of the population, while 27.5% were unemployed. Adductor SD was diagnosed in 87.5% of patients and abductor SD in 12.5%. Patients were asked at each visit to rate their best voice quality during the period of previous botulinum toxin injection effect on a scale from 1 to 10, with 10 being the best, and voice scores were recorded at 7.1 ± 2.1 while being treated with botulinum toxin. Mean Voice Handicap Index-10 score was 22.3 ± 2.8. Patients were treated with botulinum toxin injections for 158.9 ± 12.3. months. Age, gender, median household income, ethnicity, employment status, and disease duration did not significantly affect voice outcomes. Data collection is ongoing.

Conclusions: Socioeconomic variables, like median household income, ethnicity, and employment status may not have a strong effect on voice outcomes after botulinum toxin treatment for spasmodic dysphonia patients.

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Investigation of Flexible High-Speed Video Nasoendoscopy

Objective: High-speed videolaryngoscopy is widely-used in voice practices as a complement to videostroboscopy, especially when it is desired to visualize non-symmetric and non-periodic vocal fold vibration, or voice onset and offset. Because of the requirement for greater illumination at higher frame rates, the high-speed exam is usually performed with a rigid transoral laryngoscope. Although it is possible to obtain high-speed video images with a flexible fiberoptic nasoendoscope, the results are often disappointing because of the inability to provide adequate lighting inside the larynx. This paper will present the results of a systematic exploration of the feasibility of flexible high-speed videolaryngoscopy using simple tools and techniques to supplement readily available clinical equipment.

Methods: The KayPENTAX Model 9710 Color High-Speed Video Endoscopy System was used with a PENTAX flexible fiberoptic nasolaryngoscope and a new supplemental light fiber bundle to perform high-speed examinations of healthy vocal folds. Variables of the investigation included camera frame rate, camera sensitivity (color head vs. black-and-white head), optics (camera lens focal length), light coupling, nasoendoscope outer diameter, and endoscopy technique (visually perceived distance of distal tip of scope from the glottal plane).

Results and Conclusions: With the use of a prototype supplemental light fiber bundle and the optimization of the settings on the KayPENTAX Color High-Speed Video Endoscopy System, high quality video images of healthy vocal folds were consistently obtained. A discussion of the other factors considered include patient comfort, practicality, expense, and ease of use by the clinician.

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Submucosal Saline Injection for Vocal Fold Scarring

Objective: The objective of this study was to determine the effects of submucosal vocal fold saline injection on voice quality in an individual with vocal fold scarring.

Methods/Design: This is a single case, pre/post treatment study. High fidelity audio recording, videostroboscopy, phonation threshold pressure, and auditory-perceptual ratings, were obtained.

The research participant was a 38 year old female with idiopathic bilateral vocal fold thickening and scarring. Direct microlaryngoscopy was performed under general anesthesia, and approximately 1.0 – 1.5 cc saline were injected into the lamina propria of each vocal fold using a 25-gauge butterfly needle.

Acoustic analysis was performed using Praat software. Auditory-perceptual using the Consensus Auditory Perceptual Evaluation for Voice (CAPE-V), and videoendoscopic evaluation using the Stroboscopic Evaluation Rating Form (SERF) were completed by a panel of three speech language pathologists, blinded to the patient's condition. CAPE-V ratings were completed prior to videoendoscopic ratings to ensure that perceptual judgments were not influenced by endoscopic findings; ratings were averaged across the three clinicians. Phonation threshold pressure (PTP) values were obtained at four points across the patient's pitch range, pre- and post- treatment.

Results: Acoustics measures of jitter, shimmer, and harmonics-to-noise ratio demonstrated non-significant differences. However, the patient did demonstrate a greater pitch range, with her maximum frequency increasing from 582.1 Hz pre-treatment to 799.6 Hz and fewer voice breaks. Auditory-perceptual evaluation demonstrated a mild improvement to perceptions of roughness and strain. Endoscopy with stroboscopy showed mildly decreased edema and erythema bilaterally. PTP demonstrated an average decrease of 1.03 cm H_2O for the 200 – 582 Hz range common to both pre- and post- treatment sessions, with the patient reporting significantly decreased effort for phonation.

Conclusion: The results suggest that submucosal injection of saline, for the treatment of vocal fold scarring, may improve tissue mobility, phonatory effort, and voice quality.

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Cricothyroid Approximation Surgery (Type IV Thyroplasty): Learning from Failure Case, Analysis of Reasons Using 3DCT

Introduction: Type IV thyroplasty is a relatively simple surgical technique and is widely known as a surgery for increasing speaking fundamental frequency (F0). Approximating the thyroid cartilage and cricoid cartilage is thought to lengthen the vocal cords, resulting in high phonation. Normally, forward gliding movement of the inferior horn of the thyroid cartilage, in addition to rotational movement of the thyroid and cricoid cartilages, is a key factor in vocal cord extension. The rotational movement is a movement by the straight part of the cricothyroid muscle, while the gliding movement is done by the oblique part of the cricothyroid muscle. Movements observed after type IV thyroplasty are noted to differ from physiological movements. We report an example of an unsuccessful Adam's apple removal and type IV thyroplasty performed in Thailand.

Case and Progress: A 23-year old male with gender identity disorder (GID) underwent an Adam's apple removal and type IV thyroplasty under general anesthesia in Thailand. Postoperative F0 remained unchanged and the patient visited our clinic

Findings at initial visit: Laryngial endoscope revealed shortening of the vocal cords. And anterior commissure was somewhat undefined. Vocal cord mobility showed no abnormalities. Due to lack of information on the surgeries performed in Thailand, three-dimensional computed tomography (3D-CT) scans were taken to obtain detailed information on the current status of the larynx.

3D-CT Findings: The cricoid and thyroid cartilages were overlapping each other and anterior part of the cricoid cartilage had entered into the thyroid cartilage. The inferior horn of the thyroid cartilage had deviated posteriorly of the cricothyroid joint. Adam's apple removal had extended to the anterior commissure, which had caused a diastasis between the anterior commissure and the thyroid cartilage. It was considered that excessive traction caused bad result, crico-thyroid release surgery under general anesthesia was attempted.

Surgical Findings: The cricoid and thyroid cartilages had become fixed to each other and could not be released. The cricoid cartilage was found to project into the subglottis and adjacent to the vocal cords.

Conclusion: We conclude that voice monitoring under local anesthesia is essential to type IV thyroplasty surgery and that this surgery should not be performed under general anesthesia.

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Psychological Factors Associated with Spasmodic Dysphonia: A Comparison of Emotional Brain Activity Based on Psychological Testing and Functional Magnetic Resonance Imaging

Introduction: Spasmodic dysphonia (SD) is generally considered to be a dystonia of the intralaryngeal muscles, although the condition has also been attributed to psychological factors. Episodes suggesting the involvement of such factors have been reported; symptoms may be exacerbated under conditions of emotional strain. It has been difficult to distinguish primary dystonia from psychogenic disorders; however, recent pathological studies revealed that abnormalities of the neural mechanisms that link emotion and motor activity are pathogenic mechanisms triggering dystonia. Specifically, a portion of the striatum was found to play a role in the regulation of dopamine release in the basal ganglia in response to stressful input from the emotional (limbic) system.

Objectives: We compared the locations and extent of brain activity in SD patients with and without psychogenic factors.

Methods: Twenty SD patients underwent psychological testing (State-Trait Anxiety Inventory [STAI]). Functional magnetic resonance imaging during vocalization featured a block model. All patients were asked to repeat the following phrase for 30 s: "Yabu no naka kara usagi ga pyokon to dete kimashita" (this Japanese sentence is considered to readily induce spasmodic symptoms). We compared the psychological test scores with a particular focus on the brain regions involved. Ten patients without spasmodic symptoms served as controls.

Results: Brain activity in the regions responsible for emotions, including the insula and limbic system, differed between healthy individuals and SD patients. The anterior cingulate cortex was significantly activated in those with high STAI scores. This part of the limbic system is thought to have outputs to the basal ganglia.

Conclusion: Emotional factors may play important roles in some SD patients, especially those with anxiety.

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Vocal and Swallowing Complaints and Characteristics in Individuals with Parkinson Disease

Objective: To analyze voice and swallowing complaints, the findings in fiberoptic endoscopic evaluation of swallowing (FEES) and voice quality in Parkinson's disease (PD) patients.

Methods: 20 participants (9 women, 11 men), mean age of 73.3 years. The Hoehn & Yahr Scale from them was 2.8 (range 1–5). Participants were interviewed about symptoms of voice and dysphagia by questionnaire. They were underwent the FEES with fiber naso-pharyngo-laryngoscopes (FNL 10RP3 Pentax®) with three food consistencies (puree, thickened liquid and water) dyed with blue color. The evaluation of voice quality was made through acoustic analysis in the parameters Average Fundamental Frequency (F_0); Jitter Percent (Jitt); Shimmer Percent (Shim); Noise to Harmonic Ratio (NHR) using the Multi Dimensional Voice Program and Intensity in PRAAT Software. Recordings were made with the speaking of vowel /a/ in a room acoustically treated.

Results: 15 (75%) participants reported voice complaints: hoarseness (35%), low vocal intensity (30%), weak voice (25%), vocal tremor (15%), and the need to clear the throat (5%). 11 (55%) reported swallowing complaints: gagging (45%), globus pharyngeal (35%), cough during meals (30%), and said do not eat all food consistencies (30%). The FEES findings with puree were residue in the pharynx (45%) and laryngeal penetration (15%); with thickened liquid were residue in the pharynx (35%) and laryngeal penetration (20%); with water were residue in the pharynx (10%), laryngeal penetration (15%) and tracheal aspiration (5%). The results of the acoustic analysis for men and women participants were respectively: F_0 of 126,853Hz and 195.755 Hz; Jitt of 1,961% and 5,003%; Shim of 3,864% and 7,783%; and mean intensity of 76,56 dB and 76,09 dB.

Conclusion: This study demonstrated the impact in voice and swallowing in individuals with PD. It is necessary to improve early detection, diagnosis and treatment in this population.

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Contribution of High-Speed Videokymography to Diagnosis of Voice Disorders – A Clinical Study

Among the direct visualization techniques, stroboscopy is considered to be a gold standard instrument for assessing and treating various voice disorders. On the other hand, high-speed imaging technique such as videokymography (VKG) are more powerful in capturing vocal fold vibratory features which can be helpful in recognizing some voice disorders. The present study aimed at formally evaluating the diagnostic role of VKG in assessing various voice disorders. For this purpose, a questionnaire was designed, divided into two parts. First half incorporated questions related to the diagnostic value and diagnosis confidence from stroboscopic evaluation, and the second half on the diagnostic contribution of VKG as an addition to stroboscopy. A total of 104 subjects (70 females and 34 males, aged between 10 to 80 years) with primary complain of hoarseness, were examined by experienced laryngologists. On each patient, the clinician initially performed stroboscopic evaluation and filled in the first part of the questionnaire. Immediately afterwards, the same patients underwent a VKG examination and the clinician filled in the second part of the questionnaire. The pilot results showed that in 31% VKG confirmed the stroboscopic diagnosis, in 44% it made the diagnosis more accurate, and in 20% VKG evaluation resulted in an adjustment of the offered treatment. VKG was not found diagnostically helpful in 5% of subjects. After VKG the initial stroboscopic diagnostic confidence of clinicians increased in 66% of the subjects. These results show that VKG may help clinicians to take some important treatment decisions and may be recommended to be performed in patients, where clinicians are uncertain about their diagnosis and treatment.

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Is Mean Flow Rate of Running Speech Indicative of Pathology?

Recent studies of airflow in patients with voice disorders identified a wide range of mean airflow during sustained phonation (Hillman et al., 1989; Gillespie et al., 2013; and Gilman et al., in submission). These ranges are similar to norms identified by Zraick et al. (2012), suggesting the wide range of airflow patterns is not unique to the voice disordered population.

OBJECTIVE: Do these same ranges exist in running speech? Are they determined by diagnosis?

METHODS/DESIGN: This prospective study of 40 adult patients seen for evaluation of dysphonia assessed mean airflow patterns in running speech. METHODS: The PAS running speech protocol was used. With the airflow mask securely over the mouth and nose, subjects described the cookie theft picture (BADE). Mean airflow and mean airflow during voicing were assessed. Patients were grouped into 5 diagnostic categories (phonotraumatic, paresis/paralyis, muscle tension primary; edema or laryngitis and chronic cough) to assess whether airflow was related to diagnosis.

RESULTS: Overall ranges were 0.01 – 0.45 lit/sec. Three groups were identified, low- flow two standard deviations below the mean, normal, and high-flow two standard deviations above the mean in running speech (voiced and voiceless sounds) and the voiced only segments of running speech. In both groups 20% of the subjects in the low flow group, 60% and 65% respectively in the normal group and 20% and 15% in the high flow group were identified. ANOVA analysis did not detect significant difference in mean flow during phonation by diagnostic category.

CONCLUSION: Results suggest that respiratory phonatory patterns may reflect habituated patterns across all populations rather than patterns unique to the disordered voice population. Ranges of mean flow in running speech are similar to those during sustained phonation in both the disordered and normal populations. There are currently no published norms for mean airflow during running speech.

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An Acoustic Investigation on Carnatic Singers Voice

Introduction:The human singing voice is capable of wide verity of sounds. Pitch information is of most importance in research related to Indian music, and pitch tracking of Indian classical music is one of the cornerstones for research in this field.

Objectives:
1. The aim of the study was to analyze the Acoustic voice features of all notes and their relationship in ascending and descending scale of raga shankarabharanam of carnatic vocal music.
2. To compare the difference in staring swara (lowest sa) and ending swara (highest sa) in ascending and Descending

Method: Twenty professional carnatic singers participated in the study. The task given to the participants was to sing all the seven notes in ascending and descending scale of raga Shankaabaranam which was audio recorded. Pitch tract of each note was extracted using PRAAT software. The average frequency of individual note for all the participants was calculated and ratio of each note to base the base note (Sa) was calculated of all the seven notes of raga.

Results and Discussion: The results indicated that singers were able to traverse an octave from one "Sa" to another "Sa". A comparison of frequency between all the notes raga reveled difference between each note is 10Hz to 30Hz.

Conclusion: This study proves that with training the human vocal system is capable of producing notes which bear complex ratio with one another. It also highlights the fact that well trained singers have an inbuilt reference tone which minimized the need for an external drone note.

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An Open-label Study of Sodium Oxybate (Xyrem®) in Spasmodic Dysphonia

Objective: Spasmodic dysphonia (SD) is an action-induced laryngeal dystonia. About one-third of SD patients also exhibit dystonic voice tremor (VT). Recent research has shown that alcohol ingestion improves voice symptoms in up to 58% of SD and SD/VT patients (Kirke et al. 2015). In this open-label study, we examined the effects of sodium oxybate (Jazz Pharmaceuticals), an oral agent that shows improvement of dystonic symptoms similar to alcohol (Simonyan &Frucht, 2013), in alcohol-responsive SD patients.

Method: Fifty alcohol-responsive patients (28 SD, 22 SD/VT) completed voice and speech assessments before, immediately after, and 40 minutes following the oral administration of 1-1.5 g of sodium oxybate. Voice and speech recordings were anonymized, randomized for pre- and post-drug assessments, and blindly rated by an experienced speech-language pathologist. Two-sample paired t-tests were used to examine the effects of sodium oxybate on SD and SD/VT symptoms.

Results: Sodium oxybate significantly reduced the number of voice breaks on average by 32.7% (t_{22} = 2.79, $p = 0.011$) but not the severity of harshness ($t_{22} = 1.09$, $p = 0.29$) or breathiness ($t_{22} = 1.30$, $p = 0.21$) in alcohol-responsive SD patients. In the alcohol-responsive SD/VT group, sodium oxybate had significantly reduced the number of voice breaks on average by 34.0% ($t_{21} = 2.67$, $p = 0.014$), as well as the severity of harshness on average by 46.8% ($t_{21} = 3,38$, $p = 0.003$) and voice tremor on average by 39.1% ($t_{21} = 3.94$, $p = 0.001$). The severity of breathiness ($t_{21} = 1.86$, $p = 0.08$) remained unchanged.

Conclusions: In our patient cohorts, the effects of sodium oxybate were predominantly observed on voice breaks in both SD and SD/VT groups as well as on VT in SD/VT group. Further double-blind randomized study is required to determine whether sodium oxybate may represent a novel and effective pharmacologic agent for the treatment of alcohol-responsive SD and SD/VT patients.

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The Role of Patient-Rated Impairment in Predicting Therapy Adherence

Objective: Examine the relationship between the severity of patient-perceived voice impairment, perceptual dysphonia severity, and voice therapy adherence.

Methods: Adult patients presenting with a chief complaint of dysphonia over a one year period at a tertiary care, interdisciplinary voice center were included in this retrospective review. Patient perception of voice impairment using the Voice Handicap Index-10 (VHI-10) and the Voice-Related Quality of Life (V-RQOL) surveys and clinician rating of dysphonia severity using the Grade score from the Grade, Roughness Breathiness, Asthenia, and Strain (GRBAS) scale were analyzed for correlation with therapy adherence. Therapy adherence was defined as patient completion of the voice therapy treatment plan.

Results: One hundred and two patients were evaluated. Sixty-four of these patients were recommended to participate in voice therapy as a part of their treatment plan. The overall voice therapy adherence rate was 44%. The mean VHI-10 score (19.46) in the therapy adherent group was significantly higher than the mean VHI-10 score (14.75) in the non-adherent group (ANOVA, p= 0.026). The mean V-RQOL score (62.5) in the therapy adherent group was significantly lower than the mean V-RQOL score (78.75) in the non-adherent group (ANOVA, p= 0.027). The mean Grade of dysphonia (1.5) in the therapy adherent group was not significantly different than the mean Grade of dysphonia (1.6) in the non-adherent group.

Conclusion: Patient perception of voice impairment is a significantly stronger predictor of patient adherence to voice therapy than perceptual dysphonia severity. To reduce attrition, voice therapists should consider limiting therapy targets and abbreviating the treatment plan for patients amenable to therapy but who have a VHI-10 score $\leq$15 or a V-RQOL $\geq$78.

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The Influence of Occupation on Patient Reported Voice Impairment

Objective: Examine the relationships among patient occupation, perceptual dysphonia severity, and patient-perceived voice impairment.

Methods: Adult patients presenting with a chief complaint of dysphonia over a one year period at a tertiary care, interdisciplinary voice center were included in this retrospective cohort study. Patients were stratified by profession: vocal performers (PERF), high occupational voice demand (HOVD), low or no occupational voice demand (LOVD), and retired (RET). Clinician rating of dysphonia severity using the Grade score from the Grade, Roughness Breathiness, Asthenia, and Strain (GRBAS) scale and patient ratings of voice impairment using the Voice Handicap Index-10 (VHI-10) were tested using a multivariable generalized linear model.

Results: Ninety-six patients with a presenting complaint of dysphonia were evaluated. The perceptual rating of dysphonia severity and patient-perceived voice impairment was moderately correlated (Correlation coefficient .364, p=.0001). Nevertheless, the PERF and HOVD groups had significantly higher mean VHI-10 scores and lower mean GRBAS scores than LOVD and RET individuals (Mean VHI-10, PERF/HOVD vs LOVD/RET: 21.2 vs 15.5, p=.008; Median GRBAS grade, PERF/HOVD vs LOVD/RET: 1 vs 2, p=.002). Occupational voice demand category was associated with reported voice impairment independent of perceptual rating of dysphonia severity.

Conclusion: Patient-perception of voice impairment is independent of dysphonia severity and strongly influenced by occupational demand. Furthermore, performers and people with high occupational voice needs demonstrate a unique sensitivity to subtle voice changes. Targeting therapeutic goals to specific occupational needs may represent a meaningful way to reduce impairment severity in patients with mild or minimal perceptual dysphonia.

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Effect of Botuliunum Toxin on Aerodynamic Measures in Adductor Spasmodic Dysphonia

Objective: Adductor spasmodic dysphonia (SD) creates difficulty with onset and offset of voicing. Aerodynamic measures permit close examination of pressure and glottal flow changes. This study sought to examine change of aerodynamics at one month following Botulinum Toxin (BTX) injection in Adductor SD patients, paying attention to subglottal pressure, release burst, midflow measures, and final glottal flow control.

Methods/design: 10 subjects (age 47-89 years) with adductor SD were examined for values of subglottal pressure and glottal flow, using t-test to compare pre-and post-BTX injection. Subjects produced a 5-syllable /pa/ train in modal voice, with analysis of the middle 3 /pa/ syllable trains.

Results: A significant reduction (p=0.0274) in final glottal flow values was found at one month following BTX when compared to pre-BTX measures. No significant difference was found for mean glottal flow, release burst, or peak pressure for /pa/ syllable trains as an outcome from BTX injection. This suggests change of final glottal flow control during /pa/ syllable trains due to BTX injection.

Conclusions: Although mid-glottal flow would be expected to change due to chemo-denervation, SD subjects did not demonstrate this at one month post-BTX. They did however demonstrate improved control of glottal flow offset, at the end of the /a/ segment as they approached the next /p/ production in the /pa / syllable train. This suggests improved control of interphonemic aerodynamics following BTX injection for SD patients.

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Maximum Phonation Time in Vocal Fry

Background: Maximum Phonation Time is simple and frequently used procedure in clinical practice to assist in the assessment of vocal phonatory mechanisms. Previous research has reported lower airflow rate during vocal fry compared with modal register. It has also been reported an inverse relationship between airflow rate and maximum phonation time. Given that vocal fry is a common vocal production style increasingly found in everyday oral communication yet it also sometimes used as a therapeutic technique, the effect on use of increased use of vocal fry on maximum phonation time may substantiate the use of fry in therapy.

Purpose: To investigate the relationship between maximum phonation time and the occurrence of vocal fry in normal speakers.

Methods: A cross-sectional study among 40 college students was conducted. Participants produced the sustain vowel [ah] under nine different room acoustic conditions (simulated). In addition, the students read the Rainbow passage. MPT was calculated using Praat. Three trained speech-language pathologists listened to subjects' renditions of the Rainbow passage and performed a perceptual evaluation of the presence/absence of vocal fry. Generalized estimating equations were used to assess the relation between MPT and vocal fry.

Results: Students with longer maximum phonation time are also more likely to be perceptually identified with vocal fry in speech (OR= 1.06; 95% CI 1.02-1.11).

Conclusion: Due the relationship between increased maximum phonation time in individuals with a higher instance of vocal fry, previous conjectures about using vocal fry therapeutically to help shape the vocal folds into a more efficient sound source were confirmed. While extended use of vocal fry and low airflow may not be vocally healthy, some use may result in a more efficient vocal system. This relationship has implications to voice therapy plans where vocal fry is used to facilitate more optimal vocal production (e.g., vocal warm-up programs).

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Is CPPs a Good Predictor of Vocal Fry?

Introduction: Vocal fry is a common vocal production style found in everyday oral communication yet it also is a prevalent vocal quality in many with voice problems. Vocal fry is defined as a vocal production characterized for a creaky sound with a rough vocal quality. Measurements of cepstral peak prominence have been shown as good predictors of voice quality. Nevertheless, there is a lack of information in the relationship between cepstral peak prominence estimates and the occurrence of vocal fry.

Purpose: To characterize the relationship between smoothed cepstral peak prominence (CPPs) and the occurrence of vocal fry.

Methods: A cross-sectional study among 40 college students was conducted. Participants read aloud standard texts under nine simulated room acoustic conditions. CPPs was calculated using Praat. Three trained speech-language pathologists performed a perceptual evaluation of the presence/absence of vocal fry. Agreement between the CPPs and the perceptual identification of vocal fry was determined by receiver operating characteristic curves. Linear mixed models were used to investigate the association of CPPs with the identification of vocal fry.

Results: CPPs has low-moderate discriminatory value for perceptually identified vocal fry (AUC= 0.66; SE= 0.2). At a cut-off of 21.78, the specificity was high with a value of 84%, whereas the sensitivity was moderate with a value of 67%. Participants with higher values of CPPs were statistically significant less likely to be identified with vocal fry (OR= 0.8; 95% CI 0.7 – 0.9).

Conclusion: CPPs showed a low-moderate discrimination between those with vocal fry and those without vocal fry, as determined by perceptual assessment by clinician. Therefore, these measurements offer complementary information about the presence of vocal fry. The definition of cut-off of CPPs will allow to voice practitioners the objective monitoring of changes in voice quality during the use of vocal fry in treatment plans.

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Pharyngo-Upper Esophageal Pressures During Phonation Tasks at The Light of High Resolution Manometry

Introduction: Manometric evaluation of voice has been neglected due to technical limitations of conventional systems. High Resolution Manometry (HRM) fixed most of these limitations in as much The International American Association of Speech Therapists (ASHA) recognizes manometry as an appropriate instrument for evaluation of swallowing and identified this examination as an emerging area in the speech therapy clinical practice. This study aims to evaluate preliminary results of pharyngo-upper esophageal pressures during phonation tasks in professional singers.

Method: 5 singers (3 female, median age 26 years) underwent HRM examination and performed different vocal tasks (sustained vowel, 5 note scale, /go/, /hey/) at high, medium and low intensities. Pharyngeal (Pp), upper-esophageal sphincter (UESp) and thoracic (Tp) pressure were recorded. Results: Pp for sustained vowel was 2.9, 1.7, 1.4 mmHg; UESp was 162, 107, 136 mmHg and Tp was 6.5, 10.9, 21.9 mmHg for low, medium and high intensities respectively. Pp for 5 note scale was 3.1, 2.3, 2.0 mmHg; UESp was 95, 99, 105 mmHg and Tp was 9.2, 10.7, 12.8 mmHg for low, medium and high intensities respectively. Pp for /go/ was 0.9, 2.1, 1.2 mmHg; UESp was 142, 95, 122 mmHg and Tp was 6.3, 6.4, 11.2 mmHg for low, medium and high intensities respectively. Pp for sustained /hey/ 0.9, 1.7, 1.9 mmHg; UESp was 131, 147, 225 mmHg and Tp was 2.8, 4.1, 11.3 mmHg for low, medium and high intensities respectively. Pressures were not statistically different regarding voice intensity.

Conclusions: HRM is a valuable method for the measurement of pharyngo-upper esophageal pressures. Preliminary results did not show differences in pressures during diverse vocal tasks regarding voice intensity.

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The Brazilian Samba-School Singer Larynx

During the Brazilian Carnival, parades are performed by thousands of individuals organized in samba schools, in a competition in which each group tries to outdo the others, both in terms of extravagant costumes, dance, choreography and music. The singers have the mission of interpreting the same song, the "samba-enredo", for almost two hours, without rest or pauses, under a very loud musical accompaniment. Further on many attributions that any singer must have, the leading singer must thrill the audience with huge loud voice, screams, drives and a lot of energy to execute the choreography. This singer is typically a male mature individual, with no formal voice training and lack of vocal hygiene habits. Besides, unfavorable environmental conditions such as poor sound equipment quality, lack of auditory feedback and hot weather make this mosaic even more complex.

Objective: To analyze the samba-school singers larynx while singing a samba-enredo.

Method: 19 samba-school singers volunteered to participate and underwent nasoendoscopy. The recorded images were analyzed by one ENT and three SLP, by consensus.

Results: only 3 participants presented a normal larynx, 2 participants had lesions (vocal fold polyp and leukoplakia) and 14 presented some degree of laryngeal movement or alteration adjustment. The major common aspects were: opening angle asymmetry, arytenoid complex asymmetry and posterior dislocation of the cricoid joint, with signs of trachea pull.

Conclusion: There is an important association between this high volume singing and many asymmetrical laryngeal movements

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The Impact of Nasality on Cepstral Peak Measurements in the Acoustic Analysis of Voice Signals: A Correlation Study

Objective: To date, no research is apparent in investigating the sensitivity of cepstral peak measurements on nasality. The purpose of the study was to determine whether nasality would impact cepstral-based measurements in the acoustic analysis of voice signals. It was hypothesised that increased nasalance would be associated with decreased values in cepstral peak prominence.

Method: Within-subject correlation design. 30 healthy female subjects between the ages of 18-41 years were recruited to read an alternating vowel and nasal task with a head-mounted microphone and a nasometer headgear simultaneously. Three voice samples were prepared for acoustic analysis: (1) vowel, (2) midpoint of the transition between nasal and vowel, and (3) nasal. Voice samples were analysed for nasalance (percentage), cepstral peak prominence (CPP in decibels), vocal intensity (decibels), and harmonic-to-noise ratio (HNR in decibels).

Results: No significant main effects were found between (1) CPP and nasalance and (2) CPP and relative vocal intensity across the three voice samples. There were moderate negative correlations between (3) nasalance and vocal intensity in the midpoint sample ($r(30) = -.388$, $p = .034$) and the nasal sample ($r_s(30) = -.396$, $p = .030$), which were both statistically significant. There were no statistical differences between the vowel and nasal samples in HNR values. The CPP values were significant higher in the vowel sample than the nasal sample ($t(29) = 15.41$, $p < .001$).

Conclusions: Significant differences in CPP values between vowels and nasals suggest it may reflect both the source and filter. However, there is no correlation between nasality and cepstral peak measurements. Assessment of nasality may need to be conducted prior to analysis using CPP. Current practice using cepstral based measurements to indicate presence, absence or severity of voice disorders may need to be reconsidered.

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Relative Efficacy of Negative Practice and Repetitive Drill in Learning a Simple Voice Motor Skill: A Pilot Randomised Controlled Trial

Objective: To compare the efficacy of negative practice and repetitive drill in assisting the learning of a simple voice motor skill to treat hyperfunction.

Methods/Design: A randomised controlled trial design was used. Twenty-four females (mean = 22.0 years, range 18-39 years), with no vocal training or history of organic voice disorders, were perceptually rated by two experienced speech pathologists to have mild or moderate hyperfunction. They were randomised to one of three conditions: negative practice (n = 8), repetitive drill (n = 8), control (n = 8). All participants attended two pre-treatment and two post-treatment assessments of the Optimum Phonation Task, prolonged vowel, CAPE-V sentences and Rainbow Passage, and an additional immediate post-treatment assessment for treatment group participants. Participants in the first two conditions attended one treatment session to learn the Optimal Phonation Task (OPT), and completed five days of home practice. Vocal task data were perceptually rated and analysed for harmonics-to-noise ratio, fundamental frequency, intensity, and (smoothed) cepstral peak prominence. Participants also stated their perceived physical effort on a 5-point Likert scale.

Results: Negative practice was not more effective than repetitive drill in assisting the acquisition, maintenance and generalisation of a statistically significant quieter, clearer or less effortful voice. An analysis of means showed that only the negative practice group generalised the use of a perceptually clearer voice to the prolonged vowel.

Conclusions: Generalisation of vocal clarity is possible without acquisition of a clearer voice. More robust measures are needed to assess vocal clarity in a soft phonation task.

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Keeping the Voice Fit in the Group Fitness Industry: What Do Instructors Want in a Voice Education Program?

Objective: Voice disorders within the group fitness industry are prevalent, with 44–70% of group fitness instructors (GFIs) reporting chronic voice difficulties. Numerous studies have identified that voice education and training tailored to the fitness industry is warranted. However, such a program is yet to be developed. In order for development and implementation to be successful, it is important to investigate and incorporate consumer views. Therefore, this study aimed to elucidate (1) GFI's preferences for, and experiences of, occupational voice use and education, and (2) the content and manner of delivery desired for a voice education and training program.

Methods: Semi-structured interviews were conducted with 8 GFIs recruited via self-selection sampling. Participants were asked to comment on their experience of voice difficulties, voice use, education, and their preferences for future intervention. Interview transcripts were analysed using qualitative content analysis.

Results: The majority of participants reported experiencing occupational voice difficulties, citing inadequate voice education, faulty equipment, and apathetic industry attitudes as core barriers to vocal health. Education content focusing on vocal hygiene, safe voice use in the workplace, use of amplification equipment, and how to address apathetic attitudes to voice in the fitness industry was desired. Multi-modal education was preferred, with a combination of face-to-face, web-based and app-based delivery options suggested.

Conclusions: Documented success of similar approaches in other professional voice user interventions and health education programs suggest that adopting these preferences in future intervention may lead to positive outcomes for the GFI population. Careful consideration of the experiences and preferences of GFIs described by this study should be used by clinicians to contribute to the design of a vocal education and training package, to ensure that it is adequately tailored to the needs of group fitness instructors and the fitness industry.

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Changes in Long Term Average Spectrum Characteristics and Timbre Ratings as Boy Singers Progress from Soprano to Baritone

Objective: The purpose of these case studies is to compare changes in Long Term Average Spectrum characteristics with perceptual ratings of timbre for five boys as they progress from soprano to baritone in a boychoir. Understanding the changes in distribution of energy over a series of frequencies as boys sing, as well as the perceptual changes in timbre, is necessary for optimal vocal training.

Methods/Design: Long Term Average Spectrum (LTAS) provides relevant information regarding the spectral distribution of energy over a series of frequencies. Timbre is the tone quality, or tone color, given to a sound by its overtones. In examining the perceptual changes of pre- and mid-pubescent voices, one of the key perceptual components of voice change is a marked change in timbre. In an effort to observe these spectral changes in a real-life situation, each subject was asked to sing the Star Spangled Banner (SSB) in its entirety. Five subjects with soprano voices repeated this performance on each subsequent visit for comparative purposes.

Instrumental assessments were performed two to three times as the boys progressed from soprano to baritone voice categories noted by the choral director.
Instrumental Measures/Acoustic
　　　　The acoustic measures were collected in a sound-treated booth using the Multi-Dimensional Voice Program (MDVP) within the Computerized Speech Lab (PENTAX Medical, New Jersey). All voice samples were collected using a dynamic microphone (Shure SM48), with a microphone-to-mouth distance of 15 cm during the recording of the Star Spangled Banner. Subjects stood for the recording. LTAS analysis was performed on each of the SSB performances.
Perceptual Analysis
　　　　Three expert raters with greater than 10 years of experience training adolescent singing voices rated the Star Spangled Banner singing samples. Perceptual rating forms for overall timbre utilized a visual analog scale, which was a 14.5 cm line with tic marks for each .25 cm. The raters indicated the tone color of perceived timbre, ranging from dark to bright on this scale, using a tic mark. These scalar extremes were labeled, as was "appropriate" in the middle of the line.

Results: Analysis of spectral characteristics and spectral slope will be reported and comparative analysis within and between subjects will be presented. LTAS characteristics for voice change staging (based on Cooksey Staging) will be discussed. Perceptual analysis of timbre performed by the three expert raters will be compared to the LTAS characteristics.

Demographic information, singing history, and self-ratings of pubertal development will be provided for each subject.

Conclusions:
Clinical recommendations for voice professionals who assess and treat pre- to post-adolescent voices will be shared.

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Audio-Perceptual Characteristics of Vocally Healthy Elderly Adults and Elderly Adults with Voice Complaints

Background: The number of age-related voice changes, known as presbyphonia, will increase as the population becomes older. These changes are the result of multi-system changes that naturally occur with aging. Presbyphonia is associated with changes in acoustic, aerodynamic, and auditory-perceptual measurements; however, the literature is sparse on the auditory-perceptual differences between vocally-healthy elderly adults and elderly adults diagnosed with presbyphonia. The goal of the study is to compare the auditory-perceptual and social characteristic ratings of vocally-healthy elderly adults and elderly adults with presbyphonia.

Method: Vocally-healthy speakers (n = 50) and presbyphonic speakers (n = 50) recorded samples of the first sentence of the Rainbow Passage. Ten blinded raters provided ratings of overall voice severity as well as measures of social characteristics including perceived age of speaker, level of masculinity/femininity, strength, health and vocal pleasantness all on a 100mm visual analog scale. Data were analyzed for significant differences in perception between the two participant groups.

Results: <u>This study is currently ongoing; however,</u> we hypothesize a significant difference between the two groups will be observed for all outcomes. Results will be discussed within the context of self-perception of voice problems, underlying causal mechanisms of presbyphonia, and the impact of aging voice on an individual's quality of life.

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A Randomized Control Trial of Vocal Function Exercises for Presbylarynges

Objective: Vocal Function Exercises (VFEs) comprise a series of voice manipulations designed to strengthen and balance the laryngeal muscles leading to an enhanced relationship of respiration, phonation and resonance, thus improving vocal efficiency and voice quality. A limited number of studies have focused on the efficacy of VFEs as a treatment modality for presbyphonia. Current studies are limited by lack of an experiment control group and do not examine treatment outcomes across all five domains of voice assessment (patient self-assessment, audio-perceptual evaluation, acoustic and aerodynamic measures, and visual imaging of the vocal folds). The purpose of this study was to examine the efficacy of Vocal Function Exercises in enhancing voice production in individuals with presbyphonia. This study was the first to use a placebo controlled, randomized design while comparing pre- and post-treatment measures involving all five domains of voice assessment.

Methods: Twenty non-treatment seeking individuals over age 65 with presbyphonia were randomly assigned to the exercise group or the control group for 6 weeks of exercises. The exercise group received Vocal Function Exercises and the control group received sham therapy that featured sentences that required minimal vocal effort. All five domains of voice assessment (patient self-assessment, audio-perceptual evaluation, acoustic and aerodynamic measures, and visual imaging of the vocal folds: stroboscopy and high-speed digital imaging) were collected pre-treatment, at the end of treatment, and at a one-month follow-up.

Results: Data collection is currently ongoing and is on track to be completed and analyzed prior to the conference. Preliminary results demonstrate improvement of the experimental group in multiple areas of vocal function.

Conclusions: This study will demonstrate whether Vocal Function Exercises enhance voice production in a presbyphonic population as compared to a randomized sham control by assessing select parameters of the five domains of voice assessment including the addition of high-speed digital imaging.

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Stability of the VHI-10 Questionnaire as a Function of the Patient Experience

Purpose: Since its validation, the VHI-10 has become one of the core measurement tools used for both psychometric evaluation and as a method of determining the impact of treatment. Rosen et al suggests that changes in VHI-10 pre and post treatment scores are associated with the intervention, and ideally thought to be the causative factor in the score change. This relatively new compass for guiding our clinical selection of therapeutic or medical treatments assumes an inherent stability of the measure across different personalities and non-therapeutic experiences. However, given the fluid nature of self-perception, it may be prudent to investigate this aspect of the measure. The purpose of this study is to investigate whether non-treatment related situations and experiences effect VHI-10 scoring, with a specific focus on the evaluation process (e.g., the medical evaluation, receiving medical diagnosis, and following the therapists evaluation).

Methods: In this study we measured VHI-10 scores of 29 patients (14 males and 15 females) at 3 time-points during the evaluative process; at initial presentation, following the laryngeal examination, and following the speech pathologist's voice evaluation.

Results and Conclusion: Results found elevated scores between their initial presentation and following the patient's laryngeal examination and lowered scores when comparing post-MD visit to that of the post-SLP evaluation. The presence of this effect reveals some instability of this measure across non-therapeutic experiences. Several possible explanations for this phenomenon will be presented, including that of the "question-answer effect" (well-known in the marketing field) which purports that the mere act of answering questions on a survey can change subsequent behavior.

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Acoustical Analysis of Voice of Marathi Theatre Actors and Non Actors

Objective: Theatre actors in India are faced with potential challenges with voice use as they have to face the audience with or without proper amplification devices. An actor's voice is a primary necessity for their career and any small changes to vocal quality may have significant impact on their career. The present study was aimed to understand the voice characteristics of actors with a specific focus on strategies to project their voice compared to age-matched non-actors.

Methods: Ten native Marathi actors with mean age of 24.6 yrs, with minimum five years of experience in theatre, history of formal training, and no history of voice pathology participated in the study. Age and gender matched non-actors (no training) with mean age of 24 years were included in study. Further demographics from participants included information on type of theatre training, voice care and vocal load. Participants completed a dialogue from a popular Marathi theatre script at two different loudness levels (Habitual and Stage performance level). The voice samples were analyzed using LTAS (Real analysis version 5.0) and PRAAT (version 5.2) for (a) average f0,(b) level difference between strongest peak at 0-2 kHz & 2-4 kHz;(c) pattern of spectral slope; and (d) vowel space area.

Results: Independent sample t-test was carried out to compare groups at two different loudness levels. Significant differences were found across all acoustic parameters between actors and non actors in the stage performance voice (p<.01).Pattern of spectral slope was found sharply falling with higher energy concentration in actors at 2-3 kHz unlike non-actors where the spectral slope was gradually falling and/or flat. The actors showed wider vowel space area than non actors in the stage performance voice.

Conclusion: Overall, results indicate that actor's voice was different in terms of projection and resonance quality than non actors. The findings of the study highlight the role of supralaryngeal adjustments in better voice projection. The strategies can be used as a part of rehabilitation as well as part of formal training given to trainee actors to prevent voice problems.

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Automatic Methods for Objective Pathological Voice Assessment in Spectro-temporal Domain

Objective: This study investigates the accuracy and effectiveness of various proposed automatic voice pathology detection (AVPD) systems as noninvasive complementary tools for pathological voice diagnosis. The degree of voice abnormality is modeled through measurement of statistical distribution of voiced signals represented in temporal, spectral, and tempo-spectral domains based on two general frameworks: (a) comparison of the voiced signal with a reference signal, constructed after de-noising and (b) abnormality detection on the basis of attributes of the voiced signal itself. The conceptual idea lies in the difference of the distribution of various statistical distance measures between the normal and the pathologic voiced signal represented in time, frequency, or time-frequency domain.

Methods: To finely represent the irregular patterns in a pathological voice, various metrics are derived from multi-resolution time-frequency analysis of corresponding sustained vowel (i.e. /a/). The examined AVPD schemes are based on capturing various statistic/acoustical metrics including higher-order statistics, invariant moments, entropy, signal-to-noise ratio, and *Czenakowski* and *hausdroff* distances. These metrics are extracted from signal waveform or its Fourier transform, spectrogram or wavelet sub-bands. The decision about pathologic or normal voices are made using a trained support vector machine.

Results: Analysis of the results highlight the fact that irregularities in voice vary the underlying statistical characteristics of the signal which can be finely quantified with higher order statistical metrics. Experimental results show that the proposed schemes are able to detect the delicate deviations in voice quality with enough sensitivity to reflect the degree of voice abnormality.

Conclusion: The results of this study show that the proposed methods are effective and accurate enough to be considered as complementary tools for early diagnosis of voice disorders and post-surgery voice quality assessment. The reliability of the proposed algorithms can be further investigated by increasing sample sizes in each group of pathologic and normal voice.

Keywords: Pathologic voice detection, statistical distribution, spectro-temporal acoustic features, support vector machine

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Vocal Quality after a Performance: Actors Compared to Dancers

Objective: Theater actors are a special group of elite vocal performers where the slightest vocal difficulty can have serious professional consequences. Little is known about vocal habits on stage and the impact of a theater performance on vocal quality. The purpose of this study is to describe the vocal habits of theater performers on stage and to compare the impact of a performance on the objective and subjective vocal quality between theater actors and dancers. Hypothetically, the impact of a performance on vocal quality is greater in actors compared to dancers.

Methods: Speech samples of the subjects are recorded before and after a performance of one and a half hour using PRAAT. The samples consist of a combination of sustained phonation and continuous speech. For each speech sample the multiparameter index Acoustic Voice Quality Index is calculated. Secondly, maximum phonation time, frequency and intensity range and jitter (%) of an isolated vowel /a/ was determined using PRAAT for the calculation of the Dysphonia Severity Index. Auditory perceptual evaluations were performed using the GRBASI scale. Questionnaires were used to inventory vocal symptoms and influencing factors. The experimental group consists of professional actors between 18 and 40 years old. The control group consists of age and gender matched professional dancers. The duration of each theater and dancing performance is one and a half hour.

Results: The study continues until February 2016. Results will be analyzed using SPSS. Data before and after the theater performance will be compared using a paired statistical test.

Conclusion: The results of this study will gain insight in the vocal habits of theater performers on stage. Secondly, the results will show the impact of a performance on the voice quality of theater actors compared to dancers. In the future these results will help optimizing the guidance of the elite vocal performance.

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Impact of Telepractice on Voice Therapy Adherence

Objective: Studies of patient adherence to voice therapy have demonstrated high attrition. The implementation of telepractice has been shown to decrease rates of attrition in other fields. This study examines the impact of telepractice on completion of voice therapy. We hypothesize that patients who have a component of telepractice in their course of voice therapy will have higher completion rates and kept sessions in comparison to a non-telepractice group.

Methods: A retrospective review of 20 patients referred for voice therapy was completed, 10 with telepractice as a component of their scheduled therapy and 10 scheduled for face-to-face therapy only. Inclusion criteria included adult patients with the intention of scheduling voice therapy. The number of sessions each patient scheduled, kept, cancelled, and no-showed as well as whether the patient completed therapy were recorded. *Kept session* is defined as a completed session. *Cancelled session* is defined as a non-kept session with advanced notification, whereas *no-showed* ses*sion* is defined as non-kept without advanced notice. *Completed therapy* is defined as clinician discharge from treatment.

Results: Patients scheduled for face-to-face therapy only had a kept session rate of 60% in comparison to the telepractice patient group at 64%. The number of cancelled sessions was higher in the face-to-face group at 36% compared to 28% in the telepractice group. The number of no-showed sessions was also higher in the face-to-face only group at 8% compared to 5% in the telepractice group. Finally, the completion rate was only 30% in the face-to-face group compared 70% in the telepractice group.

Conclusions: Patients who had telepractice as a component of their voice therapy had a higher rate of completion. The application of telepractice to voice therapy may improve adherence. More study is needed to define the particular factors responsible for this effect.

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A New Device For SOVT Phonation

The use of semi-occluded vocal tract (SOVT) exercises as habilitative and rehabilitative tools is considered a common intervention to improve vocal economy and reduce the probability of sustaining a vocal fold injury, re-injury after vocal surgery or to correct bad vocal habits. As the use of these exercises has substantially grown in the past two decades, so too has the number of variations of the phonatory gestures or devices used to create vocal tract semi-occlusions.

There are some examples of different exercises belonging to this method: phonating through a straw; a semi-occluded face mask; LaxVox technique; hands over mouth technique; lip trill; tongue trill; tounge trill combined with hand over mouth; and so on.

It is well known that all of them have pro and cons. Methods based on placing the occlusion at the mouth or inside it restrict subjects from producing a full articulation and a free vocalization, limiting the phonation to single phoneme tasks. Alternately, methods based on placing the occlusion out of the mouth exclude the possibility of controlling the level of pressure against subject's phonation.

The aim of this study is to examine the validity of a new SOVT device we created, which overcomes the cons of the tradional methods by allowing subjects to produce continuous speech, free vocalization, and to control the pressure levels of the phonaory tasks. We highlight the results of our research, showing biomechanical features and physiological consequences on the vocal tract.

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Resonance Tube Phonation in Water – the Effect of Tube Diameter and Water Depth on Back Pressure and Bubble Characteristics at Different Airflows

Objectives: Resonance tube phonation in water is a voice therapy method in which the patient phonates through a glass tube keeping the free end of the tube submerged a few centimeters into a bowl of water. The purpose of this experimental study was to determine flow-pressure relationship, flow thresholds between bubble types and bubble frequency as function of flow and back cavity volume.

Methods: A flow driven vocal tract simulator was used for recording the back pressure produced by resonance tubes with inner diameters 8 and 9 mm submerged at water depths 0-7 centimeters. Visual inspection of bubble types through video recording was also performed. A model for the back pressure was formulated based on the Smith/Titze model for tubes in air and on the water depth. This combined model was compared with the experimental data.

Results: The static back pressure was largely determined by the water depth. The narrower tube provided a slightly higher back pressure for a given flow and depth. The combined model produced slightly lower back pressures than the measured data. The pressure oscillations increased with flow and depth. Depending on flow, the bubbles were emitted from the tube in three distinct types with increasing flow; one by one, pairwise and in a chaotic manner. The bubble frequency was slightly higher for the narrower tube. An increase in back volume led to a decrease in bubble frequency.

Conclusions: This study provides data on physical properties of resonance tube phonation in water. This information will be useful in future research when looking into the possible effects of this type of training.

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Longitudinal Monitoring of Vocal Health Using Smartphones: Acoustic Analysis and Self-Reports of Voice Quality

Introduction: Routine monitoring of vocal health has clear benefits for occupational voice users, who are at greater risk of developing voice problems than the general population. The use of mobile technology allows frequent, repeated measurements of the same voice user, facilitating monitoring of individual vocal health.

Studies of acoustic indicators of vocal health are mostly cross-sectional and rely on clinical thresholds for selected acoustic parameters. Less is known about typical longitudinal fluctuation of acoustic parameters in healthy voice users and the relationship between these parameters and recognised risk factors (e.g. vocal load, stress) for the development of voice problems.

Objectives: To investigate the patterns of fluctuation in acoustic measures of voice quality across an extended period in two groups of individuals: those who report regular voice problems and those who do not. Additionally, the long-term relationship between measures of voice quality and known risk factors in these groups are described.

Methods: A smartphone application has been developed that prompts participants to record sustained vowels, read sentences and a short story. Self-reports of voice use, voice quality, throat sensations and room configuration are recorded simultaneously. Recordings are scheduled across a period of 12-16 weeks. Field recordings are alternated with studio recordings for some participants to analyse the influence of important environment variables.

Results: At present, we have approximately 700 recordings from 60 participants who do not report regular voice problems, and recordings are ongoing. Participants who report voice problems are currently being recruited.

Conclusions: The use of smartphones allows convenient, accessible and inexpensive capture of voice data over time. The results from this study will improve our understanding of typical voice quality fluctuation and thus support the development of procedures for automatic early detection and prevention of voice problems.

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Massed versus Distributed Practice in Vocology: Effect of an Intensive Short-term Voice Training versus a Longer-term Traditional Voice Training

Objective. The purpose of this study was to compare the effect of a short-term intensive voice training with a longer-term traditional voice training on the voice quality of vocally healthy participants.

Design. Pretest-posttest randomized control group design.

Methods. Twenty healthy female participants with a mean age of 21.7 years (range: 20-24 yrs.) were randomly assigned into an experimental group (n=10) and a control group (n=10). Both groups received an identical 6-hours lasting voice training. Only the distribution of practice varied between groups: two hours per day for three consecutive days for the experimental group versus two 30-minute sessions per week for six weeks for the control group. In both groups, a voice assessment protocol consisting of objective (maximum performance task, acoustic analysis, voice range profile, dysphonia severity index) and subjective (auditory-perceptual evaluation, subject's self-report) measurements was used to evaluate the participants' voice pre- and post-training and at 6 weeks follow-up. Groups were compared over time using linear mixed models and generalized linear mixed models. Within-group effects of time were determined using post-hoc pairwise comparisons with Bonferroni corrections.

Results. No significant time-by-group interactions were found for any of the outcome measures, indicating no differences in evolution over time between both groups. Significant time and group effects were found for the maximum phonation time in favor of the experimental group, which achieved a higher score post-training than the control group. A significant time (but no group or time-by-group) effect was found for lowest intensity, highest frequency, and dysphonia severity index. Within-group effects of time showed that the evolution in lowest intensity is in favor of the control group and the evolution in dysphonia severity index is in favor of the experimental group.

Conclusions. A short-term intensive voice training may be equally effective in training vocally healthy participants compared to a longer-term traditional voice training.

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Short-Term Effect of Two Semi-Occluded Vocal Tract Training Programs on the Voice Quality of Future Professional Voice Users: "Resonant Voice Training using Nasal Continuants" versus "Straw Phonation"

Objective. The purpose of this study was to determine the short-term effect of two semi-occluded vocal tract (SOVT) training programs "resonant voice training using nasal continuants" versus "straw phonation" on the voice quality of vocally healthy future professional voice users.

Design. Pretest-posttest randomized control group design.

Methods. Twenty-nine healthy speech-language pathology students with a mean age of 19 years (range: 17-22 yrs.) were randomly assigned into a resonant voice training group (practicing resonant exercises across 6 weeks, n=10), a straw phonation group (practicing straw phonation across 6 weeks, n=10), and a control group (practicing no voice techniques, n=9). A voice assessment protocol consisting of both objective (maximum performance task, aerodynamic assessment, acoustic analysis, voice range profile, acoustic voice quality index, dysphonia severity index) and subjective (auditory-perceptual evaluation, subject's self-report) measurements was used to evaluate the participants' voice pre- and post-training. Groups were compared over time using linear mixed models and generalized linear mixed models. Within-group effects of time were determined using post-hoc pairwise comparisons.

Results. No significant time-by-group interactions were found for any of the outcome measures, indicating no differences in evolution over time among the three groups. Within-group effects of time showed a significant improvement in dysphonia severity index and shimmer local dB in the resonant voice training group, and a significant improvement in lowest intensity, highest intensity and intensity range in the straw phonation group.

Conclusions. This study could not demonstrate a better evolution in voice quality of future professional voice users who received an SOVT training program compared with those who received no voice training. However, results suggest that a resonant voice training may cause an improved dysphonia severity index and shimmer local dB, and a straw phonation training may cause an expansion of the intensity range in this population.

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Do Instrumental Acoustic, Perceptual and Subjective Voice Outcomes Indicate Therapy Success in Patients with Functional Dysphonia?

Objective: The characterisation of vocal dysfunction in functional dysphonia relies on instrumental acoustic, perceptual and subjective voice assessment techniques. However, the validity and sensitivity to change of instrumental measures such as voice range profiles (VRP) and perturbation has been controversially discussed. This work examines combined voice therapy effects on standard diagnostic acoustic parameters in patients with functional dysphonia, and if these agree with perceptual and subjective outcomes.

Methods/Design: Thirty-nine patients (26 women/13 men) aged 20-70 years (mean: 44.5ys, SD 12.79) with functional dysphonia were assessed before and after treatment. Acoustic parameters included the mean and range of speaking fundamental frequency (F0) and intensity (SPL), mean F0 and maximum SPL of calling voice; minimum, maximum, range of singing voice F0 and SPL; jitter (%) and Dysphonia Severity Index (DSI). Subjective assessment was done by Voice Handicap Index-9 international (VHI-9i) and perceptual assessment by Grading-Roughness-Breathiness-Asthenia-Strain (GRBAS) scale. Statistical differences were assessed with Wilcoxon-Signed-Ranks-Test and coherences with Spearman`s-Rank-Correlation coefficient.

Results: After treatment the speaking voice F0 (7 to 8.13 semitones) and SPL range (12.9 to 14.85 dBA) were significantly larger ($p < 0.05$), also these parameters were highly correlated ($p < 0.001$). Subjective symptoms were significantly reduced from a mean VHI-9i of 15.6 to 8.6, and all perceptual GRBAS-scale parameters were significantly improved (G: 1.05-0.51; R: 0.79-0.43; B: 0.82-0.23; A: 0.56-0.13; S: 0.58-0.36) after therapy ($p < 0.05$). Subjective and perceptual findings were not associated with any acoustic parameter ($p > 0.05$).

Conclusions: Significantly improved subjective and perceptual findings verify positive combined voice therapy effects in patients with functional dysphonia. The larger F0 and SPL speaking voice range indicates an altered voice technique after therapy. Thus these measures may be clinical indicators of therapy success, whereas all other acoustic parameters may not be sensitive enough to detect functional voice changes. This should be addressed in a larger clinical study.

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Effectiveness of Recurrence Quantification Measurements in Discrimination of Normal and Deviated Synthesized Voices

Objective: To analyze accuracy of recurrence quantification measures (RQM) for discriminating normal from deviated synthesized vocal signals.

Method: 871 synthesized / ɛ / vowel samples, 426 female and 446 male with deviations of roughness, breathiness, and tension were submitted to perceptual analysis. The severity of vocal deviation using a 100-point scale was identified. 47 samples were considered normal variability of vocal quality (bellow 35.5 points) and called normal samples and 824 were classified as having vocal deviation above normal limits (higher than 35.6 points). For acoustic analysis, selected signal samples of two seconds were divided into 62 segments of 32 ms. Twelve RQM were extracted, related to recurrence points (determinism, DET; type 1 and type 2, T^1 and T^2; transitivity, TRANS), diagonal lines (average and maximum length of diagonal lines, L_{max} and L_{med}; Shannon entropy, ENTR; and divergence, DIV) and vertical structures (average and maximum length of vertical lines, TT and V_{max}; laminarity, LAM; and recurrence time of entropy type 1, RPDE). We analyzed parameters related to recurrent topology of vocal production (embedding dimension, m; reconstruction step, τ; and neighborhood radius, Radius). Quadratic discriminant analysis and performance measures (accuracy, sensitivity, and specificity) were used to investigate discriminatory power of RQMs, as well as cross validation for random combination of signals with and without disturbances.

Results: Individually, measures such as ENTR, L_{med}, and TRANS showed excellent performance (> 90%) in discriminating normal from deviated signals. ENTR values were higher in deviated voices, while TRANS and L_{med} were lower. Combined QRMs showed gain in classification rate, with excellent performance (> 90%) for all combinations. Combination of five measures (τ, m, L_{med}, RPDE and TRANS) showed best performance for discrimination between normal and deviated voices.

Conclusions: Some individual and combined RQMs showed excellent performance in discriminating between normal and deviated synthesized voices.

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Performance of Recurrence Quantification Measurements to Discriminate Individuals with and without Voice Disorders

Objective: To analyze accuracy of recurrence quantification measurements (RQM) 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 12 RQMs extraction such as formation of recurrence points (determinism, DET; type 1 and type 2 recurrence time, T^1 and T^2; and transitivity, TRANS), diagonal lines (average and maximum length of diagonal lines, L_{max} and L_{med}; Shannon entropy, ENTR; and divergence, DIV) and vertical structures (average and maximum length of vertical lines, TT and V_{max}; laminarity, LAM; and entropy of type 1 recurrence time, RPDE). We also analyzed parameters related to recurrent vocal production system topology (immersion dimension, m; reconstruction step, τ; and neighborhood radius, Radius). A total of 15 measures were obtained. Quadratic discriminant analysis and accuracy, sensitivity and specificity of performance measures were used to investigate discriminatory power of QRMs, as well as cross-validation of random signals' combination with and without disturbance.

Results: Single measurements, such as ENTR, L_{med} and TRANS had only acceptable performance ratings of $\geq$ 70% to discriminate between individuals with and without voice disorders with an accuracy. Combined measurements achieved good performance. The combination of 8 parameters, such as L_{med}, ENTR, TT, V_{max}, τ, m, RADIUS, and TRANS, produced the highest accuracy of 83.27%.

Conclusions: RQMs related to formation of diagonal lines showed acceptable performance of $\geq$ 70% in classifying individuals with and without voice disorders. Combination of QRMs showed improved discrimination between study groups, with good performance and higher sensitivity and specificity.

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Comparative Assessment of C-VHI-10 and TAVI

Background: the C-VHI-10 (Children Voice Handicap Index) and TAVI (Test di Autovalutazione della Voce infantile, Self-Assessment of Child Voice) are two self-assessment tests for children's voice complaints, that have been developed in Italian language. They have never been translated and validated into English language.

Objective: The aim of this study is to assess and compare the validity of these two tests, analyzing the procedures used to develope and validate them.

Methods: we administered the tests to two groups of children between 8-12 years old, one dysphonic group and one control healthy group. The dysphonic group was evaluated using a perceptive method. We administered the tests twice, with a lapse of time of 15 days.

Results: We show our statistic and comparative data.

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Vocal Patterns of Dysphonic and Normal Voices when Speaking to Robotic Dogs and Cats

Objectives: The present study seeks to examine differences in voice use patterns among adult subjects when communicating with an interactive robotic pet ("GoGo My Wallkin Pup" and "Lulu's Walkin Kitties Pearly Paws) compared to baseline measures. This study is a continuation of our previous research on change of fundamental frequency when speaking with domestic pets.

Methods/Design: 20 adult dysphonic voices and 20 adult normal voices were recorded for baseline data and test condition (speaking with robotic toy). Change and range of fundamental frequency and loudness were determined between the 2 recordings. Subjects were grouped as "dysphonic" or "normal" through report of voice disability, perceptual rating, and subject reported medical history of current dysphonia.

Results: Normal subjects were found to use greater variability of fundamental frequency compared to dysphonic subjects. Loudness reduction was present for communication with a robotic cat compared to robotic dog.

Conclusions: The increased use of communication through robot devices requires an understanding of the frequency and loudness changes from baseline to targeted communication. The feasibility of animal-assisted therapy remains of concern for dysphonic subjects.

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Vocal Habits in Brazilian Country Music Singers

The popular Brazilian music has several sub styles, among them, the Brazilian country music that is quite different from the American genre. Brazilian country singers are high level professional voice users, but don't usually seek for speech therapy to enhance their voice care; they sing mostly imitating their idols or due to a natural talent. This reality generates a lack of guidance, what can lead to harmful habits to the vocal health (smoke, alcohol, drug use, medications, inadequate nutrition, incorrect clothing, hawk, cough, scream, and others), and that may have a direct impact on their quality of life and career longevity. OBJECTIVE: characterize the vocal habits profile in Brazilian country music singers. METHOD: 45 Brazilian country music singers (42 men and three women, aged between 18 and 37 years old – mean age: 27 years) were asked to answer an online questionnaire with 31 questions about their health and harmful vocal habits. RESULTS: there was significant statistical occurrence for two healthy habits ("use auditory feedback monitoring during presentations" and "do singing lesson") and for 5 harmful habits ("ingest cold drinks/food", "caffeine drinks", "alcohol", "dance while singing" and "use air conditioning"). CONCLUSION: The vocal habits profile analyzed in this group of singers indicates a predominance of harmful habits, and the absence of certain healthy habits, which could be due to a possible lack of knowledge and proper guidance about their effects on the voice.

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The Effect of Background Noise on Intelligibility of Dysphonic Speech in Adults and Children

Objectives: Speakers with dysphonia frequently report decreased intelligibility in noisy communication environments; however, this aspect of the disorder is not routinely assessed in clinical voice evaluation. As the first step towards development of an intelligibility assessment, a speech perception study was conducted to examine the effect of dysphonia and background noise on intelligibility. Acoustically, dysphonic speech often contains greater aperiodicity, which may contribute to the deficit. The effect of aperiodicity on intelligibility was thus explored as a correlation between cepstral peak prominence (CPP) and intelligibility score.

Methods: Sentences from Hearing in Noise Test were recorded from a total of 36 speakers, consisting of 6 adult males, 6 adult females and 6 children with and without dysphonia. Stimuli consisted of ten sentences from each speaker, and cafeteria noise was added to the samples at signal-to-noise ratio of +0 dB. The stimuli were presented to 60 adult listeners with normal hearing in random order. Intelligibility was measured by the percentage of words correctly identified by the listeners. CPP was calculated using Analysis of Dysphonia in Speech and Voice (KayPentax, NJ).

Results: Average intelligibility scores of normal and dysphonic speech were significantly reduced in both quiet and noisy listening conditions ($p < 0.05$ for both conditions). The effect of background noise on intelligibility was greater on dysphonic speech than normal speech (83.18% and 58.64% for normal and dysphonic, respectively). The effect of age and gender was not statistically significant. Correlations between CPP and intelligibility scores in quiet and noise were moderate ($r_s = .43$ for quiet; $r_s = .56$ for noise).

Conclusion: Background noise reduces intelligibility in general; however, its detrimental effect is greater for speakers with dysphonia than speakers with normal voice. The moderate association between CPP and intelligibility suggests that aperiodicity alone cannot explain the intelligibility deficit in dysphonic speech.

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Vowel Space and Intelligibility of Dysphonic Speech: Application of Landmark Model

Objective: Patients with voice disorders frequently report reduced intelligibility in daily communication. Acoustic analysis tools have long been incorporated in voice evaluation; however, currently available programs are designed to analyze aspects of speech signal that are relevant to voice quality. Consequently, the physical nature of intelligibility deficit is poorly understood. One of the acoustic features that influence the intelligibility deficit may be vowel space, which has been shown to predict intelligibility in normal speech. SpeechMark® is a novel automatic speech analysis program that is based on the Landmark (LM) model of speech perception. This linguistically-motivated program automatically detects abrupt changes in a signal that are elicited by speech, and labels moments of consonants and vowels with markers according to their acoustic rules. The program also provides vowel space measurements by examining formant frequency and bandwidth of detected vowels. Accordingly, this study examined the following hypothesis: vowel space measurements by the LM-based model would predict intelligibility ratings of dysphonic speech.

Methods: A total of 18 speaker with dysphonia and 3 age-gender matched speaker with normal voice recorded six sentences from Consensus of Auditory-Perceptual Evaluation of Voice. These samples were mixed with cafeteria noise at three noise levels (signal-to-noise level +3, +0 and -3 dB). Their intelligibility was rated by 45 listeners with normal hearing on a 5 point scale. Vowel space of these samples was measured with SpeechMark®.

Results: Vowel space area did not predict the intelligibility ratings. However, the intelligibility ratings at all noise levels were moderately predicted by the number of vowels with formant bandwidth and frequency values that were within the normative range.

Conclusions: Frequency and bandwidth of vowel formants may partly account for intelligibility deficit in dysphonic speech.

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Long-Time Voice Accumulation during Work, Leisure and a Vocal Loading Task in Groups with Different Levels of Functional Voice Problems

Objective: Examine vocal behavior and self-assessed vocal health in a population with varying everyday vocal loading and functional voice problems, including patients with functional dysphonia, under three different conditions: a. work, b. leisure and c. a vocal loading task.
Study design

Methods/design: Longitudinal controlled, clinical trial, mixed models. Vocal behavior and self-assessed vocal health was examined in fifty (n=50) female subjects in four vocal subgroups during 7 days voice accumulation accompanied by a voice health questionnaire. Vocal subgroups were ordered according to everyday vocal load/dose and vocal complaints: n=20 patients with functional dysphonia (FD), n=10 women with high occupational vocal load with voice complaints (HLC), n=10 women with high occupational vocal load with no voice complaints (HLNC), n=10 voice healthy controls with low everyday vocal load (C). Accumulation time was divided into three conditions: a. time in a vocal loading task (VLT) b. time during work and c. time during leisure. During the voice accumulation the following parameters were measured: a. relative phonation time (%), b. phonatory sound pressure/voice level (dB SPL), c. ambient noise level (dB SPL) and d. phonatory fundamental frequency (Hz). A voice health questionnaire tracked vocal health through a. specific voice problems assessed with 10 voice health questions (10VQ) and b. general voice problems, assessed with a 100 mm visual analogue scale (VAS).

Results: Relative phonation time was very similar in all vocal subgroups across conditions, with the VLT scoring significantly higher than the other two conditions, and work scoring significantly higher than leisure. HLC showed significantly higher relative phonation time than C in the work condition. The same pattern was shown for fundamental frequency. Voice and noise sound pressure levels were significantly higher in the VLT than the other conditions for all groups. FD reported the highest incidence of specific (10VQ) and general (VAS) voice problems across conditions, except for VAS assessments from the VLT, which were higher for HLC. FD's self-assessments were significantly higher than those of HLNC and C throughout conditions and of HLC for specific voice problems during work and leisure.

Conclusions: Vocal loading is not only dependent on prolonged phonation time at high intensity levels, it seems also to be reliant on prolonged phonation time at high fundamental frequencies. HLC experienced strain induced voice problems during confirmed vocal loading, while the FD group exhibited voice problems in all conditions, also during leisure. This may explain why people with voice problems associated with their work environment do not seek voice therapy.

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Recovery from Heavy Vocal Loading in Women with Different Levels of Functional Voice Problems

Objectives: Track recovery time following a vocal loading task imposing vocal fatigue. Explore if patients with functional dysphonia are worse affected by vocal loading and if they take longer than others to recover.

Methods/design: Longitudinal, case-control, clinical trial. Fifty (n=50) female participants in four vocal subgroups on a spectrum of everyday vocal loading and functional voice complaints, including n=20 patients with functional dysphonia, took part in a clinical vocal loading task, inflicting vocal fatigue through loud speech in ambient noise. Short-term recovery was explored through self-assessment of unspecified voice problems every 15 minutes for two hours following loading. Long-term recovery was tracked through self-assessments of specific voice symptoms during 3 days following vocal loading. Effects of heavy vocal loading were evaluated through voice recordings, LTAS, perceptual assessments and assessments of digital imaging performed pre and post vocal loading.

Results: Patients with functional dysphonia did not return to baseline for unspecified voice problems within 2 hours of vocal loading and they were worse affected by vocal loading than other groups. Women with high everyday vocal loading with no voice complaints identified vocal loading more evidently than other groups. Long-term recovery took 7–20 hours for all groups.

Conclusions: Short-term recovery is slower for patients with functional dysphonia and they are worse affected by a vocal loading task than others.

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The Effectiveness of Neuromuscular Electrical Stimulation (NMES) for Paediatric Voice Disorders Associated with Increased Laryngeal Muscle Tension: A Pilot Study

Voice disorders in children are becoming more prevalent in voice clinics in the recent decades. Clinically, these voice disorders are often described as "hyperfunctional" which involves vocal abuses and/or overuse. In the majority of cases, tensions of the intrinsic and/or extrinsic laryngeal muscles are observed to be elevated in these children. The current study aims to investigate a) the effectiveness of a Neuromuscular Electrical Stimulation (NMES) treatment protocol on the reduction of laryngeal muscle tension in children with voice disorders.

A prospective, randomized-controlled research design was adopted. Nine dysphonic children with increased laryngeal muscle tension who aged between 5;0 and 11;0 were recruited and randomly assigned to three groups, namely, a) the relaxation and NMES group; b) the NMES-only group; and c) the no-treatment control group. Subjects in the relaxation and NMES group received laryngeal manual therapy (LMT) and low frequency, high intensity NMES at the submandibular area and upper fiber of trapezius region whereas the subjects in the NMES-only group received the NMES at the same region but not LMT. The course of treatment consisted of three sessions which took place on three consecutive days. Outcome measures included surface electromyographic (sEMG) signals of the laryngeal area, acoustic and auditory-perceptual analyses of voice samples obtained pre- and post-treatment. Preliminary results obtained from the above analyses and the implication for a larger-scaled study will be discussed in the presentation.

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Clinical Experience Influence on the Perceptual-Auditory Analysis

Objective: To investigate the professional experience influence in identifying human and synthesized voices; verify the self-perception difficulty of performing a perceptual auditory analysis.

Method: 269 listeners, three groups according to professional experience: 73 voice specialist speech language pathologist (SLP), experienced group (EG); 84 non-voice specialist SLP, non-experienced group (NEG), and 112 listeners non-SLP, naive group (NG). The listening section included 18 synthesized and 18 human voices with different types and degrees of deviation (50% of repetition for intra-rater consistency analysis). The task was to classify the voices as human and synthesized. For the consistent subjects the learning factor was analyzed; this analysis verified if there was more error at the begging or at the end of the analysis. 163/269 listeners rated the degree of difficulty of the task as being "very easy", "easy", "hard" or "very hard".

Results: EG was more consistent, less excluded listeners: EG = 20.5% (15/73); NEG= 39.2% (33/84) and NG = 45.5% (51/112). EG presented learning factor, less error at the end of the task, revaluation (25.5%), than at the beginning, evaluation (28.6%); no statistical difference was found for NEG and NG. The task difficulty was perceived similarly for listeners, regardless if considered consistent or inconsistent. No one rated the task as "very easy." EG rated the task as "difficult", more often than the NEG and NG (EG = 92.9%; NEG = 64.6%; NG = 62.5%); NEG and NG used more often "very difficult" (EG = 3.6%; NEG = 34.2%; NG = 32.1%).

Conclusion: Professional experience positively interferes the voice identification, which reinforces the importance of perceptual-auditory training for voice analysis. The voice specialist seems to learn during the task and seems to be more prepared and confident for a perceptual-auditory analysis, considering it less difficult than listeners who had no formal previous training.

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Long-latency Auditory Evoked Potential (P300) in Tuneless People

Background: The long-latency auditory evoked potential (P300) is used to assess cognitive abilities such as discrimination and attention. Its responses reflect the neuro-electrical activity of the auditory pathway in the regions of the thalamus and the auditory cortex, which are structures involved in the functions of the discrimination, integration and attention processes. Thus, they provide information about how the central auditory nervous system works.

Objective: to investigate the long-latency auditory evoked potential (P300) in tuneless people.

Methods: 20 volunteers self-reported as tuneless (aged 15 to 55 years) and 17 volunteers self-reported as tuned (aged 28 to 49 years), with auditory thresholds within the normal standards and without voice complaints answered the Brazilian version of the Voice Symptom Scale and were submitted to a pitch-matching scanning test and to the long-latency auditory evoked potential (P300).

Results: Considering the P300 responses for left (LE) and right ears (RE) presented by tuneless people, both showed statistically significant difference when compared to tuned subjects.

RE: (i) lower P2 peak waves amplitude values (tuneless: 2.90 µV/ tuned: 4.47 µV, p= 0.035) and (ii) lower P300 peak waves latency (tuneless: 320.73 msec/tuned: 275.38 msec, p= 0.001).

LE: (i) lower P300 peak waves amplitude (tuneless: 5.15 µV /tuned: 7.03 µV, p < 0.001) and (ii) lower P300 peak waves latency (tuneless: 336.35 msec/tuned: 285.06 msec, p= 0.001).

Conclusion: the long-latency auditory evoked potential (P300) presented by tuneless people was worse when compared to the one of tuned people, which may suggest that the discrimination and the integration of the auditory information might have some impairment in tuneless people.

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Self-Regulation Deficits as Predictor of Dysphonia

INTRODUCTION: Self-regulation is involved in monitoring many behaviors. Since faulty self-regulation may be involved in cases of voice disorders, it is important to assess in dysphonic patients to decide the need for introducing specific strategies in therapy. GOAL: To determine the efficiency of the Short Self-Regulation Questionnaire (SSRQ) in categorizing patients with dysphonia and those vocally healthy. Moreover, we aim at using a decision model based on Multiple Logistic Regression to identify if self-regulation directly influences the chance of any individual having dysphonia. METHODS: Multicentric case-control study including 100 participants of both sexes and mean age of 35.3 years, 50 patients with dysphonia and 50 vocally healthy. Individuals have answered two questionnaires: the SSRQ and the Voice Symptom Scale (VoiSS). RESULTS: ROC curves were obtained for dysphonic and vocally healthy subjects, as well as for all 3 scores of the SSRQ: total, goal setting and impulse control. The SSRQ is not a perfect classifier, with AUC of 0.66. Cutoff values were defined as: ≤ 96 points for Total Score; ≤ 52 points for Goal Setting and ≤ 40 points for Impulse Control. The combination of vocal complaints, voice deviation, reduced goal setting and limited impulse control present a significant association with the presence of diagnosed dysphonia. CONCLUSION: The SSQR is a fair classifier to separate normal from dysphonic subjects, with defined cutoff points. Vocal complaint, a deviant vocal quality and reduced scores on goal setting and control of impulses can be predictors of dysphonia. The SSQR may contribute to understand certain cases of dysphonia.

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Perception of Timbre in Vocoded and Non-vocoded Synthetic Female Voices

Objective: For the nearly 350,000 people worldwide who rely on a cochlear implant (CI) to perceive sounds, simply making the sound louder does not enhance their perception of timbre, the attribute that causes two sounds of the same pitch and loudness to sound different from one another. CI software is designed to allow the user to perceive speech using minimal acoustic cues; thus, the implant does not reproduce sound as normal hearing individuals understand it. CI software tracks the amplitude envelope of speech and ignores many of the frequency components that are necessary for the perception of timbre. This study seeks to use a cochlear implant vocoder to simulate how cochlear implants alter the timbre of synthetic female voices. Normal hearing listeners will be presented with both unaltered and altered synthetic stimuli to see how the listener's perceptual timbre space is affected by this alteration.

Methods/design: This study employs a paired-comparison paradigm where normal hearing listeners hear synthetic female voices over headphones and rate them on a scale from "same" to "very different" using a 100-point scroll bar. Listeners rate 2 sets of stimuli: non-vocoded synthetic female stimuli and vocoded synthetic female stimuli. Non-vocoded stimuli were synthesized using 3 different source slopes, -9, -12, and -15 dB/octave, and 2 different formant patterns, one representing a shorter vocal tract and the other representing a longer vocal tract, on the vowel /a/ at 4 pitches, A3, C4, B4, and F5. Vocoded stimuli were created by modifying the non-vocoded stimuli using the AngelSim[TM] Cochlear Implant and Hearing Loss Simulator. Multi-dimensional scaling techniques are being employed to determine the perceptual dimensionality of the non-vocoded and vocoded stimuli.

Results: Preliminary results suggest that some aspects of vocal timbre are preserved in cochlear implant vocoded signal. However, the multi-dimensional timbre perception space appears to be very different for cochlear implant vocoded voices than for non-vocoded voices.

Conclusion: These results suggest that CI users may be able to use some acoustic timbre cues found in vocoded vocal signals to help discriminate human voices. However, their perceptual timbre spaces may not be identical to those of normal hearing listeners.

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Differential Effects of Cardiovascular Conditioning versus Voice Production Exercises in a Patient with Vocal Fatigue

Objective: Vocal fatigue is a debilitating condition affecting individuals with voice disorders with little known about appropriate treatment approaches. In this case report, we describe the differential effects of cardiovascular conditioning exercises versus voice production exercises on metabolic profiles (i.e., physiologic cost of speaking) and vocal fatigue symptoms in an individual with vocal fatigue.

Methods: A 44-year old female teacher with complaints of vocal fatigue identified using the Vocal Fatigue Index (VFI) completed an initial treatment of cardiovascular conditioning, submaximal aerobic training, twice a week for 4 weeks. Two months later, voice production exercises were completed, twice a week for 4 weeks. Pre- and post treatments, metabolic measures using analysis of expired gases during a speaking task, and self-reported fatigability using the VFI were obtained.

Results: Pre-test metabolic measures indicated a high mean respiratory exchange ratio (ratio of carbon dioxide produced to oxygen consumed), RER = 1.15; mean oxygen consumption, VO2 = 2.63ml/kg/min. Following cardiovascular conditioning, there was a decrease in RER (mean RER = .96) and increase in VO2 (mean VO2 =3.03ml/kg/min). Subsequently, after the voice production exercise compared to post cardiovascular training, there was a further increase in VO2 (mean VO2 = 3.9ml/kg/min) for the speaking task, while the RER remained largely unchanged, (mean RER = .97).

Conclusions: Prior to treatment, there was a substantial reliance on anaerobic metabolic resources ('without oxygen') for the energy demands of speaking. Reliance on aerobic resources following cardiovascular conditioning and the change in management of oxygen uptake following voice production exercises to meet task demands were observed. This preliminary case report will be used to provide insight in to potentially differential profiles of vocal fatigue; by defining those profiles, differential treatment options may be identified.

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The Role of Personality in Voice Range Profiles and Associated Risk for Voice Problems during Student Teaching

Objective: Teachers who experienced voice problems during student teaching are at higher risk for voice disorders. Research indicates that a weak vocal constitution includes a limited vocal range and the trait theory of voice disorders proposed a link between introversion and inhibited vocal behavior. Therefore, the aims of the study were to investigate if (1) voice range profiles (VRP) correlate with personality traits and (2) if VRPs correlate with voice quality of life after one semester of student teaching.

Methods: Participants were 43 vocally healthy participants of which 23 were student teachers. All participants completed a VRP and questionnaires on voice quality of life and personality. Student teachers completed the VRP at the beginning and end of student teaching. The outcome measures were minimum and maximum voice fundamental frequency and intensity including ranges. Personality was assessed with the Multidimensional Personality Questionnaire – Brief Form and voice quality of life with the Voice Handicap Index – 10 (VHI—10) and Vocal Fatigue Index.

Results: Spearman's rank correlation analysis for the total sample revealed a significant positive correlation between maximum intensity and the personality trait Social Potency and a negative correlation between minimum frequency and Social Potency. Descriptively, VRPs and voice quality of life decreased after one semester of student teaching. VHI—10 scores post student teaching were inversely correlated with maximum intensity and intensity ranges at the beginning of student teaching.

Conclusions: The findings confirmed hypotheses that traits related to introversion limit vocal loudness and that such students perceive more vocal symptoms at the end of student teaching. Difficulties with projecting voice can lead to vocal effort and vocal fatigue. Individuals scoring low on Social Potency would benefit from tailored voice training focused on vocal projection.

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Effect of Two Isolated Vocal Facilitating Techniques Glottal Fry and Yawn-Sigh on the Phonation of Female Speech-Language Pathology Students: A Pilot Study

Objective. The purpose of this study was to determine the effect of the vocal facilitating techniques glottal fry and yawn-sigh on the phonation of healthy female speech-language pathology (SLP) students.

Study design. multigroup pretest-posttest design

Methods. Thirty-six female SLP students with a mean age of 18.1 years were assigned into three groups: 1. a glottal fry group, 2. a yawn-sigh group (practicing the facilitating technique glottal fry/yawn-sigh across 18 weeks, n = 12) and 3. a control group (practicing no facilitating techniques, n = 12). To compare vocal measures before and after this time span, an identical objective voice assessment protocol (maximum performance task, acoustic analysis, voice range profile and Dysphonia Severity Index) was performed in the three groups.

Results. The glottal fry group resulted in a shifted intensity range to the lower intensities due to a significant decrease in lowest intensity and highest intensity (compared with the control group). The intensity range itself did not decrease significantly compared with the control group. The yawn-sigh group resulted in a significant increase in the acoustic measure fundamental frequency (f_o), and a significant decrease in the acoustic measures jitter, shimmer and noise-to-harmonic ratio (NHR) compared with the control group.

Conclusions. The results of this pilot study suggest a positive effect of the facilitating techniques on the phonation of female future SLPs. Glottal fry may optimize vocal fold oscillation in the low intensities, and yawn-sigh may reduce acoustic perturbation and noise. Control of the f_o in subjects using yawn-sigh may be necessary.

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Emotions and Values Expressed by the Voice on the Newscast

Introduction:
The aim of this study was to analyze the vocal resources employed in television news as supporting the effects desired directions. These features address mechanisms in the transmission of information in the search for effects of sensein disseminating the information. The research sample was composed of emissions, in real time, from Brazilian presenters in newscasts from three television channels.

Objectives:
This study aimed to analyze the vocal procedures used in news cast in television as adjuncts of the effects of the intended way disclosure, to analyze the modifications in voice frequency, the Brazilian TV news, that is, as the voice part of the effects of senses targeted in televised speech

Method:
This study was made based on 40 utterances made by 10 TV presenters, 5 males and 5 females of 4 newscasts from3 different television channels. The main criterion was made up of a main criterion: the coverage of different types of news, classified as "positive" and "negative". The hypothesis was that the presenter's voice changes in different contexts, depending on the type of news that is being presented.

A computerized acoustic analysis of the average vocal frequency and variation of each utterance was held. The results confirmed the relationship between voice changes and sense the desired on the news.

Conclusion:
The voice, thus, played an important role as a persuasion strategy in the search for credibility of the information, and the adhesion of the viewer.

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Acoustic Evaluation of Immediate Voice Changes in Pre- and Post- Abbreviated Semi-Occluded Warm-Up

Objective: Semi-occluded techniques are used in voice rehabilitation and voice enhancement training. Additionally, semi-occluded exercises are used in both vocal warm-up and cool-downs. The present study aimed to investigate immediate changes to vocal metrics due to a very brief straw based vocalization.

Methods: Vocally untrained participants were recorded producing a vocal task before and after a 1-minute warm-up using a small straw. These recordings sessions were repeated twice day for three days. For each recording session, the vocal task (produced before and after the warm-up) included reading aloud a standard passage and three sustained vowels. From these recorded tasks, traditional and recent voice acoustic metrics were extracted using MATLAB and Praat. These acoustic metrics were compared pre- and post- warm-up for each participant.

Results: Some of the participants showed changes in voice metrics as a result of the warm-up while others had no measureable effect. Of the participants that showed a change, significant changes were found in Alpha Ratio, Jitter, Shimmer, Harmonic-to-Noise Ratio, Smoothed Cepstral Peak Prominence (CPPS), and others.

Conclusions: The majority of participants were not vocally affected by a 1-minute warm-up with a straw. However, those that were affected showed positive acoustic changes. These results may illustrate why some vocalist respond to certain techniques while others do not. Additionally, there could be an inherent coaching or motivation difference in the participants. Further, perhaps the abbreviated warm-up was not adequate for some. Future work will investigate these factors to provide more universally effective semi-occulated warm-ups.

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Prevalence of Voice Disorders in Teachers in Mysuru

Objective: To estimate the prevalence of voice problems in teachers with a minimum of 5 years of teaching experience.

Method: 372 school teachers (327 females and 45 males) from 60 schools in the city and surrounding taluks of Mysuru participated in the study. A validated questionnaire was used to obtain information related to voice use, vocal habits and voice problems. All participants completed two vocal tasks including (a) sustained phonation of /a/ at comfortable pitch and loudness and (b) a monologue on the topic "school". Five experienced speech language pathologists completed the auditory perceptual analysis of the vocal tasks using the GRBAS scale. Dr. Speech software was utilized to extract acoustic measures.

Results: Scores obtained from the questionnaires were analyzed to determine the risk factors for developing a voice disorder. Data varied in terms of the presence or absence of a voice disorder depending on the outcome measure. On results of the questionnaire, 8.6 % of the participants were categorized as having voice problems. A higher percentage (23.7%) of participants were identified as having a voice problem solely based on acoustic measures, followed by 19.7% based solely on auditory perceptual analysis. Results were similar to the questionnaire data (7.5%) when both acoustic and perceptual measures were included to categorize as having voice disorder.

Conclusion: Based on the results, about 8% of teachers present with a voice disorder. The following risk factors were identified as significant for the development of voice problem: participants using their voice to discipline their children at home apart from teaching at school, conducting tuition classes at home, frequently indulging in long continuous chats and frequent exposure to dusty environment.

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Occupational Risk Factors on Voice Characteristics in Teachers in Mysuru

Objectives: Teachers are at risk for a voice disorder given their increased vocal demands. Additionally, factors in a teacher's work environment tend to affect their vocal quality and increases the risk for a voice disorder. The purpose of this study was to identify the impact of teachers' work environment factors on a teacher's vocal quality.

Method: 308 school teachers (264 females and 42 males) participated in this study. Teachers completed (a) a validated questionnaire regarding voice use, vocal habits, and work related factors, and (b) various vocal tasks including sustained phonation on /a/, MPT for three different vowels, and a monologue for one minute. Three experienced speech language pathologists completed auditory perceptual analysis. Acoustic measures using the MDVP and Real Time Pitch of the Computerized Speech Lab were obtained.

Results: Differences in voice characteristics including minimum F_0, RAP, ATRI, Fhi and perceptual characteristics were obtained for (a) location: rural versus urban classroom, (b) years of teaching experience, (c) number of hours spent teaching, (d) classroom size, (e) number of students in a classroom, (f) grade level, and (g) subjects/courses taught by teachers. Females tended to present with poor vocal characteristics compared to males across the factors.

Conclusion: Results from this study provide further evidence that females present with more voice problems than males. Additionally, work related factors have a significant impact on voice characteristics in teachers. The data will be utilized to educating the teachers and school systems about work related risk factors and strategies to prevent voice problems.

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SOVT Exercise Measurement Tools

The use of Singing Voice Handicap Index (SVHI) and Evaluation of the Ability to Sing Easily (EASE) and CAPE-V with the Impact of Semi-Occluded Vocal Tract Exercises on Vocal Function in Singers.

Objective: The purpose of this study is to compare the effect of straw phonation and lip trill therapy in adult singers without known vocal issues. The purpose of this talk is to discuss the implications of SVHI, EASE and CAPE-V and why they may be best used with different audiences and different outcomes.

Methods/Design: 16 individuals underwent 3 weeks of voice exercises with a skilled voice professional for a total of three sessions. Pre and Post measurements of the EASE, SVHI and CAPE-V ratings will be completed. Patients completed approximately 16-20 minutes of home therapy each day outside of the clinic. Comparison between the straw and lip phonation will be assessed.

Results/Conclusions: Both subject groups showed meaningful and significant changes in measures but there was not a statistically significant difference between the two groups. It appears there is not a statistically significant difference between straw phonation and lip trill in singers. The SVHI measures were not statistically significant, but the EASE measurements were statistically significant. This suggests the EASE may be more of a useful instrument with singers who are healthy compared to SVHI, which may be best to measure singers who have or are about to have a pathology. CAPE-V scores were not statistically significant when used with singing teachers to rate the ability of each singer, which could suggest perceptual ratings between singing teachers is not always reliable.

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Conversation Training Therapy (CTT) Efficacy: Preliminary Results of an Ongoing Investigation

Objective: A critical need exists for a new approach to voice therapy. Traditional treatments are associated with attrition and relapse rates approaching 70%, which contribute to the high costs associated with treating voice disorders. In addition, traditional treatments vary in duration between 4-26 sessions. A new voice therapy approach, Conversation Training Therapy (CTT), was developed by a team of expert voice-specialized speech-language pathologists to address these short-comings. The current study demonstrates the efficacy of CTT in the rehabilitation of patients with benign vocal fold lesions (lesions) and muscle tension dysphonia (MTD).

Methods/Design: Ongoing, randomized, prospective study of patients with MTD and lesions who underwent baseline testing, 4 sessions of CTT intervention, and short-term follow-up testing. In CTT, target voice skills are trained in the context of patient-initiated conversation as the sole therapy stimulus.

Results: At short-term follow-up, mean VHI-10 scores decreased from 19.74 to 10.75, vocal effort rating scores decreased from 45 to 25.25, percent of normal vocal functioning improved from 56% to 76%. Improvements were also seen across acoustic and aerodynamic outcomes.

Conclusions: Preliminary analysis of participants who underwent CTT intervention revealed substantial improvements across patient-perceptual, voice-handicap, acoustic and aerodynamic voice outcomes. Based on current recruitment, data on a minimum of 19 participants will be available upon abstract presentation.

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VoiceEvalU8: A Smartphone and Tablet App

Objective: A voice evaluation app was created to enable telemonitoring of daily voice use. The app includes acoustic, aerodynamic, and perceptual voice measures. A description of the app will be provided with preliminary results from a clinical trial involving student teachers.

Methods: Student teachers participated in a voice disorders prevention program for four weeks. VoiceEvalU8 was used twice a day, before and after talking all day, to capture acoustic, aerodynamic, and perceptual information. The app was used for five days before beginning the program (pre-treatment) and for five days at conclusion of the program (post-treatment).

Results: Study is ongoing this fall 2016. It will conclude the first week of December 2016.

Hypotheses: The control group will not have any significant differences across the voice measures from pre- to post-treatment. The treatment groups (in-person voice program and telepractice voice program) will have significant differences across the voice measures from pre- to post-treatment.

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Reliability of Perceived Listener Effort Ratings of Electrolaryngeal Speech

Objective: Perceived listener effort (PLE) is a "partner-focused" perceptual dimension used to identify the amount of work necessary to understand or listen to speech. In the voice literature, it is common to use a visual-analog scale (VAS) or an equal-appearing interval (EAI) scale to obtain auditory-perceptual ratings. Sensitivity generally increases as the number of points on a scale increases (i.e., with 100mm VAS); however, as sensitivity increases listener reliability tends to decrease. Electrolaryngeal (EL) speech is difficult to listen to because of its unique characteristics. Previous research using VAS indicates that PLE may uniquely differentiate EL speech when speech intelligibility and acceptability are roughly equivalent. This study examines whether scale type affects 1) PLE ratings of EL speech or 2) listener reliability for those ratings.

Methods/Design: This is a mixed measures study combining inter- and intra-rater measures of reliability, and between-group measures of PLE. Twenty adults will transcribe and rate two blocks of 60 stimuli with a range of intelligibility from a corpus of EL speakers. Ten listeners will use the VAS first; ten will use an 11-point EAI first. Similarly, ten listeners will rate block 1 first; ten will rate block 2 first. VAS ratings will be converted from mm to EAI "scale value equivalents." Mean PLE ratings will be compared using 2-factor ANOVA. Reliability will be calculated using intraclass correlations.

Results & Implications: Recruitment is ongoing. Differences in mean EAI and VAS ratings are not predicted to differ significantly. Inter- and intra-rater reliability are predicted to be stronger for EAI ratings. Results would provide evidence that the 11-point EAI scale is an efficacious outcome measure for disordered speech. Results have implications spanning speech and hearing disorders for measuring communicative success in terms of the "other" partner's experience.

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A Survey of Voice Professionals' Preferred Methods, Confidence, and Trust of Evaluation Procedures

Objective: The purpose of this survey was to obtain better insight on what voice specialists use during their evaluation process, how confident they are in their equipment/methods, and how much they trust their findings.

Methods/Designs: A public survey was posted, in which 49 speech-language pathologists with a voice specialization participated. The survey's questions included topics on visual perceptual measures/procedures, auditory perceptual measures, patient perceptual scales, acoustical measures/procedures, acoustical analysis software, aerodynamic measures, and aerodynamic analysis software/hardware in which participants indicated their preferred methods and possible reasons for not choosing any of the above. The survey also asked participants to indicate their confidence obtaining and interpreting the measures, as well as their trust level and recommendation for these measures.

Results: The results indicated that there is a large variation in what equipment/methods therapists use during their voice evaluations. It was also found that therapists have a reported trust in their findings and recommend use of the equipment selected, but vary in regard to their feelings of confidence obtaining and interpreting these data. Objective results and trends in data are available, but were not included due to word count constraints.

Conclusions: There is no required set of tests/tasks that must be administered during a voice evaluation; however, the field of voice may benefit from a more concrete protocol that reflects the comfort level and preferences of the clinicians. The survey indicated that clinicians might not have a clear understanding of what type of measure corresponds to the categories listed above. Also, they reported cost restricts their choices for the diagnostic procedure. Training programs may also need to include more instruction on obtaining and interpreting data. Further research is required in order to produce a suggested protocol for voice evaluations.

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The Effect of Experience on Response Time When Judging Synthesized Voice Quality

Objective: The purpose of this study was to determine the effect of level and type of experience on response time and the number of replays needed when judging voice quality.

Methods/Designs: Speech-language pathologists, singing voice teachers, speech-language pathology graduate students with and without experience with a voice client, graduate students who have completed a voice pedagogy course, and inexperienced listeners ($n = 60$) rated stimuli with systematically altered measurements of jitter, shimmer, and noise-to-harmonics ratio (NHR) on a visual analog scale ranging from mild to severe for overall severity, roughness, breathiness, strain, and pitch. Response time (in seconds) and number of replays were recorded during the experiment.

Results: Results showed that experienced listeners took the most time when rating the stimuli. Stimuli with two altered acoustical components also yielded longer response times as compared to the stimuli with one altered acoustical component. Lastly, level and type of experience had some effect on the number replays for each stimulus during the rating task.

Conclusions: In conclusion, experience does affect response time when judging voice quality as well as the number of replays during voice quality rating tasks. Continued research is needed regarding the reasons for extended time and replays as per experience so as to enhance future training protocols.

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Association between Sleep Changes and Vocal Quality

Objective: To identify vocal impact related to perceived changes in sleep quality. Methods: self-assessment of voice quality, of sleep pattern and related data, collected by an on-line survey. The survey was divided in 3 parts: 1. Demographic data, 2. Self-assessment of sleep and vocal quality and the influence that sleep has on voice, 3. Sleep and voice self-assessment tools, which included the Epworth Sleepiness Scale - ESS, Pittsburgh Sleep Quality Index - PSQI and Voice Handicap Index reduced version – VHI-10. 862 people were included (493 women; 369 men - mean age of 32 years old). Results: The perception of the influence that sleep has on voice showed difference (p<0.050) between sleep and voice self-assessment. There is more risk of presenting alteration on the ESS, PSQI and VHI-10 protocols if sleep and vocal self-assessment are worst. The influence of sleep on voice impacts only the VHI-10 score: the greater the perception of this influence, the larger the perceived vocal disadvantage. Sex was not a determinant factor on the outcome regarding the self-assessment instruments. A total of 73 individuals (8.5%) presented deviations for all protocols: ESS, PSQI and VHI-10, while 134 subjects (15.5%) had no deviation for anyone of them. No relationship was found for presence of snoring and vocal quality. The aspects that influence a vocal disadvantage are: voice self-assessment, ESS total score and self-assessment of the influence that sleep has on voice. The absence of daytime sleepiness is a protective factor (OR>1) against vocal disadvantage, meanwhile the presence of daytime somnolence is a damaging factor (OR<1). Conclusion: The sleep quality influences the vocal quality. The variables that influence vocal disadvantages are vocal self-assessment, ESS total score, and self-assessment of the influence that sleep has on voice. Daytime somnolence may cause vocal disadvantage.

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Laryngeal Diadochokinesis Across the Adult Lifespan

Objective: Diadochokinetic tasks provide valuable clinical information regarding neuromuscular control and coordination. The ability to perform rapid, alternating movements challenges neuromotor function. However, voice clinicians rarely assess laryngeal diadochokinesis (LDDK) despite its potential to provide insight into the neuromotor function of the larynx. Furthermore, aging can affect the speed and precision of movement, including that of the laryngeal muscles. The objective of this study was to provide normative data for LDDK tasks across the adult lifespan in men and women.

Method: Over 300 men and women, 20-90 years of age, produced rapid repetitions of /ʔʌ/ and /hʌ/ to assess adductory and abductory laryngeal articulation, respectively. The syllable productions were analyzed for rate (DDKavr) and regularity (DDKjit) from a 5-second sample using Pentax CSL Motor Speech Profile software and verified or corrected by hand. Samples that could not be analyzed using CSL were measured for rate by hand but were excluded from regularity analysis. Analyses of variance examined the data for task, sex, and age differences where participants were grouped into 10-year categories for age.

Results: LDDK rate was significantly faster for men than women $[F(1,298) = 7.83, p = .005]$ and decreased significantly across age $[F(6,298) = 3.63, p = .002]$; sex-by-age interaction was not statistically significant $[F[6,298] = 1.22, p = .296]$. Productions of /hʌ/ were significantly slower than productions of /ʔʌ/ $[F(1,298) = 16.76, p < .001]$. Syllabic repetitions became significantly less regular with age for /hʌ/ $[F(1,6) = 2.76, p = .016]$ but not for /ʔʌ/ $[F(1,6) = 0.74, p = .623]$.

Conclusion: These data highlight age-, sex-, and task-related production differences that should be considered when using LDDK as an assessment tool for laryngeal motor control.

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Using Functional Near-Infrared Spectroscopy to Assess Brain Changes as a Result of Voice Therapy

Purpose: The purpose of these case studies was to investigate regional cerebral hemoglobin changes as a result of integrated implicit-explicit voice therapy in four individuals with voice disorders.

Methods: Each individual received 8-weeks of voice therapy with one, 60-minute session per week. Sessions followed the hierarchy outlined in Tellis (2014), and included explicit instruction regarding the anatomy and physiology of voice production. Each subject was taught how to produce Twang quality through voice therapy sessions.

Subjects included a 25-year-old male diagnosed with mutational falsetto and slight unilateral vocal fold paresis, a 70-year-old female diagnosed with bilateral edema of the true vocal folds, a 56-year-old female diagnosed with bilateral subepithelial lesions and a unilateral true vocal fold paresis, and a 66-year-old female diagnosed with unilateral true vocal fold paresis and bilateral atrophy.

Testing was conducted in four sessions: (1) at time of evaluation, (2) after 4 voice therapy sessions, (3) after a total of 8 voice therapy sessions, and (4) 12 weeks after completion of therapy. At each testing session, subjects completed the Voice Handicap Index-10 (VHI-10). In addition, participants completed a voice sample, including the sentences from the Consensus Auditory Perceptual Evaluation of Voice (CAPE-V), speaking the words to "Happy Birthday" and explaining the steps to making a peanut butter and jelly sandwich, which was video recorded for auditory-perceptual analysis. fNIRS was used to measure changes in oxygenated, deoxygenated, and total hemoglobin concentrations during sustained phonation, spontaneous speech, reading aloud, sustained phonation in Twang quality, and jaw movement tasks. These tasks were randomly presented through the use of E-Prime software for five-second stimulus periods, alternated with 15-second rest periods.

Results: All subjects demonstrated increases in oxygenated hemoglobin in the inferior prefrontal cortex during the production of a novel voice quality over the course of voice therapy. In addition, several subjects showed increases in the premotor cortex, Broca's area, postcentral gyrus, and superior temporal gyrus as compared to baseline at evaluation. In some subjects, changes in hemoglobin concentration during the target vocal quality task were similar to changes in the typical speaking voice task over time, though were generally larger in magnitude. Results also showed increases in auditory-perceptual and quality of life measures.

Discussion: Increases in oxygenated hemoglobin in the inferior prefrontal gyrus, premotor cortex, Broca's area, postcentral gyrus, and superior temporal gyrus are all associated with explicit or implicit motor learning, an indicator that subjects acquired the target voice task through voice therapy. These findings are the first to suggest a change in pattern of oxygenated hemoglobin concentration due to learning in the field of voice. The continued use of fNIRS in subjects with voice disorders could help to improve understanding of motor learning in voice and ultimately improve therapy outcomes for patients.

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The Use of Elastic Bandage on Singers – a Preliminary Study

Objective: Verify the incidence of vocal tract discomfort symptoms and the 24-hour effect of the elastic bandage use on singers.

Methods: Twenty individuals, mean age of 33,8 yeas, active singers, responded about: sample characterization, presence or absence of cervical discomfort, and the Vocal Tract Discomfort Scale - VTDS. The elastic bandage was applied at the specific discomfort related locations in 18 of them who had associated muscles complaints while singing. After 24 hours of bandage usage they were asked about its effects on cervical comfort, voice quality and effort to speak.

Results: 95% of the singers have reported at least one sign of vocal tract discomfort and 55% have informed four or more signs. After 24 hour-use of the elastic bandage, 72,2% of subjects reported cervical comfort improvement, 33,33% reported better voice quality and 50% reported less effort while speaking. The real nature of the perceived effect is hard to identify, however, the outcome is quite interesting and deserve a case-control study.

Conclusion: Most of the surveyed singers presented high incidence of vocal tract discomfort symptoms. The use of elastic bandage may represent a way of achieving better cervical comfort with positive impact on vocal quality and effort to speak on singers.

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Vocal Discomfort in Individuals with Cervical Complaints: A Self-Assessment Questionnaires Approach

Introduction: The voice clinical practice suggests that many patients with voice disorders also experiences some kind of vocal discomfort due to laryngeal muscle effort. The aim of this research was to investigate the occurrence of vocal tract discomfort in individuals with cervical complaint.

Methods: 30 subjects (8 male and 22 female; age vary from 18 to 65 years old) were asked to answer cervical and vocal self-assessment instruments: Copenhagen Neck Functional Disability Scale (CNFDS), Vocal Tract Discomfort Scale (VTDS) and Voice-Related Quality of Life (V-RQOL).

Results: for CNFDS there was no occurrence of "minimal "and "severe" disability classification; the most recurrent classification was "moderate disability" (50%) followed by "mild to moderate disability" (30%). For VTDS we found average of four vocal tract discomfort symptoms per person; 96.67% had one or more symptom of vocal tract discomfort; 44.8% reported five to eight symptoms; 20.7% had only one. "Dry" was the most refereed item (76.6%), followed by "sore" (63.3%) and "tickling" (56.6%). For V-RQOL 23.3% had no problem in their quality of life related to voice.

Correlations: From 30 patients with cervical complaints, 96.67% reported vocal discomfort, 43.33% had five or more vocal tract discomfort symptoms, 20% reported only one of the signs and symptoms. There is a negative correlation between VTDS and V-RQOL, so as higher the occurrence of symptoms of vocal tract discomfort, lower the V-RQOL scores and vice versa / as higher the number of vocal tract discomfort symptoms, worst the quality of life related to voice.

Conclusion: for individuals with cervical complaint as higher the number of vocal tract discomforts symptoms, higher the impact on quality of life related to voice.

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Comparison of Two Acoustic Indices of Dysphonia Severity: The AVQI and CSID

Background and Aims: The Acoustic Voice Quality Index and the Cepstral Spectral Index of Dysphonia are two multi-parameter acoustic dysphonia severity indices designed ostensibly to objectively estimate dysphonia severity and track treatment changes following behavioral, medical, and/or surgical management. This study aimed to directly compare the performance of these two dysphonia assessment tools as compared with listener judgments using an identical/common corpus of dysphonic speakers.

Methods: Pre and posttreatment samples of sustained vowel and connected speech productions were elicited from 112 patients across six diagnostic categories: unilateral vocal fold paralysis, adductor spasmodic dysphonia, primary muscle tension dysphonia, benign vocal fold lesions, presbylaryngis, and mutational falsetto. Listener ratings of dysphonia severity in connected speech and sustained vowels were compared to acoustically estimated severity ratings derived from the CSID and two iterations of the AVQI (versions 2.02 & 3.01).

Results: Both the AVQI- and the CSID-estimated severity for the sustained vowels, the connected speech, and combined context were strongly associated with listener ratings pre-treatment, post-treatment, and change observed pre- to post-treatment. Furthermore, acoustic estimates of dysphonia severity derived from the AVQI and the CSID were highly correlated across all voice contexts. However, based upon inspection of raw correlations (r) and partial R-sqare, the CSID appeared to outperform the two versions of the AVQI, and accounted for more variance in listener severity ratings across most of the diagnostic groups. Furthermore, a stepwise regression analysis confirmed that the CSID accounted for more unique variance in listener ratings as compared with both versions of the AVQI.

Discussion and Conclusions: The CSID and the AVQI are strongly correlated and provide valid estimates of dysphonia severity. Associations observed between the CSID and listener-estimated dysphonia are almost uniformly stronger than the AVQI v. 2.02.

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Vocal Symptoms, Behavior and Social Skills of Children and Adolescents: Self-Evaluation and Parental Evaluation

Objectives: To verify the relationships between vocal symptoms, behavior and social skills in children and adolescents, regarding self-evaluation and parental evaluation.

Methods: 748 individuals participated divided in 3 studies: Study 1-Brazilian validation of the Questionnaire des Symptômes Vocaux translated as Questionário de Sintomas Vocais Pediátrico – QSV-P. The process of validation was done according to Scientific Advisory Committee of the Medical Outcomes Trust and involved children/adolescents, with and without vocal disorders, between 6 and 18 years and their parents (N=748). Study 2- Behavior and social skills of children and adolescents. Parents of children/adolescents, with and without vocal disorders between 6 and 18 years, and children/adolescents between 11 and 18 years answered the Strengths and Difficulties Questionnaire – SDQ (N=575). Study 3- Correlation between vocal symptoms, behavior and social skills and agreement parents and children. The participants were recruited from studies 1 and 2 (N=696).

Results: Study 1- The QSV-P demonstrated reliability and reproducibility satisfactory for Brazilian population and responsiveness to treatment. The cutoff values of the QSV-P are: Parental version 2,125 and self-reported version 7,625. Study 2- Children and adolescents with vocal disorders demonstrated higher scores in the following domains: hyperactivity, emotional problems, peer problems, conduct problems and in the internalizing, externalizing and total difficulties scales. Study 3- There is no correlation between vocal symptoms and social skills. There is a positive correlation between vocal symptoms and behavior, both internalizing as externalizing. Parents and children/adolescents presented a higher agreement for vocal symptoms and a lower concordance for behavior and social skills.

Conclusions: The QSV-P was validated to Brazil and it is a good instrument for vocal evaluation. The presence of vocal symptoms in the pediatric population can be a risk factor to mental health. The correlation between parents/guardians and children/adolescents for vocal symptoms is satisfactory but unsatisfactory for behavior and social skills.

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Observed High-Speed Laryngeal Imaging Differences in Premenopausal Females across Menstrual Cycle Phases

Objective: Women have a higher prevalence of voice disorders than men (46.3% vs. 36.9%). A primary physiologic difference between men and women is the sex hormone profile. In premenopausal females hormone function influences the vascularity of the musculo-mucosal complex and thus has the potential to influence vocal function. Empirical investigations of vocal fold vibratory function associated with changes in hormone function during the premenopausal phase are lacking, despite the known acoustic and perceptual differences in voice quality at the onset of menses. The goal of the study is to identify whether there is a phase of the menstrual cycle where women may be more vulnerable to vocal pathology and likely to experience a decline in voice function.

Methods: High-Speed videoendoscopic recordings were obtained at 4000fps across four phases (follicular, ovulatory, luteal, and ischemic) of the menstrual cycle for two different menstrual cycles. Tasks included two trials of sustaining /i/ and one trial repeating /hi.hi.hi/. A total of 15 premenopausal females (20-35 years) were recruited. Measurements of oscillatory onset time (OOT-milliseconds), speed quotient (SQ), and amplitude periodicity (AP) will be derived from the glottal area waveform. To evaluate the sex hormone profile venous blood samples were collected during the four phases to determine estrogen, progesterone, testosterone and Neuropeptide Y levels.

Results and Conclusions: All data has been collected and 70% of the high-speed recordings have been analyzed. It is anticipated that the OOT, AP, and SQ will be greater during the follicular phase when the hormone profile is relatively stable and reduced during the luteal phase when progesterone and Neuropepetide Y hormone levels are the greatest potentially creating edema and dehydrating effects on the mucosa. Findings from a repeated measures univariate analysis of variance on how the vibratory function differs across the four phases of the menstrual cycle will be presented.

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Exploring the Neural Bases of Primary Muscle Tension Dysphonia (pMTD):
A Case Study using fMRI

Introduction: Primary muscle tension dysphonia (pMTD) refers to a voice disturbance that occurs in the absence of known structural or neurological laryngeal pathology. A wide array of psychopathological processes contributing to voice symptom formation in pMTD has been proposed. The "Trait Theory of pMTD" (Roy & Bless, 2000) proposed that specific personality traits contribute to the development of pMTD, and emphasized a theme of inhibitory laryngeal behavior with its origins in nervous system functioning. The Trait theory suggests that this inhibition is mediated by the "Behavioral Inhibition System" (BIS) (Gray, 1982) and related to neural structures located in the septohippocampal system (i.e., part of the limbic system), with connections to the prefrontal cortex. This case study used fMRI to evaluate brain activation changes associated with successful management of pMTD, and provides the first glimpse into the possible neural bases of this poorly understood disorder.

Method: The participant, a 61-year old woman, presented with a year long history of severe pMTD and was successfully treated following a single session of manual circumlaryngeal techniques. fMRI tasks consisted of two overt speech conditions across two unique scanner sessions (pre- and post-treatment) completed on the same day.

Results: Statistical analyses were computed for the whole-brain, and also for 10 small volume regions of interest (ROIs). Pre- vs. post-treatment comparison of the ROI data revealed significantly increased brain activation (before treatment) observed in the periaqueductal gray, hypothalamus, hippocampus, amygdala, anterior cingulate, dorsolateral prefrontal cortex, Brodmann's areas 6 and 10, as well as the pre- and post central gyri.

Discussion: A hyperactive BIS is central to the Trait Theory of pMTD, and is hypothesized to contribute to laryngeal motor inhibition. Our fMRI evidence is compatible with overactivation of neural regions typically associated with the BIS. We contend that this motor-limbic interaction compromises normal voice production by interfering with laryngeal motor preparation, initiation, and execution contributing to voice suppression in pMTD.

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Use of Terminology and the Effect of Training on Auditory-Perceptual Ratings of Speaking Voice by Expert Teachers of Singing

Objectives: In the care of the professional voice, team treatment of dysphonia involves the close collaboration of a Speech-Language Pathologist (SLP) and a singing teacher. Both clinical voice pathologists and singing teachers must discern and describe maladaptive auditory-perceptual characteristics of voice quality. Terminology may be shared (e.g. "breathiness" or "strain"), but the application of terms in different contexts of speaking and singing may lead to breakdowns in communication. The purpose of the present study is 1) to examine differences in the terminology used in auditory-perceptual judgments of dysphonic speaking voice quality by singing teachers and SLPs, and 2) to determine the effects of training on the inter- and intrarater reliability of singing teachers in rating the samples.

Methods: Approximately twenty experienced teachers of singing will be recruited to participate in a pre-post- test design. Prior to data collection, audio samples of patients reading the standard CAPE-V sentences were rated by three SLPs who specialize in the diagnosis and treatment of voice disorders. Subjects will complete a brief questionnaire examining comfort level working with injured singers and attitudes about the efficacy of interdisciplinary cooperation. Ten samples will be rated at baseline with free descriptions and an overall severity rating of 0-100. The subjects will be trained in the use of the Consensus Auditory-Perceptual Evaluation of Voice (CAPE-V) with verbal definitions and auditory anchors. The samples will be rated again in randomized order to determine the effects of training.

Results: Data collection is scheduled for November-December 2016. Outcomes examined will report divergence from expert clinical opinion in singing teachers' choice of terminology and the effect of training on inter-and intrarater reliability. Questionnaire responses will be examined for correlation with sample ratings. Training subjects in the use of the CAPE-V is expected to improve reliability for Overall Severity ratings.

Conclusions: Findings will provide answers regarding the agreement of terminology used to describe auditory-perceptual features of voice between SLPs and voice teachers. Differences in ratings may reveal the potential for miscommunication in the team treatment of professional voice. The study may suggest that voice teachers who wish to rehabilitate injured singers would benefit from instruction in auditory-perceptual evaluation of speaking voice.

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Effectiveness of the Method Vocal Therapy for Elderly Applied in a Conventional and Intensive Approach: A Controlled Randomized Clinical Trial

Introduction: There are few intervention methods to treat aging voice and the analyses of its effects are limited. Traditionally, the vocal therapy is delivered once or twice a week, however some studies suggest an intensive approach.

Objective: To verify the effects of the method Vocal Therapy for Elderly (VTE) and the differences between an intensive and conventional approach.

Methods: Twenty seven elderly with vocal complains related to the aging process were recruited and submitted to 16 sessions of vocal therapy aiming to improve glottal closure, loudness, resonance and mucosa vibration. Participants were randomized into two groups, Intensive Group (IG) who underwent therapy four times a week, and Conventional group (CG) who underwent therapy twice a week. The effects of therapy were measured by the analysis of vocal quality using perceptual-auditory assessment, voice related quality of live questionnaire (V-RQOL) and visual-perceptual assessment of the laryngeal images. The first stage of the study was constituted by vocal assessment and V-RQOL of 15 participants before and after a period of time equal to the duration of therapy, but without treatment. In the second stage, all the participants underwent vocal and laryngeal evaluation and self-assessment before treatment, a week after finished and one month after.

Results: There were no differences between voice parameters and self-assessment without treatment. When compared the moments before and immediate after therapy of the 25 subjects who finished treatment, an improvement on vocal quality and self-assessment was observed. After a month the improvement in quality of life and some of the voice parameters were maintained. There were no differences between groups, in exception of vocal fold bowing which decreased on IG.

Conclusion: The VTE method is effective to improve voice quality and quality of life of elderly in similar way when therapy is administered intensive or conventionally, however the intensive approach is superior regarding modification of vocal fold configuration.

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Autonomic and Acoustic Measures during Speech as a Function of Cognitive Load in Healthy Older Adults

Objective: This study sought to determine the relationship among autonomic and acoustic measures and the cognitive load condition in which a sentence was produced by older adults. Additionally, this study sought to compare findings in older adults to those from a previous study of younger adults.

Methods/Design: Twelve healthy older adults orally read a sentence containing an embedded Stroop task eight times in each of two conditions: congruent and incongruent. In both conditions, participants verbalized the font colors in which color words were written. In the congruent condition, font color and word text matched. In the incongruent condition, font color and word text differed, creating an increase in cognitive load relative to the congruent condition. Three physiologic measures of autonomic arousal (pulse volume (PV), pulse period (PP), and skin conductance response amplitude (SCRamp)) and four acoustic measures of voice (sound pressure level (SPL), fundamental frequency (f_0), cepstral peak prominence (CPP), and low-to-high spectral energy ratio (L/H ratio)) were examined. A logistic regression model was constructed to predict the cognitive load condition (congruent/incongruent) using participant as a categorical predictor and the three autonomic and four acoustic measures as continuous predictors.

Results: The regression model revealed that four variables were significantly associated with cognitive load condition: PV, SCRamp, f_0, and L/H ratio. SCRamp and f_0 significantly increased (ps = 0.004), while PV and L/H ratio significantly decreased ($p = 0.015$, $p = 0.037$, respectively) with increased cognitive load.

Conclusion: Older adults show changes in autonomic and acoustic measures under increased cognitive load. These findings are similar to previous findings in younger adults with respect to SCRamp and L/H ratio but differ in respect to PV, f_0, and CPP. Results will be discussed in the context of potential similarities and differences in autonomic arousal and laryngeal physiology in younger and older adults.

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Proposal of Periodization of Vocal Training with Tongue Vibration Technique

Objective: to evaluate the effect of Periodization of the Vocal Training (PVT) with tongue vibration technique in the vocal quality of women without vocal complaints.
Method: Prospective, controlled and randomized study. Participated 30 women aged 18 to 39, vocally healthy (evidenced by vocal assessment and larynx evaluation), divided into two groups randomly: experimental group (EG) - 15 who received PVT; control group (CG) - 15 who received traditional vocal training (TVT). The assessments were performed before and after vocal training and after 30 days: sensations in the voice, larynx, breathing and articulation; vocal intensity measurement; perceptual and acoustics vocal analysis. In both groups the training consisted of 6 sessions, 12 minutes of tongue vibration technique in usual pitch. The PVT considered the principle of overload, with administration of vocal intensity and controlled execution intervals (30 seconds) and rest (30 seconds). The TVT performed in a traditional way, with rest period every three minutes, without rest time control. Statistical tests (ANOVA, Tuckey tests; $p<0.05$) were applied to compare the results before and after training.
Results: positive sensations in the voice and articulation were reported by both groups. The EG presented significant increase of vocal intensity after ($p=0.005$) and after 30 days ($p=0.000$), improvement of instability parameter after 30 days ($p=0.0057$); significant improvement in jitter values ($p=0.008$) and frequency variation 30 days after PTV ($p=0.027$). The GC presented significant worsening of tension parameter after 30 days ($p=0.039$); significant improvement of the soft phonation index after TVT ($p=0.034$).
Conclusion: the PVT, with the use of the vocal vibration technique was able to produce improved vocal instability, usual vocal intensity and acoustic measures when compared to the traditional vocal training in women healthy vocally. The proposed vocal training did not influence negatively in the accounts of sensations in the voice, larynx, breathing and articulation.

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Imediate Effect of Transcutaneous Electrical Nervous Stimulation (TENS) and Straw Phonation in the Pain Intensity and Vocal Syptoms in Dysphonic Woman: a Pilot Study

Objective: to evaluate the imediate effect of TENS, placebo TENS, TENS followed by straw phonation and Placebo TENS followed by straw phonation in the musculoskeletal pain intensity and vocal/laryngeal symptoms in dysphonic woman.
Method: prospective, cross-over, controlled study. Participated 8 women aged 18 to 40, with nodules/cysts in the vocal folds. All the volunteers had four steps of vocal intervention: 1. TENS (200 μs, 10Hz, motor thereshold, 20 minutes, electrodes on the submandibular area and trapezius muscle); 2. Placebo TENS (the same parameters than the TENS, but with the minimal intensity); 3. TENS followed by straw phonation (LaxVox tube, phonation of /u/ vowel in a normal pitch, in a glide, 10 minutes); 4. Placebo TENS followed by straw phonation. All aswered a musculoskeletal pain and the vocal/laryngeal symptoms protocols before and after each step. There were compared the moments before and after intervention (Wilcoxon test, $p<0.05$).
Results: There were significant improvement of musculoskeletal pain intensity: After TENS - temporal ($p=0.027$), submandibular area ($p=0.046$); After Placebo TENS: neck pain ($p=0.043$), shoulders ($p=0.017$), superior back ($p=0,035$), masseter ($p=0.027$); After TENS+ straw LaxVox: neck pain ($p=0.027$), masseter ($p=0.043$); After Placebo TENS + LaxVox: neck pain ($p=0.027$), shoulders ($p=0.017$), larynx ($p=0,029$).Improvement of symptoms: after TENS - hoarseness ($p=0.046$), voice failure ($p=0.042$), lump in the troat ($p=0.027$), pain with voice use ($p=0.043$), pain when swallowing ($p=0.027$), dry throat ($p=0.043$), vocal fatigue ($p=0.017$; after Placebo TENS: dry throat ($p=0.027$); after TENS+LaxVox: hoarseness ($p=0.042$), voice failure ($p=0.027$), Lump in the troat ($p=0.027$), dry cough ($p=0.043$), mucus in the throat ($p=0.027$); after Placebo TENS+LaxVox: dry cough ($p=0.027$) and vocal fatigue ($p=0.027$).
Conclusion: Just after the Placebo TENS followed by straw LaxVox improved the pain intensity of larynx. Both TENS and TENS followed LaxVox improved greatest amount of vocal/laryngeal symptoms than when applied Placebo TENS followed by LaxVox.

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Effectiveness of Low Frequency Transcutaneous Electrical Nerve Stimulation in the Voice Therapy of Dysphonic Women: Control, Randomized and Double Blind Clinical Trial

Objective: to verify the effectiveness of low frequency TENS associated with voice therapy on larynx, acoustic parameters and self-perception in dysphonic women.

Methods: 27 women with vocal nodules, aged 18-45, participated, randomly divided into Experimental Group (13 women), with 12 sessions of transcutaneous electrical nerve stimulation (pulse:200 microseconds, frequency:10 Hz, in motor threshold), with electrodes placed on the trapezius muscle and submandibular area, bilaterally, for 20 minutes followed by 30-minutes vocal exercises, and Control Group (14 women), with 12 sessions of the placebo transcutaneous electrical nerve stimulation (as with the Experimental Group, but with no electrical current stimulus), followed by 30-minutes vocal exercises. All were submitted to acoustic voice analyzes; ENT evaluation through visual perceptual analysis; vocal self-perception; voice-related quality of life through the Voice-Related Quality of Life Protocol (V-RQOL), before, immediately after treatment and after one month treatment. All assessments were compared through the Likelihood Ratio Test, ANOVA and Friedman test (p<0.05).

Results: Immediately after treatment (p=0.012) and one month later (p=0.010), a reduction was seen in lesion size on the vocal folds, only in the Experimental Group, however, a decrease in the Soft Phonation Index acoustic parameter (p=0.002), was seen in both groups. There was no significant difference in the voice related quality of life, in both groups. There was improvement in the vocal self-perception in both groups after treatment

Conclusions: The low frequency of the electrical nerve stimulation associated with vocal therapy was effective in reducing the lesion size on the vocal folds and the noise measure related to vocal breathiness in dysphonic women, as well improve self-perception of voice.

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Questionário de Saúde e Higiene Vocal – QSHV (Vocal Health and Hygiene Questionnaire): Development, Validation, and Cutoff Value

Introduction: Knowledge in vocal hygiene is an important tool in voice therapy and cannot be derived instinctively.

Objective: To develop and validate an instrument about health and vocal hygiene knowledge evaluation.

Methods: 1007 adults, three studies: 1- 866 individuals dysphonic and nondysphonic answered an initial survey about positive and negative voice aspects; 2- 41 voice specialists classified these vocal aspects as positive, no influence or negative; 3- 50 dysphonic and 50 nondysphonic subjects answered the initial version of the *Questionário de Saúde e Higiene Vocal* – QSHV. The QSHV was submitted to psychometric measures.

Results: 5260 answers were organized into 365 voice aspects. Most common positive aspects: water and apple; most negative: smoking and shouting. The items had interrater reliability above 0.950 formed an initial version of QSHV was obtained; 9 of the 40 final items did not differentiate the subjects and were excluded. Dysphonic subjects have self-evaluated their voices as being worse, had lower score for the QSHV and greater vocal handicap. Higher internal consistency value (Cronbach's alpha = 0.881) and excellent test-retest reproducibility (p=0.804) were achieved. Dysphonic subjects had an average of 17.84 points and nondysphonic of 29.12 (p<0.001). The QSHV cutoff value was 23 points.

Conclusions: The instrument was proved to be a responsive and reliable protocol for evaluation of knowledge in health and vocal hygiene; dysphonic subjects have fewer knowledge regarding vocal aspects. The instrument was considered an accurate diagnostic classifier able to separate dysphonic from nondysphonic subjects.

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Vocal and Communicative Profile of the Most Influential Brazilian and International Youtubers According to Youtube Ranking

Objective: Investigate the voice profile and communicative aspects of the most influent youtubers in Brazil and compare to Youtubers in the world.

Methods: transversal study. Fifty Youtube channels with the highest audience were selected in Brazil, compared to other fifty in the world according to Youtube ranking. Animation channels, music and those that are popular on TV were excluded. The evaluation criteria were: voice quality, pitch, loudness, modulation, resonance, articulation of speech sounds, speech rate, expressiveness of speech, accent, body language, speech analysis and vocabulary.

Results: 95% of evaluated Youtubers are men. 5% have hoarseness, 36% use high pitch, 50% speak in midtone, 54% speak with increased loudness or scream during the videos, 54% has increased speech rate, 63% use pre script established protocol, but all speak without teleprompter. The use of bad language appears in 81% of the analyzed channels.

Conclusions: Youtube has more than one billion users that watch hours of video every day. On Youtube 80% of views are from outside United States. The communication pattern of the Youtubers differs from the traditional television because most of the content is performed without script, with intense vocal use. The communication style is similar in most of the evaluated channel over the countries. The language used by Youtubers is simple, according to the age of the speaker and the target audience.

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Effect of Chewing Technique on the Phonation of Female Speech-Language Pathology Students: a Pilot Study

Objective. The purpose of this study was to determine the effect of the vocal facilitating technique chewing on the phonation of speech-language pathology (SLP) students.

Study Design. A pretest-posttest randomized control group design was used.

Methods. Twenty-seven healthy female SLP students with a mean age of 18.8 years were randomly assigned into either an experimental group or a control group. The experimental group practiced chewing exercises across 18 weeks, whereas the control group received no vocal facilitating techniques. Both groups completed pre- and post- objective voice assessment measures (maximum performance task, acoustic analysis, voice range profile, and Dysphonia Severity Index). Differences between pre- and post-data were compared between the experimental and control group using an independent sample t test.

Results. Compared with the control group, chewing resulted in a significant decrease in jitter and noise-to-harmonic ratio, a significant increase in fundamental frequency, a significant expansion of the voice range profile, and a significant increase in dysphonia severity index. Shimmer and maximum phonation time were not significantly different between groups.

Conclusions. The results of this pilot study suggest that the vocal facilitating technique chewing may improve objective vocal measures in healthy female SLP students.

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Effect of Two Isolated Vocal Facilitating Techniques Chant Talk and Pitch Inflections on the Phonation of Female Speech-Language Pathology Students: a Pilot Study

Objective. The purpose of this study was to determine the effect of the isolated vocal facilitating techniques chant talk and pitch inflections on the phonation of speech-language pathology (SLP) students.

Study design. A multigroup pretest-posttest design was used.

Methods. Forty healthy female SLP students with a mean age of 18.7 years were randomly assigned into three groups: a chant talk group (practicing the facilitating technique chant talk across 18 weeks), a pitch inflections group (practicing the facilitating technique pitch inflections across 18 weeks) and a control group (practicing no facilitating techniques). To compare vocal measures before and after this time span, an identical objective voice assessment protocol (aerodynamic measurement, acoustic analysis, voice range profile, and Dysphonia Severity Index) was performed in the three groups.

Results. Both chant talk and pitch inflections groups resulted in a significant decrease of the acoustic measure noise-to-harmonics ratio compared with the control group. The chant talk group resulted in a significant increase in the acoustic measure fundamental frequency compared with the control group.

Conclusions. The results of this pilot study suggest that the facilitating techniques chant talk and pitch inflections may improve the objective measure of breathiness (noise-to-harmonics ratio) in healthy female SLP students.

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Immediate Impact of Vocal Demand in Brazilian Musical Theater Singers

Objective: To investigate singer's perception of vocal demand immediately after a performance. Methods: 264 Brazilian musical theater singers were evaluated, 126 women and 138 men, mean age of 33 years old (minimum 18 y-o and maximum 70 y-o). A demographic questionnaire asked information about singing voice-use behavior, vocal impairment, self evaluation of voice after performance, list of vocal signs and symptoms and performance features. The perceived immediate impact of voice use on vocal function was assessed by the EASE-BR. Results: Singers showed mean of 1,56 vocal signs and symptoms and only the ones with higher numbers had higher scores in EASE-BR total score and subscales. In addition, lower values at EASE-BR were obtained by singers who had been active for a long time. Lower scores at EASE-BR total score and subscales were found for singers who sang opera and vocal solo besides musical theater. Significant difference was found in Vocal Concern subscale at EASE-BR for singers who perceived voice problem. Moreover, significant voice self-assessment differences were identified for all EASE-BR subscales and total score. No significant age and gender differences were found for any EASE-BR subscale or total score. Conclusions: Most part of the singers considered that their voices were ready to continue singing if required. EASE-BR is a useful scale to identify vocal changes after demand, giving information about voice in a specific circumstance with low correlation to vocal symptoms.

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Parameters and Scales Used to Assess and Report Findings from Stroboscopy: A Systematic Review

Objective: Laryngeal endoscopy with stroboscopy (LES) is a critical component of the assessment and diagnosis for voice disorders, but rarely used as a voice treatment outcome measure in the scientific literature. We hypothesize that this is due to the lack of standardization in the assessment and reporting of vocal fold vibratory features from LES. The aim of this systematic literature review was to determine the vocal fold vibratory features that are assessed as treatment outcome measures in the scientific literature and to evaluate whether there is a common core of features. Additional objectives included determining the terminology used for the vocal fold vibratory features and the scales used in their assessment.

Methods/Design: We searched Pubmed, Ovid and Cochrane for studies where LES was used as an outcome measure for the treatment of a voice disorder. The search terms were those representing "stroboscopy" and "treatment". PRISMA statement standards were used to conduct this review.

Results: In the 62 articles that met inclusion criteria and used a LES rating scale, we identified 138 terms that represented 22 parameters. Five parameters were most commonly used as outcome measures in voice treatment studies: glottal closure, mucosal wave, regularity, symmetry and amplitude. The measures were assessed on scales ranging from binary (present/absent) to 100-point visual analog scales. For example, among the 27 articles that reported a feature of mucosal wave, 20 different rating scales were used.

Conclusions: When LES is used as a treatment outcome measure, there is a large variety in the vocal fold vibratory features reported and the scales used. There continues to be a lack of standardized terminology, with definitions, and a reliable rating scale that is broadly adopted by clinicians and researchers. Without broad use of a standardized method of assessing and reporting vocal fold vibratory features from stroboscopy, clinicians must re-assess patients or, worse, treat patients with a vague understanding of the pathophysiology of the disorder. Furthermore, the lack of such a standardized tool greatly diminishes the comparison of and clinical implementation of the results of treatment outcomes research in voice disorders.

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What Conclusions Do Outcome Measures Allow Us to Draw in Voice Therapy Research?

Objectives: Conclusions drawn from voice therapy studies depend on the measurement methods used to assess treatment outcomes. The objectives of this review were to appraise recent voice therapy literature and to describe the most common outcome measures used and the terminology employed to state the resulting findings.

Methods/Design: A literature search was conducted using the following databases: PubMed, Scopus, and CINAHL. A similar strategy was used in all three databases to target the concepts of "therapy" and "voice disorders." Only randomized controlled trials were included in the review.

Results: Fifteen articles met the inclusion criteria, covering six categories of outcome measures related to voice. The most common categories were self-assessment (present in 11 studies), followed by perceptual judgment of voice quality (present in 10 studies), acoustic analysis (present in eight studies), and aerodynamic measures or phonation time (present in five studies). Only three studies considered visual examination of the larynx in their results, despite it being the most direct assessment method of physiological changes following therapy.

The outcome measures employed were not always standardized and varied considerably across studies, making comparisons among different treatment approaches challenging. There is a lack of indicators of minimal clinically important differences and, therefore, clinical significance of therapy outcomes was rarely discussed. The most common terms used to describe the findings were *effectiveness* and *effective.* Other terms were: *efficacy, non-inferiority, complementary treatment method, utility, practical clinical effect, and viable delivery option.*

Conclusions: Outcome measures in current voice therapy literature do not always allow readers to: 1) understand the physiological changes related to a treatment, 2) discern whether there was a clinically meaningful improvement following treatment, or 3) compare outcomes across studies. These elements should be addressed to optimize the knowledge gained from voice research and to make the literature more informative for clinicians.

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Listener's Ability to Accurately Identify Four Different Voice Qualities

Objective: The purpose of this study is to examine listeners' ability to perceptually discriminate between the four TVFBC conditions (Estill, 1994). This study aims to establish group agreement and determine if listeners of different experience levels can perceptually identify the four TVFBC conditions.

Methods/Design: Subjects consisted of 48 naïve listeners, 44 novice listeners, and 37 expert listeners (20 Estill-certified individuals and 17 speech-language pathologists). Participants were presented an expert production of each of the four TVFBC conditions via a customized computer program. Participants were instructed to listen to each production and select which of the four perceptual anchors it was most similar to. The perceptual anchors were randomized in presentation per stimulus. Auditory stimuli included eight expert productions of each of the four TVFBC conditions, as well as eight randomly repeated samples to establish intra-rater reliability.

Results: Estill-certified and novice-trained groups demonstrated group agreement at 80%, followed by the voice speech-language pathologists (SLP) at 75%. The naïve group of listeners demonstrated the lowest group agreement at 59%. Results from a one-way ANOVA indicated a significant difference in group agreement between the four groups ($p<.05$). Pairwise t-tests revealed that the naïve group ratings were significantly different from the other three groups ($p<.05$).
Intra-rater reliability was calculated for each of the experience groups. Results revealed that participants in the Estill-certified group demonstrated the highest intra-rater reliability at 85%, followed by the novice-trained group at 79% and the voice SLP group at 77%. The naïve group demonstrated the lowest intra-rater reliability at 62%. Results from a one-way ANOVA indicated that a significant difference in intra-rater reliability existed between the four groups ($p<.05$). Pairwise t-tests revealed that the naïve group was significantly different from the other three groups ($p<.05$).
The Kruskal-Wallis Test indicated that a significant difference ($p<.05$) existed between the groups' ability to rate the four TVFBC accurately. Results revealed that the naïve group rated all TVFBC conditions significantly differently, while the trained groups rated only slack and thick significantly differently from the other conditions.

Conclusions: The results of this study show that exposure to any type of training improves the reliability of the rater. An individual being exposed to the Estill Voice Training System further improves reliability. Of the four TVFBC conditions, slack TVFBC was the easiest to identify and thick TVFBC was the most difficult across all groups.

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Self-Assessment of Communicative Behavior of Leaders of Different Professions on Public Speaking

Objective: Understanding how corporate leaders evaluate themselves in situations of public speaking, considering voice aspects, speech, manifestations of nervousness and anxiety.

Methods: Three hundred and twenty-eight individuals participated in this study, being 143 men and 185 women, having positions of corporate leadership, mean age of 41 years. Three evaluation instruments were applied: the Communication Contexts Questionaire CCQ-R reduced from the Questionnaire of Self-evaluation on Speech and Voice Abilities in Various Communication Contexts – QCC, the Self-Statements during Public Speaking Scale - SSPS, and the Voice Handicap Index 10 – VHI-10. The results were evaluated according to sex and age.

Results: Speaking in meetings was the most referred experience of speaking in public (88,4%). Perceiving that the voice and the speech suffer alteration when speaking in public were the symptoms most pointed out (50,3% and 78,5%, respectively). The majority of the leaders feel nervous in this situation (84,4%). Insecurity about the context is the factor generating high nervousness (69,0%). The majority of the leaders feel anxious when speaking in public (83,3%), the symptoms being sweating on the hands (31,3%). Despite negative manifestations in the researched aspects, leaders evaluated themselves positively when speaking in public, according to SSPS. There are fewer occurrences of negative manifestations on speech and voice, nervousness and anxiety in older participants, which suggests a positive effect of the experience and informal learning on this practice. A high percentage of leaders, 14,7%, perceived some vocal disadvantage according to the VHI-10.

Conclusion: For the majority of leaders, speaking in public pose a challenge, which can generate negative impacts on communication. They evaluate their communication on speaking in public as good, even recognizing some deviations in speech and voice, and manifestations of nervousness and anxiety. For both sexes, aging seems to have a positive effect in public speaking situations.

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Vocal Danger Zone in Music Majors

Objective: This study was designed to investigate indications of vocal risks in music students majoring in singing in order to understand the effects of substantial voice usage and associated routine behaviors in this population.

Method: This study involved application of the survey "Are you in the Vocal Danger Zone?", available at the Voice-Academy website from the University of Iowa. University students responded to questions related to their vocal lifestyle habits and feelings regarding their voice usage. All participants were pursuing college degrees in music with a major in singing. Frequency distributions and correlations between specific concepts associated with questions were applied to the data in order to inspect key aspects of the questionnaire.

Results: Outcomes indicated noteworthy aspects related to habits that may have an impact on the voice. For example, overall daily ingestion of water was observed, as well as consumption of potentially voice harmful substances such as tobacco and caffeine. Statistically significant correlations between reported symptoms of voice disorders and detrimental vocal behaviors suggested a relationship between phonotrauma and voice health.

Conclusions: Results of this study suggest that application of the survey "Are you in the Vocal Danger Zone?", from the Voice-Academy website yields promising preliminary data regarding the effects of vocal and lifestyle habits on the voice. Outcomes revelead that inappropriate use of voice may affect the quality of voice performance of future music educators and performers.

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Cross-cultural Adaptation of the Brazilian Version of the Vocal Fatigue Index – VFI

Objective: To develop the cultural adaptation of the Brazilian version of the Vocal Fatigue Index – VFI.

Methods: Two Brazilian bilingual speech-language pathologists (SLP) translated the original version of the VFI in English to Portuguese. The translations were reviewed by a committee of 5 SLP, resulting in the initial Brazilian version of the instrument. A third bilingual SLP back translated the Brazilian version, which was reviewed for appropriate content and translation. This initial Brazilian version of the VFI questionnaire was answered on categorical scale of 0-4 indicating the frequency of the symptoms: 0=never, 1=almost never, 2=sometimes, 3=almost always and 4=always. For cultural equivalence, the option "not applicable" was added to the categorical scale. Twenty subjects with vocal complaints and dysphonia completed the initial Brazilian version of the VFI. Any question considered "not applicable" by the participants, would be disregarded from the Brazilian version of the protocol.

Results: None of the questions had to be removed from the instrument. The Brazilian Portuguese version was entitled "*Índice de Fadiga Vocal* – IFV" and features 19 questions, same as the original instrument. Of the 19 items, 11 were related with tiredness of voice and voice avoidance, five were related to physical discomfort associating with voicing and three were related to improvement rest or lack thereof.

Conclusion: The Brazilian version of the VFI presents cultural and linguistic equivalence to the original instrument.

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Vocal Fatigue in Teachers and its Relation to General Fatigue throughout the School Year

Objective: To understand vocal fatigue in teachers throughout one school year.

Methods: 102 teachers, 48 with and 54 without vocal complaints, evaluated in 4 moments: first February week-E1, last June week-E2, first August week-E3 and first December week-E4. Procedures: vocal self-assessment; Signal and Symptoms Vocal List; Vocal Fatigue Index–VFI, Chalder Fatigue Questionnaire and sustained vowel for perceptual auditory analysis.

Results: Teachers presented better vocal self-assessment and less vocal signs and symptoms during E3. Voices presented mild to moderate deviation with no changes during the year. There was no difference on the vocal fatigue across the evaluations. General fatigue presented variations throughout the year, with low values. Teachers with vocal complaints had higher vocal and general fatigue in the 1st. semester. Vocal deviation degree for all evaluations and mental fatigue for E3 had not correlated with vocal fatigue.

Conclusions: Teachers do not realize vocal fatigue variations throughout the year, although they have changes on vocal self-assessment and vocal signs and symptoms. Clinical voice assessment showed overall mild to moderate deviation, with no changes over the year. Teachers presented low scores in Chalder Questionnaire, with variations throughout the year. Teachers with vocal complaints had higher vocal and general fatigue in the 1st semester of the school year. Vocal fatigue correlates positively with vocal self-assessment, signs and symptoms and general fatigue for all evaluation moments, with the exception of the mental fatigue after June and vocal deviation for all evaluations.

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Immediate Impact of Vocal Demand in Brazilian Musical Theater Singers

Objective: To investigate singer's perception of vocal demand immediately after a performance. Methods: 264 Brazilian musical theater singers were evaluated, 126 women and 138 men, mean age of 33 years old (minimum 18 y-o and maximum 70 y-o). A demographic questionnaire asked information about singing voice-use behavior, vocal impairment, self evaluation of voice after performance, list of vocal signs and symptoms and performance features. The perceived immediate impact of voice use on vocal function was assessed by the EASE-BR. Results: Singers showed mean of 1,56 vocal signs and symptoms and only the ones with higher numbers had higher scores in EASE-BR total score and subscales. In addition, lower values at EASE-BR were obtained by singers who had been active for a long time. Lower scores at EASE-BR total score and subscales were found for singers who sang opera and vocal solo besides musical theater. Significant difference was found in Vocal Concern subscale at EASE-BR for singers who perceived voice problem. Moreover, significant voice self-assessment differences were identified for all EASE-BR subscales and total score. No significant age and gender differences were found for any EASE-BR subscale or total score. Conclusions: Most part of the singers considered that their voices were ready to continue singing if required. EASE-BR is a useful scale to identify vocal changes after demand, giving information about voice in a specific circumstance with low correlation to vocal symptoms.

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Dysphagia and Voice Symptoms in Patients with Marfan Syndrome

Objective: Case reports of comorbid swallowing disorders and/or dysphonia associated with the heritable connective tissue disorders Marfan Syndrome have only been minimally discussed in the literature (e.g. Ito, 2007, Rimmer, 2008) and no studies have addressed if there is a quality of life impact on persons with dysphagia and voice disorders on persons with Marfan Syndrome. The purpose of this study was to analyze QOL concepts typically used to evaluate a persons' perception of disordered swallowing and statements used to evaluate voice handicap.

Method: A total of 220 participants, aged 22-86 years (143 females, 72 males, 1 transgender, and 4 not reported) completed a Quality of Life Index (Ferrans & Powers, 1984), a survey that included a modified version of the SWAL-QOL (McHorney, et al. 2002) to assess 8 QOL concepts: burden, duration, desire, food choice, fear, mental health, social concerns, and fatigue, and the Voice Handicap Index-10 (VHI-10; Rosen et al., 2004).

Results: Dysphagia symptoms were reported by nearly 25% of the participants. A multiple regression analysis was conducted that included the 8 responses on the SWAL-QOL as predictor variables and overall life satisfaction on the QOL Index as the outcome variable. This model was statistically significant and accounted for 12.8% of the variance ($R^2Adjusted = .128$, $F(8, 203) = 4.87$, $p<.001$). Voice handicap was reported by approximately 36% of the participants. A multiple regression analysis was conducted that included responses on the VHI-10 as predictor variables and overall life satisfaction on the QOL Index as the outcome variable. This model was statistically significant and accounted for 9.3% of the variance ($R^2Adjusted = .093$, $F(10, 201) = 3.17$, $p=.001$). The strongest predictors of overall life satisfaction were "my voice problem causes me to lose income" ($\beta= -.189$, $t(201) = -2.079$, $p= .039$) and "the clarity of my voice is unpredictable" ($\beta= -.293$, $t(201) = -2.196$, $p= .029$).

Conclusion: The results indicated that individuals with Marfan Syndrome experience some degree of swallowing and voice difficulties and these difficulties impact the overall quality of life in this under-investigated group.

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The Relationship between Menstrual Cycle Phase and Frequency Measures in Premenopausal Females

Objective: Women have a significantly higher prevalence of voice disorders than men (46.3% vs. 36.9%) and often receive clinical advice to avoid extensive voice use prior to menstruation for avoidance of vocal injury, indicating a possible correlation between cyclical hormonal fluctuations and voice function. The objective of this study is to determine if there is a phase of the menstrual cycle when premenopausal females are more susceptible to experiencing frequency changes in voice function.

Methods: Measures of frequency were taken at 4 time points associated with the 4 phases of the menstrual cycle (i.e., follicular, ovulatory, luteal and ischemic) for two different cycles. A total of 15 premenopausal females between 20-35 years (age range) were recruited. Cepstral Peak Prominence (CPP), Speaking fundamental frequency, and maximum frequency range measures were collected across the four phases of the menstrual cycle during two different tasks: reading the rainbow passage and a maximum frequency range task.

Results and Conclusions: All data has been collected. Data collected and descriptively analyzed for participants to date indicate that premenopausal females who are not taking oral contraceptives are variable across the four phases of the menstrual cycle. CPP's derived from the first sentence and first paragraph of the Rainbow Passage have the lowest CPP values during the ovulatory phase and greatest values during the Luteal phase. Speaking fundamental frequency (Sf_0) values were also derived from the first sentence and first paragraph of the rainbow passage. Sf_0 is highest during the ovulatory phase and lowest during the follicular and luteal phases. The frequency range data indicate a greater likelihood of having a decreased range during the Luteal or Ischemic phases and a greater range during the follicular and ovulatory phases. Findings from a repeated measures univariate analysis of variance on the frequency measures between the stages will be presented.

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Voice Analysis of Asymptomatic Subjects

Voice problems or disorders are noticed by the speaker and/or the listener as difficulty in voicing or hoarseness. However, many patients see their primary care physicians late because they do not perceive the problem due to lack of education about voice production. It is also common for patients to be asymptomatic during the early stages. This study intends to show the significance of early identification. Asymptomatic subjects, who did not have any complaints about voice, were assessed for conformation. Acoustic, self-perception of voice (VHI), and endoscopic analysis were reviewed to confirm normalcy. This study revealed voice problems of various types in fourteen of the twenty subjects. The goal of this presentation is to reinforce regular voice screenings and include voice analysis as a part of annual wellness check appointments.

Methods
Subjects: Subjects who perceived their voice to be normal and had no vocal symptoms volunteered for this study. Five males and fifteen females were selected for routine voice analysis. The mean age of the subjects was 30 years (19-73).
Protocol: Acoustic recording of CAPE-V, Voice Handicap Index-10, Vocal Effort, MDVP analysis, and endoscopic evaluation were carried out on these volunteers.
Analysis: Measures from the above mentioned tests were analyzed to confirm normalcy.

Results: Out of these twenty subjects only four were declared normal in all the above mentioned tests. Fourteen subjects presented with a variety of voice problems/disorders

Conclusion: This study performed on a small population suggests including voice analysis as a part of annual wellness check at least in the high-risk population.

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Vocal Quality and Articulation in Female Students Training to Be Speech Language Pathologists

Objective: The purpose of this retrospective study was to determine the speech characteristics regarding speech intelligibility, voice, articulation and fluency in future speech language pathologists (SLPs). Additionally, in 31 SLP students the differences in speech characteristics between the first bachelor and the master year were measured.

Participants and methods: The data of the screening assessments of 600 future SLPs (mean age: 18.4y) of the first bachelor year were analyzed (period 1995-2010). To evaluate the students' progress during the program the speech, of 31 female subjects (mean age: 21.4y) was evaluated at the end of the program. A consensus evaluation by two SLPs was used.

Results: Speech intelligibility and fluency were evaluated as normal in resp. 99% and 99.7%. Perceptual evaluation of vocal quality revealed a disordered vocal quality in 27%. The most prominent articulation errors were distortions of vowels and dental and interdental articulation of alveolar consonants. A significant decrease of distortions vowels and consonants after three years of education was found (p>0.05).

Conclusion: Although an improvement in distortions in the master students was measured, articulation errors and dialect are present in SLP students working with speech and language disorders in the future.

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Effects of Vocal Warm-Up on Rock Singers through Phonetography

Objective: To investigate the effects of vocal warmup on the voice of rock singers through phonetography. Methods: Thirteen rock singers, aged between 21 and 45 years (mean=28 years; SD = 7.14) participated in the study. The inclusion criteria for this study was to be the band's singer for at least one year. The voices were analyzed through Phonetography, before and after vocal warmup, and the following measurements were analyzed: minimum and maximum frequencies and vocal range, minimum and maximum intensity, and maximum dynamic range (MDR). The warmup took an average of 30 minutes and consisted of body stretching, costodiaphragmatic breathing and exercises associated with vocalises. Results: After the vocal warmup, Phonetography indicated the following results: expanding the minimum frequency from 1 to 6 st (semitones) in 8 (61.5%) rock singers; increasing of the maximum frequency from 1 to 19 st (semitones) in 8 (61.5%) singers; and increasing of the vocal range from 1 to 21 st in 8 (61.5%) singers. Regarding the intensity measures, 8 (61.5%) rock singers showed a decrease in minimum intensity from 1 to 7 dB, increase in the maximum from 1 to 12 dB and of the MDR from 2 to 17 dB after vocal warmup. All participants showed improvement in at least one of Phonetography results, and of these 69.2% (6) in 4 of the 6 parameters. All rock singers reported improvement in voice quality and greater comfort during the Phonetography after the vocal warmup exercises. Conclusion: The vocal warmup expanded the dynamic field of the voice in the minimum and/or maximum limits, in the frequency and vocal intensity of rock singers. Moreover, most of the participants had improvement in four of the six Phonetography parameters.

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Voice Acoustic Characteristics of Young Adult, Adult and Elderly Brazilian Population

Objective: To investigate acoustic changes in vocal production of normal Brazilian speaking individuals with different age ranges.

Methods: Voice samples of 129 Brazilian Portuguese adults (66 female and 63 male) with age ranging from 19 to 77 years stored in a database were included in this study. All participants had no voice complain and their voice were judged as neutral quality by three Speech-Language-Pathologists. The voice recordings were distributed into six groups with different age groups (G1 = 19-29, G2 = 30-39, G3 = 40-49, G4 = 50-59, G5 = 60-69 and G6 = 70-79) for acoustic analysis. Fundamental Frequency (F0, Hz) and Harmonic Noise Ratio (NHR) were extracted using the computerized Multi Dimension Voice Program (MDVP) program. The two-way ANOVA test (post-hoc) was used to examine differences in age groups and gender.

Results: For males, mean F0 values ranged from 117.699Hz to 128.316Hz with no significant difference between the age groups. For females, F0 for G6 (179,505Hz) was significantly lower than the other groups (G1=224,909Hz, G2=216,538Hz, G3=200,099Hz, G4=198,256Hz, G5=201,216Hz) ($p<0.05$). G1 and G2 differed from G3 with higher pitch at younger ages. In addition, intermediate age groups differed from G1 (higher pitch) and G6 (lower pitch). F_0 were different for all age groups of women and men ($p = 0.000$). NHR was significantly higher in G6 (0.187) than the other groups (G1=0.144; G2=0.136; G3=0.148; G4=0.157, G5=0.164) ($p <0.05$) for males. There was no significant difference for NHR among female groups (G1=0.128; G2=0.130; G3=0.130; G4=0.133, G5=0.144; G6=0.140). There was significant difference in G4 ($p= 0.20$) and G6 ($p=0, 000$) for women and men, with higher NHR values for males.

Conclusion: F0 reduced for females as age increased. Elderly males showed higher NHR values, suggesting higher noise in the voice signal.

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Normative Nasalance Scores for Brazilian Speakers across the Lifespan

Objective: The first goal of this study was to establish normative nasalance values for middle age and elderly Brazilian Portuguese speakers. The second goal was to characterize the stimuli in terms of possible age and gender effects across the lifespan. Methods: Mean nasalance scores were obtained from 122 (61M, 61F) participants with normal speech, resonance and voice for seven speech stimuli (three orals, two nasals and one oronasal stimuli using the Nasometer II 6400 (KayPentax, N.J., USA). The participants read the stimuli while wearing the Nasometer´s sound separator plate. The nasalance scores of the middle aged and elderly speakers were combined with data acquired from younger speakers (children, adolescent, young adult and adult) in Marino et al. (2016). Repeated-measures two-way analyses of variance were used to investigate differences between the stimuli by gender and age groups.

Results and Conclusion: There was an effect of stimuli of stimuli ($F_{(6,2082)} = 12{,}087.12$, $p > .000001$), gender ($F_{(1,347)} = 15.16$, $p = .000118$), age group ($F_{(5,347)} = 16.01$, $p > .000001$), a stimuli-age group interaction effect ($F_{(30,2122)} = 9.96$, $p > .000001$) and a gender-age group interaction effect ($F_{(5,347)} = 2.64$, $p = .023345$. Oral stimuli had the lowest scores, the oronasal stimuli had lower scores than the nasal stimuli, and the nasal stimuli had the highest scores, demonstrating that nasalance scores increase when the stimuli contain more nasal sounds. Females' mean nasalance scores were higher than those for the males. Mean nasalance scores for the young speakers were significantly lower than for elderly speakers. In addition, children had scores significantly lower than middle aged adults. These results might be related to changes in orofacial structures, including an increased cross-sectional area of the nasal cavity with advanced age. These data may provide important reference information for resonance assessment of clinical population.

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Effects of Various Environments on Measures of Experienced Female Singers' Vocal Performances

The purpose of this study was to assess selected phonation behaviors and perceptions of female vocal soloists ($N = 20$) as they performed in two rooms: (a) a university Recital Hall, and (b) an individual practice room with 4 digitally-adjustable simulations of reverberation and reflections (Practice Room, Large Auditorium, Large Recital Hall, and Arena). Participants performed the same sung material at the same tempo in each environment, with the order of the 5 environments randomized among participants to control for potential order effect.

Impulse response testing showed virtually no change in actual reverberation time within the individual practice room, regardless of the digitally simulated setting. Therefore, the 4 virtual acoustic environments provided a subjective impression of reflections and reverberations through built-in microphones, a computer processor, and loudspeakers.

Participants wore an ambulatory phonation monitor and a head-mounted, omni-directional microphone during each sung performance. Acquired data included dosimeter-acquired amplitude, distance dose, fundamental frequency intonation, and long-term average spectra. Following each performance, participants completed brief questionnaires soliciting perceptions, preferences, and comments.

Virtual acoustics practice rooms have been marketed as a means to simulate the acoustics of larger performance venues, thus potentially allowing students to practice as if they were in a given performance venue, when scheduling time in the actual venue may be problematic. However, no study to date has examined singer phonation behaviors in such virtual acoustics environments, compared these behaviors to phonation behaviors exhibited by the same singers in an actual recital hall, or solicited singer perceptions of virtual acoustics environments.

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Singing with Tori – A Soprano's Search for Resonance

Abstract: This presentation will introduce audience members to the genetic and biological phenomena of mandibular and palatal tori. Torus Mandibulus and Palatus is a bony protrusion that occurs in the oral cavity, often bilaterally. It is most often found in Asian and Innuit populations with a slightly higher rate among males. It is estimated that only 7-10% of the United States population has the presence of tori. It is believed that tori occur because of two factors: bruxism and genetic factors. This lecture will cover the subject of tori through the experience of the singer/patient (Dr. Bernardini) and the pedagogical ramifications through spectrum analysis as well as other scientific analysis as performed at the Swank Voice Lab at Ohio State University by Dr. Scott McCoy.

The presence of tori in the mouth of a singer is problematic as it affects resonance, speech, breath and facial/mask resonances. This lecture will show the changes that take place in a soprano with significant tori after reconstructive oral surgery.

The presentation will be outlined as thus:

(By Dr. Denise Ritter Bernardini)
1. An introduction of tori and its causes.
2. Pictures of the oral cavity before surgery and the experiences of the singer within the context of performing and speaking.
(By Dr. Scott McCoy)
3. A pre-surgery profile of voice range, long-term average spectrum both speaking and singing, formant locations and maximum flow declination rate.
(By Dr. Denise Ritter Bernardini)
4. The surgical process, what was removed and how the surgery was performed as well as the recovery process.
(Dr. Scott McCoy)
5. A post-surgery (9 weeks out and 8 months out) profile of voice range, long-term average spectrum both speaking and singing, formant locations and maximum flow declination rate.
6. A discussion of how to help singers with this abnormality and ways to discuss sensation and singing technique in a way that may be helpful to someone who is struggling with this condition.
7. Questions and answers

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Training Up for Fatigue Resistance: Vocal Dose and Fatigue Considerations in a Single Subject

Objective: Fatigue is often considered in a negative light and as something to be avoided. Some have speculated that fatigue may occur secondary to poor technique. Through the application of well-established exercise science training principles, the authors propose that fatigue is an inevitable outcome of extensive voice use. Given these considerations, a systematic approach for training up to singing tasks—such as full recitals and operatic roles—is hypothesized to assist the singer in much the same way that athletes use specific regimes to train up to distance efforts such as marathon running. For this single subject, it was hypothesized that with vocal dose remaining consistent, a singer preparing for an extensive hour-plus recital would experience less perceived vocal fatigue with training up to the recital performance.

Methods/Design: Using a repeated measures single-subject design, vocal dose measures using the ambulatory phonation monitor (Pentax Medical) and perceptual measures of vocal fatigue and effort were gathered while training up to and performing an extended singing task: Schubert's *Die schöne Müllerin*.

Results: Ambulatory phonation monitoring indicated matched voice load calculated as voice distance across singing trials. Results from the Voice Fatigue Index (Nanjundeswaran, et al., 2014) and perceived phonatory effort (PPE) measures taken before and after each singing trial were evaluated for the influence of rehearsal schedule, performance schedule, performance venue, and extraneous occupational voicing requirements.

Conclusions: In this preliminary study, study of fatigue resistance with the vocal load held relative constant, is complicated by acoustic factors as well as additional extraneous voicing requirements for the subject. There is preliminary evidence to support a targeted approach to singing training may be effective in ameliorating performance fatigue. This study is the first of its kind to document total vocal dose for a recital context for baritone type and this specific repertoire.

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Real-time Visual Feedback of Airflow in Voice Training: Aerodynamic Properties of the Flow Ball

Objectives: This study aims at investigating the back pressure and ball height as a function of flow for the flow ball, a device implemented in singing lessons by the author FL to promote real-time feedback of air flow.

Methods: A flow driven vocal tract simulator was used to investigate the aerodynamic properties of this device. The flow range investigated was between 0 and 0.5 L/s. Audio, flow, pressure and ball height were recorded.

Results: The static back pressure created by the flow ball was similar to that of a straw with a 3.7 mm diameter. To lift up the ball to a height ranging from 0 to 10 cm, a flow of 0.2-0.4 L/s was needed.

Conclusions: This device can be applied as a tool for practicing semi-occluded vocal tract exercises, with the benefit of adding real-time visual feedback of airflow during phonation. As in any case of voice therapy and training, the chosen tool must serve the purpose for which it is being used; thus implications in voice pedagogy concerning current feedback tools in the singing studio will be discussed.

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The Effect of Classroom Size and Capacity on Vocal Fatigue as Quantified by the Vocal Fatigue Index

Previous research has concluded that teachers are at higher than normal risk for voice issues that can cause occupational limitations. While some risk factors have been identified, there are still many unknowns. To gain more understanding regarding some of these unknowns, a self-reported survey was distributed electronically with more than 500 female respondents. The survey quantified vocal fatigue using the Vocal Fatigue Index. The areas investigated with the survey included the amount of potential risk involved for teachers of varying classroom sizes. Teachers' responses from several different school districts throughout the United States were analyzed to compare grade level and classroom size on the teachers' reported experience of vocal fatigue. Results indicated a significant effect of the physical size and capacity of classrooms on teachers reported amounts of vocal fatigue. Teachers of larger classrooms experienced significantly more vocal fatigue. Age related factors, teachers' experience of sinuses, colds, and laryngitis, as well as their use of voice amplification all had significant effects on teachers reported amounts of vocal fatigue. These research discoveries will have a great effect on the precautions taken by educators and school administrators to avoid vocal fatigue, and, thus, occupational risk from short- and long-term voice issues. Many additional factors which may affect perceived vocal fatigue must be explored in future research.

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Psychological Correlates of the VHI: Trauma, Attachment and Emotions

Objectives. Two preliminary studies aimed at investigating relationships between psychology self-report measures (specifically of trauma, attachment and emotions), and the Voice Handicap Index in two samples recruited online (singers and non-singers). Based on studies showing a relationship between trauma, attachment, health and psychophysiology, we hypothesized that relationships can exist between trauma, attachment and vocal discomfort.

Methods/Design. Participants were administered the Voice Handicap Index, the V-RQOL, and questions about vocal discomfort (e.g. vocal fatigue, hoarseness). Additionally, measures of trauma, attachment and self-conscious affect were administered. Correlations and regression analyses were performed to test our hypotheses.

Results. Study 1 (91 non-singers with no voice training) revealed significant relationships between the VHI, trauma, insecure attachment and shame. Study 2 (44 Musical Theatre Singers with 4 or more years of voice training) showed similar results for trauma, attachment and particularly minimization of trauma.

Conclusions. In both singers and non-singers psychological factors have a relationship with self-reported vocal discomfort. Yet, differences exist in these relationships (trauma and minimization of trauma seem to impact singers more profoundly). Singers and non-singers have a different emotional experience and level of identification with their voice, which could account for these differences.

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Delineation of Three Main Areas of Voice Pedagogy: Voice Building, Coaching, and Voice Rehabilitation

The final keynote panel of the 10th Pan-European Voice Conference (PEVOC) was concerned with the topic "Voice Pedagogy – What do we need?" In this presentation the panel discussion is summarized and the authors provide a deepening discussion on one of the key questions, addressing the roles and tasks of people working with voice students. In particular, a distinction is made between (a) voice building (derived from the German term "Stimmbildung"), primarily comprising the functional and physiological aspects of singing; (b) coaching, mostly concerned with performance skills; and (c) singing voice rehabilitation. Both public and private educators are encouraged to apply this distinction to their curricula, in order to arrive at more efficient singing teaching and to reduce the risk of vocal injury to the concerned singers.

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The Sounding Body Forgotten: Teacher Education and Voice Awareness

Objective: Research has documented that the teacher's voice is particularly vulnerable to fatigue and dysfunction. The voice is an audible, muscular, finely calibrated work that the body has to produce in as much as 80 % of the time in a normal teaching lesson. In the early 1980s, voice care disappeared from the national guidelines for teacher education in Norway. We wanted to identify teacher students' experiences of voice problems in professional settings, and highlight how voice training might help prevent such difficulties.

Method: Two different qualitative methods were used. All first-year students at a teacher training college in Norway, approximately 550, were offered a one-hour intensive course in professional voice care. The 282 participants completed a questionnaire asking them to describe experiences with voice use and voice problems. The replies were transcribed and analyzed qualitatively. In addition, six teacher students with 10 hours course in voice use were interviewed individually, and the transcripts analyzed. Findings are discussed in light of the research literature in special education, speech therapy and voice education.

Result: In the survey, 96 % of respondents had felt tiredness or soreness in their voice. Fatigue or hoarseness was connected with giving instructions in music, choir, arts and craft, or sports, and when giving lectures in class. Mental stress was identified as a cause of voice trouble, short breath, muscle tensions and difficulties in concentrating. The students with previous voice education reported encountering the same challenges, but had strategies and techniques that allowed them to consciously prevent stress-related voice problems during talking and singing in class-like situations.

Conclusion: Teacher students are professional voice users that need to be taught voice care during their higher education. The disappearance of voice training from teacher education can be regarded as an instance of intellectualizing oblivion of the bodily foundations of human functioning.

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Understanding the Vocal Skill Set for Contemporary Christian Singers: Insights from Elite Singers

Objective/Hypothesis. Contemporary Commercial Music (CCM) places unique demands on the singing voice. Voice science and pedagogy support style-specific instruction for CCM singers. Unfortunately, most are untrained or their training is primarily based on Western classical (operatic) music. Contemporary Christian Singers (CCS) are a population of CCM musicians who rarely receive style-specific vocal training. Accordingly, the vocal skills CCSs need for commercial success may not be reflected in the manner in which they are trained. Elite singers are seen as models of excellence and represent what the marketplace has selected as commercially viable in their musical genre. Their unique insights on the skills required for CCS commercial success were solicited, specifically their perceptions of the "ideal" vocal characteristics for this population of singers.

Study Design. Semi-structured interviews, qualitative inquiry. Code transcription analysis.

Methods. Dove and Grammy award-winning CCSs (n=3) were interviewed to solicit their perception of the ideal vocal skill set of a successful CCS. Each participant took part in a 25-30 minutes semi-structured interview. The interviews were transcribed, member checked, thematically coded and peer checked for accuracy.

Results. Participants believed that ideal CCSs' voices should use a pop sound and not sound overly classical, should sing easily, comfortably, and with freedom. The singing should not be distracting and should use good diction in order to communicate the message clearly. Among the most relevant findings is the suggestion that CCSs have a heavy and demanding vocal load and may face higher risks of vocal injury.

Conclusion. The ideal vocal skills for successful CCSs (as identified by elite performers) may inform our style-specific training of these singers to better prepare them for the music marketplace. Directions for future research will be discussed.

Key Words: contemporary Christian singers – elite singers – contemporary commercial music – voice pedagogy – recording industry

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Timbral Perception and the Modern-Day Voice Teacher

The diversity present within K-12 classrooms in the United States presents teachers with students from many backgrounds and musical traditions. Within the field of vocal education, the need for a re-assessment of vocal pedagogy is imperative to include diverse student populations. Voice teachers who are steeped in the Western classical tradition are susceptible to "biased" modeling and "biased" listening and may inadvertently devalue students' cultural vocal aesthetics. Recent research has explored the implications of timbral perception when listening to singing. Subjects demonstrated a predisposition for timbral aesthetics with which they were familiar both culturally and experientially. FMRI scans showed that when participants perceived a "good" sound, the region of the brain connected to laryngeal function, the Rolandic Operculum, was activated. This allowed for subvocalization, as the participant "mirrored" the singer. When a sound was perceived to be "bad," the Rolandic Operculum was inactive signifying a lack of mirroring during the perceived "bad" sound. Wallmark's (2014) study demonstrates that sound perception is both conscious and subconscious. The subconscious appraisal of the sound is culturally, socially and experientially mediated. The lack of mirroring during a "foreign" sound suggests that the singer is not able to empathize or relate to the sound. The purpose of this study was to discover voice teachers' perceptions of diverse singing timbres as well as the ways in which timbral perception impacts voice teachers' ability to teach. Surveys and semi-structured, open-ended interviews were conducted with voice teachers and singers. Results from voice teachers and singers, trained within Eurocentric musical contexts, demonstrated a bias for Western styles and timbres. The evidence from this preliminary study provides justification for the diversification of the field of vocal pedagogy. This presentation will address the results from this preliminary study as well as future possibilities for timbral perception research within the field of vocal pedagogy.

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Singing Interventions for Persons with Late Stage Dementia: An Examination of Caregiver Familiarity and Usage Barriers

Objective: Caring for persons with dementia (PWDs) presents substantial challenges for both professional and non-professional caregivers. The neurodegenerative and behavioral symptoms of dementia are typically treated pharmaceutically, but serious negative side effects are common for these medications. Alternate/adjunct therapies such as singing interventions improve the quality of life for PWDs. Studies show that caregiver singing reduces resistant and violent symptoms in PWDs, and increases PWD awareness of and interaction with caregivers. The benefits of singing interventions have been well documented, but usage barriers result in their therapeutic under-utilization. Singing voice pedagogues are well suited to address caregiver singing intervention barriers. The following research questions will be examined: (1) How familiar are caregivers with the use of singing interventions with PWDs? (2) How comfortable are caregivers with singing to PWDs? (3) How frequently are caregivers singing to PWDs? (4) What factors might prevent caregivers from using singing interventions with PWDs?

Method/Design: An online survey will be designed and distributed to caregivers of PWDs, including nursing/care staff at geriatric facilities and non-professional or family caregivers.

Results: Data will be statistically analyzed to determine caregiver knowledge of singing interventions and the voice, attitude towards such interventions, and reasons for use or non-use.

Conclusion: The results will be used as a baseline to inform future research on the involvement of singing voice pedagogues with singing interventions for PWDs.

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Singing in the Basement: Resonance Strategies in the Soprano Lower Extension

Objective: The purpose of this study was to quantify acoustic patterns shared by soprano voices with developed lower extensions.

Method:

Participants - Five Westminster Choir College graduate level, classically trained sopranos, ages 21 to 24, were examined. All 5 sopranos were voice primaries and candidates of the Master of Music in Voice Performance and Pedagogy degree.

Equipment - Singer's were recorded in the Presser Voice Laboratory at the Westminster Choir College. Singers' voices were recorded via microphone [model: Earthworks QTC30 HDM] and her sound was then analyzed via VoceVista software.

Procedures - Singers sang a descending major, 8-note scale on /a/ from A4-A3 at a comfortable loudness. The singer then sustained the lowest note of the scale, A220 (A3), and produced as large of a crescendo as possible. The sopranos were permitted to modify the sustained vowel as needed. The obtained spectrogram images were analyzed for shared formant-harmonic similarities in the lower extension. The lower extension was considered to be the range of a fifth below the soprano primo passaggio of E/Eb4.

Results: Sopranos with strong lower extensions, noted by a developed chiaro-scuro sound or a boosting of both lower/higher harmonics, shared similar format-harmonic shifts. These shifts were absent in the spectrograms of lesser developed lower extensions. Whether the soprano identified as a fuller or lighter/coloratura voice, soprano voices with strong lower extensions shared the same formant-harmonic interactions. When sopranos with strong lower extension began on A440, harmonics 1, 2, and 3 were boosted by the presence of vocal formants. In less developed lower extensions only harmonics 1 and 2 were elevated. On the final pitch of A220, sopranos with developed extensions further boosted harmonics 1-5, in particularly harmonics 3 and 5, and harmonics within the singer's formant range of 3000-4000Hz. In lesser developed lower extensions, only harmonics 1 to 3 were elevated. Harmonics 4 and (in particular) 5 were not elevated. Boosting of harmonics within the singer's formant frequency range were also less apparent.

Conclusion: Developed lower extensions, extensions demonstrating a chiaro-scuro timbre (a boosting of both lower/higher harmonics), were present in both fuller and lighter soprano voice types. The shared formant-harmonic relationships of developed lower extensions suggests one factor of weakness in the soprano lower extension may be inefficient vocal filter shaping.

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A Qualitative Analysis of Music Performance Anxiety and Worst Performance Experiences in Undergraduate Music Major and Non-Music Major Singers

Music performance anxiety has become better understood in recent years, but remains less so with some populations and under certain (particularly non-solo) circumstances. This study involved a qualitative analysis of 95 undergraduate singers' descriptions of their worst performance experiences. The students were a mix of music majors and non-music majors drawn from 5 Mid-Atlantic colleges and universities, and all sang in an ensemble at the time the open-ended prompt to describe the worst performing experience was administered. The purpose of the study was to explore themes contained in the responses in order to gain new insights about and confirmation of previously observed music performance anxiety factors in order to develop a) pedagogical strategies for this population, and b) questions for future research. Common themes included memory loss, equipment failure, adequate and inadequate preparation, shaking, voice cracks, increased heart rate, illness, and last minute changes to the performing routine. Worst performance experiences occurred not only under solo and audition conditions, but also during rehearsals and when performing as an ensemble member. Because bad performing experiences can have long term effects on students' music performance anxiety, satisfaction, and performance, voice teachers and directors should consider how to limit or prevent these experiences when preparing students for performances, whether these performances be solo or as part of a group. Some recommendations for teachers are that a) students should have sufficient preparation, b) students should have ample opportunities to practice their performing, c) lower level students should have more flexibility with performing from memory or with music, and d) last minute changes to performance circumstances should be strictly avoided.

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Temporomandibular Disorder Symptom Prevalence in University Singers

Objective: Temporomandibular Disorder (TMD) is a frequently reported concern for musicians, but its prevalence and severity in the collegiate singing community is not well understood. Previous studies have reported increased prevalence of TMD in persons with high levels of stress and in musicians who use their jaw to play their instruments (e.g. woodwind players). We hypothesize that collegiate vocalists may be particularly susceptible to the deleterious effects of TMD due to the stressful nature of their programs and their reliance on jaw mobility in singing. Examining the prevalence of TMD symptoms in this population will enhance our understanding of its effects on the singing voice and may lead to compensatory pedagogical strategies.

Methods/Design: A paper survey was designed and administered. Participants (n=152) were university student musicians with varying majors, instruments, and educational levels. Survey queries included demographic data and Fonseca's Anamnestic Index to classify each subject's level of TMD symptomology. Subjects were further asked to indicate how negatively these symptoms affected the playing of their instrument.

Results: Participants (n=152): 31% listed voice as their primary instrument (n=47). Of the singers, 87.2% reported some level of TMD, compared to 63.8% of non-singers. In previous studies 40-60% of the general public reported TMD symptoms. Our preliminary statistical analysis indicates a higher prevalence of TMD symptoms in singers than in other student musicians. Furthermore, 61.7% of singers reported a negative impact (above 25%) on their singing, compared to 19% of non-singer musicians.

Conclusions: Results support the hypothesis that TMD symptom prevalence is higher in singers than in other student musicians. Singers also report that TMD symptoms more negatively impact their performance. Further statistical analysis is in progress. Areas for future research will be discussed.

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Undergraduate Voice Assessments: Measuring the Vocal Development of Singers over a Four-Year Bachelor's Degree Program

Objective: This study investigated the vocal health and efficiency of undergraduate school singers (voice performance majors and voice primaries) upon entering and upon completion of a four-year Bachelor's degree program at a northeastern conservatory by acoustical and perceptual assessments. The following research questions guided the study:
1. What is the vocal profile of an entering Bachelor's degree singer who considers voice as their primary instrument?
2. Which measured parameters show differences, if any, after four years of study at a music conservatory?
3. What pedagogical considerations can be suggested, if any?

Methods: The participants ($N > 30$) at initial testing were aged 17 – 20 as entering freshmen to a Bachelor's degree program, and then 21 – 24 as post-tested seniors nearing graduation of that degree program, a four-year differential. Procedures included measurements of airflow and acoustical measurements of perturbation and other properties via the MDVP (Multi-Dimensional Voice Program by KayPENTAX), speaking fundamental frequency (Real Time Pitch), and resonance and vibrato (VoceVista). Perceptually, range limits, efficiency of phonation (breathy to pressed), intonation, primary transitions, and postural observations (stance, head, neck, tongue, and jaw) were recorded. Demographic information included past vocal health issues and current vocal concerns at the time of both tests.

Results and Conclusions: Results are reported for all acoustical and perceptual tests and examined for differences and commonalities, both during the pre-test and the post-test investigations. Protocol adjustments for future assessments are suggested and pedagogical considerations are offered. Future research includes the continuing data collection of undergraduate and graduate singers (who will be post-tested at the four year and two-year conclusions of their degrees, respectively) of this longitudinal study.

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The Effect of Two Different Instructions on Subglottal Pressure, Sound Pressure Level, and Airflow Rate during Singing

Objective: W. Stephen Smith, a well-respected voice pedagogue, has strongly objected to the use of the term "support" suggesting that the students will use increased air pressure upon hearing this word. The investigation, therefore, is to examine differences in physiological parameters comparing a conventional singing instruction that uses the word "support" with an alternative instruction that integrates Smith's concept. The current study attempts to determine the value of the alternative instruction.

Methods: The parameters (subglottal pressure, sound pressure level, and airflow rate) were obtained by using the KayPENTAX Phonatory Aerodynamic System. Three instructions were given to 49 participants in randomized order: (A) Sing the way you usually sing (baseline); (B) Allow your breath to flow steadily with clear /ɑ/ vowels; and (C) Keep the tone well supported with clear /ɑ/ vowels. The singing material consisted of seven intonations of the syllable /pɑ/ to the tune of "Somewhere over the Rainbow." 48 participants filled out a questionnaire composed of how they applied instructions (B) and (C).

Results: The results revealed significant differences in both subglottal pressure ($p = .002$) and sound pressure level ($p = .035$) between instructions (B) and (C): Subglottal pressure and sound pressure level showed a lower mean for instruction (B) than for instruction (C). The mean difference (.533 dB) between instructions (B) and (C) in sound pressure level, however, did not meaningfully distinguish perceptual differences in hearing.

Conclusions: The statistical results and the participants' answers related to instruction (B) (e.g., "*legato*," "free," "naturally," "easier") suggest that voice educators have an option which can facilitate students' efficient singing without additional strain. Instruction (B) can act as an alternative directive for vocal pedagogy.

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A Post-Positivist Voice Research Project Observing Development in the Training of Operatic Singers

Over the last half century the remarkable advance of technology for analysis of the physiology and acoustics of human voice has had only a limited effect on the practice of studio instruction in singing. Two major reasons for this limitation are 1) individual variation, especially among accomplished singers, is far greater in the singing voice than in other instruments, and 2) the criteria of excellence remain finally subjective and qualitative, rendering incremental improvement difficult to identify and quantify. Thus one sees few longitudinal studies where the focus is on evidence of (intended) improvement, which is far more difficult to demonstrate in singing than in the medical studies that are often regarded as models for voice research.

The present study seeks to get past these limitations, at least in part, by selecting examples from among a body of students who have already passed a barrier of demanding admissions standards and are presumably strongly motivated to succeed in the highly competitive world of opera singing. Efforts toward improvement over time, sometimes involving several years, are monitored with non-invasive technology that is used both to describe the desired changes in voice production and to provide feedback to measure success, both immediate and incremental. The technical goals of the instruction are generally selected by the tutor in consideration of what he/she finds in the vocal material the student arrives with.

Whether such goals constitute improvement remains finally subjective and can be discussed, but the changes, where accomplished, are of an objective nature and may be imitated and monitored in other individuals with similar material.

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The Female Broadway Belt Voice: The Singers' Perspective

Background - Less than a century from its inception, the female musical theatre belt voice has become one of the quintessential sounds of Broadway singing. The range of this sound has evolved, particularly in the past fifteen years, due to the rapid increase of the contemporary rock/pop musical. With the relatively recent establishment and evolution of the sound, female musical theatre singers need current, effective strategies to produce the belt sound.

Objective - The intent of this study is to gain a clear understanding of the techniques and strategies used by singers to successfully produce the female musical theater belt voice.
Method - The study is a qualitative design composed of two data collection methods: interviews with seventeen female belt students from the studios of four nationally recognized master musical theater voice teachers, and observations of these students working in private lessons with the master teachers.

Results - There was much consensus among the singers on the strategies used to produce the female musical theatre belt voice, such as developing their entire range and incorporating physical support. Distinct techniques for producing the belt sound in the traditional and contemporary ranges emerged. Singers report that they produce the female belt sound with a combination of teacher guidance and self-exploration.
Conclusions - Singers use similar techniques to produce the female musical theatre belt sound, and approach the traditional belt and the contemporary belt with different strategies. Belting is a mutual process between singers and teachers. Female singers reported the need for their teachers' instruction, however there is also an element of independent self-exploration for the belt technique.

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Enhancing the Core Curriculum: Performing Artists and Health Professionals Bring The Translational Imagery Afforded By Performing Arts Programs To Impoverished Elementary Schools

Objective: We celebrate the arts for the value they add to learning and life. Educational literature has documented the power of the translational imagery of the arts to enhance reading, language, mathematical skills and test scores, develop critical thinking and social skills, and motivate learning. However, arts education in public schools continues to be decimated by shifting priorities/budget cuts, disproportionately affecting impoverished schools. We describe a program established by a local musical theater company, via a non -profit corporation, to provide this translational imagery education via music, dance, acting and performing artist health to all students, grades K-6, in several impoverished elementary schools. This curriculum is incorporated into the weekly class schedule alongside of the core curriculum.

Methods: The 6 week modular musical theater curriculum, which incorporates dance movement, singing & solfege, acting and performing artist health for each age group, will be described. Currently 500 children ages 4-6 year are participating in the first module. The program is anticipated to reach 6,000 children by year's end. Observations volunteered by classroom teachers and school administrators on behavior, attendance and improvement in core subjects will be presented. Additionally, comments volunteered by the classroom teachers on the curriculum's impact on their teaching styles will be presented.

Results: Given the 6 week modular structure of the first year, only qualitative observations of target behaviors such as attendance, class disruption, and effect on core curriculum scores can be made. Long term benefits and measurable outcomes will come with program expansion to a weekly class throughout the school year in the next few years.

Conclusions: As the education system continues eliminate arts programs that clearly enhance core curriculum learning, the onus is on us - passionate artists and health professionals - to provide this translational arts imagery to impoverished schools and enhance learning opportunities for these children.

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Vocal Dose, Hearing Dose, and Voice Changes of a Karaoke Singer: A Case Study

Introduction: Karaoke is a popular form of singing worldwide which often takes place in loud club environments. A small number of studies to date have analyzed voice changes after periods of karaoke singing, but no studies have analyzed the vocal or hearing doses acquired by karaoke singers acquired over the course of an evening or compared those doses to changes in voice quality readings or perceived singing voice function. Such data could inform singers, pedagogues, medical professionals and club owners of vocal and hearing risks associated with karaoke singing.

Objectives: The purpose of this study was to investigate the relationship between vocal dose, hearing dose, voice quality, and perceived vocal function of a karaoke singer.

Methods: A karaoke singer ($N=1$) was observed over the course of one full evening of karaoke club singing through: (a) ambulatory measurements of vocal dose and voice quality collected with an unfiltered neck accelerometer signal; (b) ambulatory measurements of hearing dose acquired with a noise accelerometer, (c) pre- and post- measurements of voice quality during singing and speaking vocal tasks acquired with an acoustic transducer; and (d) pre- and post- applications of the Evaluation of the Ability to Sing Easily (EASE) questionnaire of perceived singing voice function. Pre and post measures were compared as was the change during the course of the singing.

Results: Results were discussed in terms of voice use (vocal dose, mean F_0 and mean SPL dB levels), hearing dose, Lombard Effect, pre- and post- measurements of voice quality (pitch strength, harmonic-to-noise ratio, shimmer jitter, LTAS slope, alpha ratio and dB 2-4kHz), and pre- and post- EASE scores.

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The Power of the Voice: Legend Or Reality

If we're to understand the power of the voice, we need to get back to Pavlov; on the salivary front, it's a reflex, in other words, an adaptation by the organism to a given situation, a reaction in which the Central Nervous System transmits and coordinates the excitation stimuli and their effects
Is there an algorithm for the voice of leaders?
Four instincts, four behaviours

A1 is the first instinct: the fighting instinct.
It feeds on the urge to fight death, to avoid danger. It calls on the survival instinct. Fear, anguish, depression, but also bravery or enthusiasm, can constitute the stock-in-trade of the voices in power.
A2 is the second instinct: the feeding instinct.It feeds the urge to act for the survival of the species, also called the feeding instinct. It highlights economic advantage and financial profit. It acts by performing a balancing act between misery and poverty, dreams and hopes. If the wording is right, it can convince the hottest dissidents.
A3 is the third instinct: the sexual instinct.More limited and more specific, it calls on the instinct for self-reproduction and therefore for self-preservation. This instinct has two fundamental components: primitive components that provoke erotic excitation; and sublimated components that thrive on music, singing, beautiful women, artists and models.
A4 is the fourth instinct: the parental or protective instinct

The leader's voice subjects the crowd to one or several of these four primary instincts. They have a nigh subconscious impact. The individual members of a crowd react without any real cognizance.

But these four instincts seem not to be the sole constituents in the algorithm of the voices in power. If four varieties of discourses are also taken into account, the result is impressive.
Indeed, this powerful conviction displayed by leaders also draws on four other behavioural criteria that seem to me to be indispensible and complimentary in relation to the four instincts:

B1 is the first behaviour, mystical or religious.
B2 is the second behaviour, a rallying one (for the group, using a war faring or military approach).
B3, the third behaviour, is the expertise criterion (through reasoning and scientific analysis).
B4 is the fourth: charisma, which is fundamental.But let us pause here and try to profile our politicians and leaders against these eight criteria. All of them display at least six of the eight criteria. Below six, they seem to have little chance of becoming a leader, a politician or a CEO. For example, referring to the letters and numbers attributed above to each instinct and behaviour, we find:

François Mitterrand: A1 A2 A3 A4 B1 B2 B3 B4: he exhibits 8 criteria.
Martin Luther King: A1 A2 A4 B1 B3 B4/ 6 criteria.
Jacques Chirac: A1 A2 A3 A4 B1 B2 B3: 7 criteria.
John Fitzgerald Kennedy: A1 A2 A3 A4 B1 B2 B3 B4: 8 criteria.
Bill Clinton: A1 A2 A3 A4 B1 B2 B3 B4: 8 criteria.
Gandhi: A1 A2 A4 B1 B2 (he maintained that one cannot preach non-violence and also be a warrior) B4: 6 criteria.
Up to you to add to this list...

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Effects of Supraliminal Priming on Elected Tempo and Acoustical Measures of Individual Singers' Performance of a Familiar Melody

Objective: Voice professionals routinely provide imagery and instructions designed to evoke changes to specific vocal behaviors.

Social science researchers have found that supraliminal priming can evoke unconscious behavior modifications. Supraliminal priming is conscious priming that occurs when the individual is fully aware of the priming stimulus but is not aware of the underlying pattern, which serves to prime a particular construct (Bargh & Chartrand, 2000). Using a scrambled sentence task, supraliminal priming evoked significant effects on food consumption choice (Minas et al., 2016) and personality traits linked to hostility (Costin, 1969). When primed for elderly stereotypes with a scrambled sentence task, participants walked more slowly after the experiment compared to those who received neutral priming (Bargh, 1996). A thorough review of extant literature revealed no investigations of supraliminal priming in vocal pedagogy. The purpose of this investigation was to measure the effect of supraliminal priming of individual singers on elected tempo and acoustical measures of a familiar sung melody

Methods/Design: Participants ($N = 40$), comprised of singers with varied degrees of training, sang from memory "My Country 'Tis of Thee" at the tempo of their choosing. Prior to subsequent singings, they underwent a randomized supraliminal priming scrambled sentence treatment modeled after the stereotype priming in previous research related to walking speed (Bargh, 1996). The sentence completion treatments were designed to evoke feelings of (a) elderly and (b) youthful stereotypes. Headset microphone recordings provided data for comparisons of excerpt duration and acoustical measures (frequency, amplitude) related to the priming condition.

Results and Conclusions: Should supraliminal priming affect song tempo and acoustical measures it might also affect other voicing techniques. Such information might impact the wording of verbal instruction and imagery voice professionals use in studios and clinics to assist in voice behavior modifications.

N.B. These data have not yet been analyzed.

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Singers, Take Care! Noise Dosage and Sound Level Measurements Acquired by Singers in University Music Practice Rooms

Objective: Previous research has suggested that musicians may be particularly susceptible to noise induced hearing loss (NIHL). Much of the existing literature examined instrumental music-making and factors associated with NIHL, such as noise exposure. To date, however, very few studies examine noise exposure acquired by university vocalists as they practice in school practice rooms, many of which may be small and poorly constructed. No study to date examines university student vocalists across multiple practice sessions. The purpose of this study was to assess the noise exposure of university singing students ($N = 31$; $n = 12$ sopranos, $n = 4$ mezzo-sopranos, $n = 10$ tenors, $n = 5$ baritones) during five practice sessions in university designated practice rooms.

Methods: Participants ($N = 31$) wore Etymotic Personal Noise Dosimeters (Model ER-200D) calibrated according to National Institute of Occupational Safety and Health (NIOSH) recommendations across five practice sessions. Each session consisted of a natural, non-guided practice routine, documented by each participant, lasting for a duration of the participant's choosing. In addition, four participants ($n = 1$ soprano, $n = 1$ mezzo-soprano, $n = 1$ tenor, $n = 1$ baritone) collected data during waking hours for one day.

Results: Primary results indicated that 77.4% of participants exceeded 100% of a permissible daily dose in a single practice session. Questionnaire responses indicated that the majority of participants did not think that the sound levels in their practice room exceeded safe levels or affected their hearing. Data across a full day of use indicated that practice room sessions yielded the greatest or equivalent-greatest L_{EQ} across other daily activities.

Conclusions: To date noise exposure has been better documented among instrumentalists than vocalists. However, data from this study indicated that singers can achieve daily noise doses in excess of NIOSH recommendations. Findings were discussed in terms of vocal pedagogy, hearing health, and suggestions for future research.

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A Survey of Voice Faculty in Commercial Music Degree Programs

Anecdotal evidence suggests that there has been significant growth in the number of universities offering commercial voice degrees in the last ten years. Prior studies have examined the preparation of voice teachers for teaching CCM styles (LoVetri & Weekly, 2003 and 2009) and voice teachers attitudes towards teaching pop/rock singers (Edwards & Meyer, 2012). However, there have been no studies designed to gather information from current faculty of commercial music degree programs.

The current survey will investigate training, performance experience, and pedagogical approaches among faculty who teach in these degree programs. It will also investigate private lesson requirements, including genres, foreign languages, and evaluation methods. Results of the survey will provide insight into these degree programs and provide valuable information to graduate pedagogy programs whose students may eventually apply for jobs in commercial voice programs. The information could also prove valuable to those interested in developing continuing education opportunities for CCM voice teachers.

Objective: To examine the training that voice students receive in commercial music training programs throughout the United States.

Methods/Design: The survey consists of multiple choice and open ended questions that have been vetted by expert reviewers. The data will be analyzed using descriptive statistics.

Results and conclusions:. The survey is currently in progress. Results from this study may have implications for the training of voice pedagogues at the collegiate level.

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A Survey of Curriculum in Commercial Music Degree Programs

Anecdotal evidence suggests that there has been significant growth in the number of universities offering commercial voice degrees in the last ten years. Prior studies have examined the popular music content in music education programs (Wang & Humphreys, 2009) but not popular music programs themselves. The National Association of Schools of Music Handbook has no official standards for commercial voice degrees, leaving universities without guidelines for these programs (NASM, 2014). Without a clear understanding of what these programs are teaching, it is difficult to train voice pedagogues to be viable candidates for positions at these institutions.

The current survey will investigate degree types, student enrollment, required faculty qualifications, performance and studio recording opportunities, and ensemble requirements. Results of this survey will provide insight into these degree programs and provide valuable information for graduate pedagogy programs whose students may eventually apply for jobs in commercial voice programs.

Objective: To examine the training that voice students receive in commercial music training programs throughout the United States.

Methods/Design: The survey consists of multiple choice and open ended questions that have been vetted by expert reviewers. The data will be analyzed using descriptive statistics.

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The Effect of Singer-Held Folders on Choir Sound

Introduction: Many choral singing research studies incorporate long-term average spectra (LTAS) analyses as a dependent measure. No study to date, however has investigated what, if any, effects the use of choir music folders in performance may have on the spectral energy of conglomerate choir sound as heard by the conductor and by audience members.

Objective: The purpose of this study was to assess the long-term average spectra of a mixed choir performing a memorized motet recorded at two microphone conditions (conductor position 12 ft. from the front row of the choir; audience position 32.5 ft. from front row of choir) under three conditions: (a) without folders, (b) folders held at an angle of 45 degrees, and (c) folders held at 90 degree angle to the floor.

Method: To control for potential confounding variable, microphone positions and standing positions of choirsters remained consistent throughout the recording session. In addition, singers followed a videotaped conductor to ensure that all nonverbal conductor behaviors were exactly the same across conditions. Each singer's folder had a portable level measure attached to it, ensuring that folder angles were consistent among the choristers. Professional grade, omnidirectional microphones placed at conductor position ear level and the ear level of a seated audience member captured all sung trials at a sampling rate of 44.1 kHz (16 bits) in .wav format. I used KayPentax Computerized Speech Lab (CSL) Model 4500 software to examine the recordings. To acquire LTAS Data, I analyzed each recording using a window size of 512 points with no pre-emphasis or smoothing, a bandwidth of 86.13 Hz, and a Hamming window.

Results: Data analyses are currently in progress.

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Classical and Contemporary Commercial Music Singers' History of Vocal Pathology and Level of Vocal Health Support within the Professional Production

Objective: To investigate professional singers' history of vocal pathology, whether they felt compelled to perform while experiencing vocal difficulty, and the level of support provided from the production's team.

Methods/Design: 199 professional singers completed an online survey about education/training, performance history, and general and vocal health history.

Results: Among 199 participants, 45% sang classical and musical theatre (MT), 29% classical only, 22% MT only, and 4% other styles. 77% said "yes" to "have you ever been asked or felt compelled to perform while having voice difficulty". 35% said "yes" to "have you ever been diagnosed with a vocal pathology" (nodules, polyps, fold hemorrhage, frequent laryngitis, or "other"). 50% of participants reported access to voice professionals in their current production.

According to singing style (classical and MT, classical only, MT only, and other styles), 83%, 67%, 88%, and 33% felt compelled to perform while having voice difficulties and 34%, 42%, 26%, and 33% were ever diagnosed with a vocal pathology, respectively.

Other CCM style singers reported the highest percentage of vocal nodules (22%); MT only singers reported the highest percentage of vocal polyps (5%) and frequent laryngitis (9%); and classical only singers reported the highest percentage of vocal fold hemorrhage (9%) and "other" vocal pathologies (21%).

Conclusion: More than 75% felt compelled to perform while having voice difficulty, with MT only singers having the highest percentage. However, more classical only singers were diagnosed with a vocal pathology. Only half of the singers reported having a voice professional available in their current production. This is a different practice when compared to the sports culture, where athletes receive guidance followed by immediate treatment and care when experiencing some type of distress or injury. Findings from this study can help voice teachers, singers, and medical professionals to advocate for vocal health and preventive education.

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Closed Vowels and Their Effect on Male Head Register Contact Quotient Values

The purpose of this research is to examine and compare the Contact Quotients (CQ) of the vowels /u/ and /o/ with the neutral vowel /a/ in the male head registers of tenors and baritones. Previous research indicated not only a percentage increase in CQ for /i/ and /e/ in the male head register, but also a percentage increase that was directly correlated to the closed nature of the vowel. Vowel modifications (that ultimately make adjustments to CQ values) are often used by voice teachers to assist their students in facilitating a smooth head register transition, with some preferring /o/ and /u/ strategies over /i/ and /e/. A complete understanding is needed of the role these vowels play in training the vocal anatomy of the male head register. Thirty male singers who can successfully demonstrate the ability to transition into their head register (passing through the *secondo passaggio*) will be utilized for this study. Data will be collected using the Audacity software, a free standing microphone and an electroglottograph. These data will be displayed and analyzed using the Spectrum, Spectrogram, Audio, EGG and EGG CQ history windows of the VoceVista 3.3 software. Each participant will be asked to sing an /a/ vowel on a comfortable pitch in head register. Then, while sustaining that pitch, they will be asked to transition to an /o/ and then to an /u/ vowel. Resonance strategies will be monitored during the singing of these examples as it will be required that each subject remain in head register during the entire process.

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Do Amateurs and Professionals Seek the Same Vocal Health Advice?: Survey of 1195 Voice Users

Objective: Although many voice users are aware of the risks associated with continued use on an injured laryngeal mechanism, many are unlikely to seek medical attention due to a variety of reasons including lack of insurance, fear of results, and lack of knowledge on where to seek appropriate care. In order to better understand current rationale among voice users, a survey was designed. The aim of the study was to provide insights into current practices related to vocal health among amateur and professional voice users.

Methods: Subjects were solicited via survey links to members of professional vocal arts organizations. Voice users completed an online survey related to their practice in seeking medical care for vocal health concerns, with specific focus on current preference for traditional (laryngology/SLP team), alternative medical (homeopathic, Eastern medical approaches, nonmedical), or a combination of these options. Specific vocal symptoms/conditions for which subjects feel would warrant evaluation is also queried, as well as their preference for voice use and management should laryngeal pathology be diagnosed during a medical exam.

Results: The impact of traditional and alternative medical assessment and management continues to evolve as amateur and professional voice users seek financially and timely recovery of dysphonia. The specific practices of voice users' management of vocal health concerns is expected to show contrasts across genres and geographical locations.

Conclusions: Amateurs and professional voice users seek professional assistance including alternative medical professionals for symptoms and diagnosed vocal pathology. Colleges and Universities should consider including entrance baseline laryngeal exams for acting and singing programs. Voice users for appropriate care and management for dysphonia seek a combination of traditional and alternative medical professionals.

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Retraining Voice Users with a Diagnosed Vocal Pathology

Objective: The aim of this study is to investigate and provide insights into current practices regarding teaching or retraining a person with a diagnosed vocal pathology. In order for today's vocal pedagogues to provide quality training, they must familiarize themselves with several disciplines, including voice science and voice medicine. It is increasingly common for voice users with vocal pathologies to receive treatment from voice care teams. These teams may include laryngologists, speech language pathologists, singing voice specialists, voice scientists, and psychologists, among other professionals. In this modern array of professionals guiding the rehabilitation of singers, where do voice educators fit in and what are their practices?
Methods: An online survey was designed to identify these practices as well as the personal medical history and demographics of professionals. The survey link was provided to professional membership organizations who serve the professional needs of vocal educators.
Voice educators and professional singers of various vocal styles completed the survey. Respondents answered questions about their comfort level and studio practices regarding teaching a new student who has a diagnosed laryngeal pathology, is recovering from vocal fold surgery, or is recovering from a vocal injury.
Results: Statistical analysis obtained from the data may lead to a better understanding of the role vocal educators play in vocal "habilitation" and whether they have training in vocal rehabilitation.
Conclusions: The speech language pathologists will rehabilitate the voice from injury to function and the voice educators from function to optimal. Ideally voice educators maintain relationships with physicians and speech language pathologists by sending students/clients who are recovering from surgery or injury back to these professionals for check-in visits and have had some form of instruction enabling them to interpret written reports from physicians.

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Acoustic and Perceptual Differences between Novice and Professional Music Theatre Singers

Objective:
Research examining contemporary commercial music (CCM) styles of singing has increased significantly over the last ten years. While acoustic analysis has helped determine which characteristics define various vocal genres, discrepancy still exists in how those acoustic characteristics are perceived, described, and evaluated.

Methods: The current study recorded 7 novice and 4 professional musical theatre singers performing belt, legit, and mix vocal samples. Novice singers were defined as 1st and 2nd year students in an undergraduate musical theatre program while professional singers were defined as having played at least one major role in a musical theatre production on Broadway. Three acoustic analyses were applied to the excerpted recordings from each singer using the Praat voice and speech analysis software: The spectral slope of the long term average spectrum (LTAS) was calculated, as well as the noise to harmonic ratio (NHR), and the dominant harmonic (1st, 2nd, or 3rd) was noted for each sample. Results were compared across pitch, style (belt v. legit), and training level (professional v. novice). Finally, raters listened to the recordings and rated each sample on the basis of style (belt v. legit), roughness (rough v smooth), and tone quality (brassy v flutey, and bright v dark). A 120mm liechert scale was provided to each rater for each of the rating variables. Results of the perceptual assessments were compared with acoustic measures to elucidate discrepancies in how ccm characteristics are perceived.

Results:
Auditors identified the style (belt/legit) more reliably for the professional singers, however ratings of other qualities varied significantly between raters.

Conclusions:
Professional singers were more capable of producing a distinct difference between their "belt" and "legit" voice productions than were the novice singers. There appears to be little consensus among the auditors, however, about which acoustical qualities define either style.

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Glottal Resistance in Different Singers

Objectives: In singing, voice classification seems to be related to vocal fold and vocal tract lengths and also to vocal intensity. This study aims at investigating whether glottal resistance (i.e. the ratio between subglottal pressure and glottal airflow) can also be relevant to classification, as this parameter influences vocal intensity. Glottal airflow varies with glottal area, which is affected by vocal fold length.

Method: Glottal resistance was compared between female and male singers, who sang diminuendo sequences of the syllable /pae/ at different pitches. Subglottal pressure was measured as the oral pressure during /p/-occlusion. Flow was captured by means of a Rothenberg flow mask.

Results: The results show a great inter-individual variation of resistance. As compared with male voices, sopranos tend to have lower glottal resistance. The relevance of this finding for voice classification will be discussed.

Conclusions: Glottal resistance seems to contribute information relevant in the training of singers of different genders. In addition, it reflects an important aspect of glottal adjustment and hence the efficiency of the singing technique.

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Pre-service Music Educators' Knowledge of and Perceptions Toward Computer-simulated and Traditional Laboratory Dissection in a Vocal Pedagogy Course

Science-education literature is replete with studies examining how students learn anatomy most effectively. Some studies show that students learn best through hands-on learning in comparison with digital/media learning. Other investigations have concluded students rate both computer and hands-on learning as effective and enjoyable (Youngblut, 2001). Interestingly, in other studies, students have shown greater retention of information with live specimen dissection (Michel-Clark, 2003; Taeger, 2006).

No studies to date have examined anatomical learning of pre-service music education students. Therefore, the purpose of this investigation was to examine the effectiveness of computer-simulated dissection versus hands on dissection in learning anatomy and physiology of the laryngeal structure for pre-service music educators in a vocal pedagogy course. University students ($N = 26$) enrolled in a vocal pedagogy course were given vocal anatomy and physiology instruction. Both groups were then given a pretest on laryngeal physiology and anatomy. Thereafter, the first group ($n = 13$) attended five, one-hour sessions of hands-on, human laryngeal dissection in a cadaver lab. The second group ($n = 13$) attended five, one-hour sessions in a computer lab equipped with *Physiology and Anatomy Revealed, version 3.0* (McGraw Hill) a computer program designed to simulate dissection. Following the in-person or simulated experience, each group was given the test again. Student perceptions of the dissection process and mode of learning were gathered through a short questionnaire.

Results indicated that perceived and measured learning of the participants did not show significant differences between groups in student learning between pre- and posttest measures although both groups showed a significant increase in mean scores between pre- and posttest measures (Group 1 (dissection): 21.42 points, 43%) and Group 2 (software): 20.23 points, 40%)). Student perception of benefits and drawbacks of the experience was varied with 96% of participants stating they would recommend the experience.

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Voice Analysis of Abstract Vocal Images

Objective: Vocal training offered by voice teachers include instructions that are direct and indirect. Teachers demonstrate the desired voice quality and students match it based on their auditory perception and the verbal instructions given to them. The output is then approved or modified by the teacher. This process includes a variety of vocal instructions given by the teacher often in the form of abstract images. These images, however, do not have a direct physiological correlation nor do they assist students in understanding what is expected from them. Understanding the science behind these images may enhance student learning and also add to the basic understanding of singing voice training. This poster is a report on voice analysis of students performed pre- and post-instruction by a singing teacher. The change in acoustic measures will be correlated to the vocal image given by the teacher.

Methods:Subjects: Four participants, two males and two females, and one voice teacher (primary presenter) participated in this study.

Protocol: The participants were asked to sing the vowel /a/ on a comfortable note and perform a vocalise in their comfortable range. The voice teacher instructed these participants with twelve vocal images and the participants repeated the vowel and vocalise based on how they interpreted the instruction. Acoustic recordings were performed before and after instruction and saved as .wav files.

Analysis: Spectral analysis comparing formant transitions, Singing Power Ratio, and Cepstral Peak Prominence were analyzed and compared between the pre- and post-instruction voice samples.

Results: Descriptive analysis of the results of these measures will be presented in this poster to describe the physiological representation of the vocal images used.

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Evaluating the Effects of Stress Reduction Techniques and Fitzmaurice Voicework® on Physiologic Markers and Mental States Related to Performance Anxiety in Student Actors

Objective: Actors as well singers struggle to deal with the physical and psychological effects of performance anxiety. These symptoms may include shallow breathing, muscular tensions, loss of focus and memory, and recurring negative thoughts during performance. We hypothesize that a training program incorporating Fitzmaurice Voicework® and Mindfulness Based Stress Reduction may ameliorate physical signs of stress, and reduce mental anxiety around performance, thereby enhancing focus.

Methods/Design:Students in the experimental group received the Fitzmaurice Voicework® and stress reductions training over the course of two semesters; those in the control group were wait-listed. Baseline measures of heart rate, respiration, and skin conductance of all students were taken and repeated shortly before three auditions during the course of two semesters. In addition, all students completed pre and post surveys (Freiburg Mindfulness Survey, McCroskey's Personal Report of Public Speaking) to assess their levels of stress in general and before an audition.

Results:Twelve students were recruited to participate in this study, 6 in the experimental group and 6 in the control group. Analyses of pre/post surveys indicated no significant difference between the groups (p=0.81). Analyses of the Biopac physiologic measures indicated no significant difference between groups for heart rate or skin conductance. Baseline and pre-audition heart rates were atypically high for all trials. Additionally, respiratory traces indicated that most participants were using speech breathing patterns as they quietly sat during data collection, indicating that they were likely rehearsing their monologues during data collection.

Conclusions:The findings from this study did not support the initial study hypotheses; however, the finding of a high heart rate pre-audition was unexpected. Speech breathing patterns identified during quiet data collection also indicate the influence of mental rehearsal on speech breathing patterns. The physiological parameters and the questionnaires chosen may not have been sensitive enough to identify the benefits of the mindfulness based methods that were taught to the experimental group.

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Clinical Symptoms and Signs Related to Voice Disorders among Collegiate-Level Singers

Although numerous questionnaire-based studies reported a high prevalence of vocal attrition symptoms among occupational voice users, there has never been a study investigating the relationship between self-reported vocal symptoms and clinical reports among collegiate-level singers.

Objectives: 1) Characterize the demographics and vocal health history of collegiate-level singers, particularly those with a voice disorder and 2) describe self-reported symptoms of singers across diagnostic categories of vocal fold disorders.

Methods: This retrospective study reviewed clinical reports of 56 collegiate-level singers that visited the Voice Diagnostic Clinic at the University of North Texas for voice evaluations between 2010 and 2015. Information was extracted from clinical records including demographic data, vocal health history, self-reported voice-related symptoms, and voice diagnosis confirmed by strobolaryngoscopic examinations and phonatory function testing. Diagnoses of voice disorders were grouped under three categories: normal (i.e., no perceptible pathology), benign lesions and irritation/inflammation.

Results: Fifteen singers were male (26.8%) and 41 (73.2%) were female. Seven singers were diagnosed as normal, 27 (51.8%) with benign lesions, and 22 (39.3%) with irritation/inflammation. All singers diagnosed as normal were females. Female singers have twice as many benign lesions as inflammation/irritation whereas males presented the opposite pattern. Nodules, polyps, cysts and irritation/inflammation were the most common voice disorders. Singers with allergies and a past history of voice problems demonstrated a higher incidence of voice disorders. The top five self-reported vocal symptoms were worse voice in the morning (50%), pain in throat (46.4%), voice worse with prolonged use (44.6%), vocal fatigue (42.9%), and breathiness (41.1%).

Conclusions: Access to diagnostic clinics is essential to the health of collegiate-level students. Gender, allergies, and a history of voice problems are associated with prevalence of voice disorders. Self-reported symptoms are not a reliable screening tool to determine vocal pathology.

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An Introduction to Myofascial Release for Vocal Dysfunction

Myofascial release (MFR) is a manual therapy intervention available to speech and voice professionals for the treatment of a variety of vocal dysfunctions. Walt Fritz is a physical therapist who teaches MFR through his Foundations in Myofascial Release Seminars. Through this workshop participants will have the opportunity to see, feel, and hear the possibility that some vocal dysfunction may be influenced by soft tissue tightness/neural tension, and that symptoms of such may be simultaneously felt by the receiver and palpated/ treated by the intervener through the anterior neck region. The workshop will consist of a brief introduction with the majority of the time allowing participants to pair off into a supervised lab practice situation. They will explore some of the core principles of a myofascial release approach in a few of the common areas that can be affected with vocal dysfunction. Evidence-based information will be presented through handouts. Emphasis of this workshop will be to educate the participant to the possibilities of engaging issues of voice and vocal dysfunction through direct touch and manual therapy, with logical carryover into intervention. They will have ample opportunity to safely evaluate and explore the potential for the treatment of vocal dysfunction using these myofascial release principles.

Learning objectives would include:
1. Provide the participant a brief overview of the Foundations Approach to myofascial release as it applies to the treatment of vocal dysfunction
2. Provide evidence for myofascial release/manual therapy with vocal dysfunction
3. Provide the participant opportunities to explore evaluation and treatment of vocal dysfunction via hands-on experience using the core principles of the Foundations Approach to myofascial release

Walt Fritz, PT, BS. Physical Therapist at Pain Relief Center (Rochester, NY) and Foundations in Myofascial Release Seminars

The Telephone Voice: Development of a Voice Talent's Voice Automation Repertoire

Objective: To train and raise awareness in voice talent of the variety of vocal styles in voicing telephony (IVR or Interactive Voice Response) and automation platforms; styles driven by market trends, current speech affectations, client vision, and cultural influences.

Methods: In this workshop, voice professional Allison Smith – CEO of The IVR Voice.com – will guide participants using actual scripts from existing phone systems she has voiced, in an exploration of the various styles called upon to create audio for telephone systems. Participants will have a chance to cold-read an IVR script, and then modify their approach and vocal treatment using Allison Smith's coaching and direction.

Results: Participants will gain a firm understanding that many factors "drive" the direction of the phone systems mood, feel, and ultimately its usability: will the company/client require a more traditional cold, emotion-free automaton, or perhaps a friendly, conversational personality which better suits the industry or the direction of the company or reflects more modern tastes?

Conclusions: The effectiveness and ease of use of an automated telephone system is largely influenced by the recorded human voice which a caller hears. The degree to which callers engage with a voice can influence the public's perception of the company; the voice actor's ability to deliver a style which is suitable to the client's industry -- and adaptable to various client's visions – demands versatility and adaptability in the voice actor.

Allison Smith, BFA, CEO: The IVR Voice.com, Calgary, Alberta, Canada

Treating Athletes with Exercise Induced PVFM

Exercise-induced shortness of breath and stridor stemming from abnormal movement of laryngeal structures are common in athletes and often misdiagnosed as asthma. Patients are routinely referred to Speech Pathologists for diagnosis and treatment of this disorder. Paradoxical Vocal Fold Motion (PVFM), Supraglottic Airway Collapse and Muscle Tension Dyspnea are common causes of this type of shortness of breath. Once the correct diagnosis is achieved, the majority of patients respond very well to a short course of Respiratory and Laryngeal Control Therapy. Outcomes of therapy result in symptom resolution and allows patients to resume participation in organized competitive sports without handicap from poor breathing. This workshop will focus on specific breathing and laryngeal exercises specifically developed to manage symptoms. This therapeutic approach goes beyond the basics (such as establishment of abdominal breathing and slow nasal breath). Implementation of this therapeutic program ultimately restores normal laryngeal activity, until a complete resolution of the condition is achieved. Attendees to the workshop are expected to have basic knowledge of paradoxical vocal fold movement. There will be hands-on practice.

Topics include:
- Identification of inefficient breathing patterns and Muscle Tension Dyspnea
- Development of advanced breathing control practices, with the use of respiratory ratios, progressive slow breathing, modification of air-hunger threshold
- Development of glottic control practices
- Modifications to use by patients with exercise-induced symptomatology

Claudio F. Milstein, PhD, Director, The Voice Center, Associate Professor of Otolaryngology, Cleveland Clinic Lerner College of Medicine, Head and Neck Institute, Cleveland Clinic, 9500 Euclid Ave - Desk A-71, Cleveland, Ohio 44195

Country Singing for Musical Theatre 101

Today Broadway musicals are written in and encompass a plethora of styles including country as seen in Broadway productions like *Bright Star, Big River, Best Little Whorehouse In Texas,* and the recent studio recording of *The Robber Bridegroom*. There is an increasing interest in and demand for singers trained in a wide variety of music styles. Because of these demands, singers need flexibility to switch between vocal registers making different interior shapes to allow changes in the resonance to serve the song style. The Country style of singing cannot be left out of vocal training of musical theatre singers.

Country Singing for Musical Theatre 101 uses a hands-on and skill-building delivery style, interacting with participants and working with musical theatre singers to examine specific ways to present their song in the country style.

As a group participants will experiment with exercises for laryngeal flexibility and singing in the country style. Through vocal exercises and country "vocal stylisms", such as cry, yodel, various slides, bent notes, tails, etc., this workshop is designed to enhance skills of professional performers and to train students of musical theatre. Participants of Country Singing for Musical Theatre 101 will leave with tools to use in the classroom, studio setting, auditions and the professional stage to help bring a song to life vocally in the country style.

Edrie Means Weekly, BME, MM, Associate Professor of Voice and Vocal Pedagogy, Contemporary Commercial Music Vocal Pedagogy Institute, Co-Founder, Shenandoah University and Conservatory of Music, 1460 University Ave., Winchester, VA 22601

Energy Tapping Techniques in the Voice Studio

Two techniques, Thought Field Therapy (TFT) and Emotional Freedom Techniques (EFT), claim to alter physical 'energy fields' using acupressure points and eye movement. Advocates claim that these techniques can cure emotional trauma, phobias, cravings and even physical pain from headaches to fibromyalgia all in under eight minutes and in as little as 30 seconds.

TFT and EFT, in addition to EMDR ((Eye Movement Desensitization and Reprocessing) have proven to be useful in the voice studio to relieve emotional distress, performance anxiety, long-standing emotional trauma (at least temporarily), phobias of all descriptions, and headaches.

I have been using these techniques successfully for 26 years and although I do not profess to understand the mechanism of why this approach works, my students and I continue to be stunned by its efficacy.

In this interactive workshop, I plan to demonstrate, using participants, the tapping sequences of both TFT & EFT and show several EMDR patterns for various challenges which can rise in the course of any private voice lesson or group voice workshop. The techniques are simple to learn and can be easily taught to singers and actors to enhance their learning and performance skills.

Lisa Popeil, MFA in Voice, Voiceworks®

Inverse Filtering

The voice source, i.e. the pulsating glottal airflow, is a main contributor to voice timbre. It is controlled by the breathing apparatus and laryngeal muscles and so has a direct relevance to vocal pedagogy and health. It can be studied by inverse filtering.

This workshop will demonstrate voice source analysis. Participants will be offered the possibility to observe their voice source in real time, so as to see how it changes when tone production is changed e.g., from hypofunctional to hyperfunctional. Also software for voice source analysis will be demonstrated.

Johan Sundberg, PhD, Professor in Musical Acoustics, KTH, Royal Institute of Technology, Dept. of Speech, Music and Hearing, Lindstedtsv. 24, SE-10044 , Stockholm, Sweden

Brian P. Gill, DMA, Certificate of Vocology, Associate Professor of Voice and Voice Pedagogy, Jacobs School of Music, Indiana University

Relaxation and Visualization Techniques for Voice and Swallowing Problems

This workshop will be an experiential exploration of relaxation and visualization for use in the therapy setting for a variety of voice and swallowing problems. There will be three parts to the presentation. Part 1 will be a brief explanation of the differences between, relaxation, meditation, self-hypnosis, guided meditation and visualization. The audience will participate in a basic relaxation and visualization induction The second part of the presentation will be addressing specific problems, such as muscle tension, air flow, breathing techniques, pain and fear or anxiety issues involved in voice use or swallowing. There will be a patient with Spasmodic Dysphonia who successfully uses her relaxation techniques for her BoTox injections, swallowing liquids following BoTox, and not "pushing" or straining her voice. The workshop participants will try techniques for decreasing pain; "rehearsal" for anxiety; and utilization of prep sets for swallowing sequences. The third part of the presentation will be addressing any specific questions or problems as to how these techniques can enhance any therapy process. These would include treatment for paradoxical vocal fold disorder, vocal fold paralysis, spasmodic dysphonia, muscle tension dysphonia, oral, pharyngeal and esophageal swallowing dysfunctions, as well as neurological voice and swallowing disorders. Resources for getting training in these techniques will be provided. The caveats for having full medical work-ups, addressing issues only within our scope of practice, and referring to other professionals will be stressed.

Adeline R. Schultz, AB, M.Ed, CCC-SLP/L, BCS-S, Speech-Language Pathologist, Voice and Swallowing Center and Rehabilitation Medicine, Thomas Jefferson University Hospital

Real-Time Visual Feedback of Vocal Fold Contact

Objective: Phonation can be highly variable across the voice range, which poses a challenge when we try to analyze voices in a representative way. To cope with this inherent variability, it would help to have a tool that automatically identifies different regimes of phonation.

Methods/Design: A prototype system displays in real time how the electroglottographic (EGG) waveshape varies across the voice range. The system 'learns' and categorizes incoming or recorded EGG pulses; or, classifies them into previously learned categories. Several modes of visual feedback of the EGG pulse shape are given, including a multicolored voice range profile plot from soft-to-loud and low-to-high. The required hardware is an electroglottograph, a good microphone, a high-end audio interface, and a fast computer. The software, called FonaDyn, is freeware that runs on Windows or MacOS. For research work, all outputs of FonaDyn can be exported to files of text or of multichannel time-series. Technically, the categorization is based on data-driven statistical clustering of spectral features of every EGG cycle, normalized in both duration and amplitude. Hence it is blind to both f_o and SPL – only the shape of the EGG matters.

By training FonaDyn on different signals, the user can explore the effect of arbitrary conditions on vocal fold contact; for example, changing vocal register, the acoustic load (semi-occlusion or vowel), or the volitional posturing of the larynx or of the respiratory system. The classification feature makes it possible to make comparisons pre-post intervention or inter-subject. Also, the system tracks the instability of phonation, so as to identify phonatory incidents such as voice breaks.

Results/Conclusions: Does it work? Please come and try it, electrodes on, and see for yourself. We are eager to discuss how this approach might be of interest to voice teachers and clinicians.

Sten Ternström, PhD, MSc, Professor of Music Acoustics, KTH Royal Institute of Technology, Stockholm, Sweden

Heightening Vocal Physiology Using Diaphragm Training

The trademarked system called Diaphragm Target Training, uses vocal warm-ups with body position awareness and applied techniques. This system is a subset of BreathingRx for Singers program. The program offers a holistic and comprehensive approach to improving vocal strength safely.

Once a client has incorporated the BreathingRx methodology into their daily practice their whole physiology changes, enabling increased vocal power and flexibility more safely than with traditional methodologies alone.

Come listen and try the system for yourself.

In the workshop we will cover:

- Defining the Maximum Performance of the Diaphragm
- The Medical Studies That Support the Work
- Demonstrated Student Results
- Doing the Basic Exercises (Hands on participation)

Steven Flam uses passion and years of teaching experience to reveal the BreathingRx Methodology in this 60-minute workshop. This work is the result of a 40-year collaboration with Metropolitan Opera Principle Singer and Star- Atarah Hazzan. The methodology incorporates the breakthrough research on the diaphragm discovered by Carl Stough, with applied elements of Feldenkrais and Dr. Milton Trager. It may change your whole paradigm and thinking about breath support. Thousands have benefited from these techniques and still today they are groundbreaking.

About the Presenter:
Steven Flam is a seasoned professional who has traveled the world teaching his ground-breaking methodology to voice teachers, singers, speakers, and actors. Based today in New York City, Steven is a frequent presenter throughout the city where he helps participants find their authentic voice. Through his work, students are able to stretch their potential while keeping their vocal instruments healthy. His work has been accepted and received in, Sibileus Academy; The Finnish Voice Teacher's Association; The Canadian Voice Care Foundation; and various hospital and medical respiratory units worldwide. His revolutionary work has earned him the title: *"The Wizard of Breath".*

Steven Flam, BreathingRx.com, Voice Foundation, NATS, NYSTA

Samba-Enredo Experience: Specific Voice Approach for a Specific and Challenged Vocal Demand

Introduction: during the Brazilian Carnival, parades are performed by thousands of individuals organized in samba schools. It is like a team competition and each samba school tries to outdo each other, both in terms of extravagant costumes, dance, choreography and music. The thematic nature of the carnival samba parades also led to the invention of yet another type of samba named samba-enredo that basically represents a song composed specifically to be played during the parade.

Each samba school has a lead singer whose mission is to interpret the same samba-enredo, for almost two hours, without rest or pauses, under a very loud musical accompaniment. Further on many attributions that any singer must have, the leading singer must thrill the audience with huge loud voice, screams, vocal drives and a lot of energy to execute the choreography.

Objective: to make all workshop participants understand the needs of a samba-enredo singer; practice loud voice callings and singing; sing a samba-enredo.

Method: the authors will present samba-enredo videos and audios for the audience. Some voice exercises will be performed to train the audience about the loudness required. Some dynamic exercises will be proposed to the audience to experience the samba-enredo singing.

Thays Vaiano, MD, Speech Pathologist, CEV, UNIFESP

Mara Behlau, PhD, Speech Pathologist, CEV, UNIFESP

Jazz Training and Vocal Function

Objective: To demonstrate low volume singing at the prosody of speech in order to gain the vocal function necessary to accomplish the quick, rhythmic demands of traditional swing-style jazz. Since jazz ballad singing also requires the ability to interpret lyrics improvisationally and at the same rate as speech,this teaching method also avails itself to working on phrasing for all tempos of music.

Methods: In this workshop I will demonstrate a method of interval training for muscle specificity. Standard jazz literature is inherently rich with diverse intervals sung from note to note, and by taking a very short passage from a song, a vocal exercise can be created and used to address any number of functional voice issues in the moment. Figure 1 (below) is measure 22 of the song *Skylark* by Johnny Mercer and Hoagy Carmichael (1941). In this measure the singer performs a minor 3rd, whole step, tritone, and major 4th. This becomes a vocal exercise when moved up and down by half steps, sung on only vowels, sung on nonsense syllables, and then returned to the original lyric and appropriate key for the singer. A singer can also practice complex harmonic awareness by playing the bass note of each chord against the corresponding melody note with very little piano training. (See intervals in red.)

Results/Conclusions: Jazz-style singing is an effective tool for training healthy vocal function and musicianship that can be mapped onto other styles of contemporary music. Jazz encourages vocal fold flexibility, airflow management, diction practice, and musicianship. It can be used as a training modality in which to address functional issues and can help get a voice "up and running" while simultaneously training the brain to practice unfamiliar intervallic and harmonic structures.

Figure 1. Measure 22 of *Skylark*.
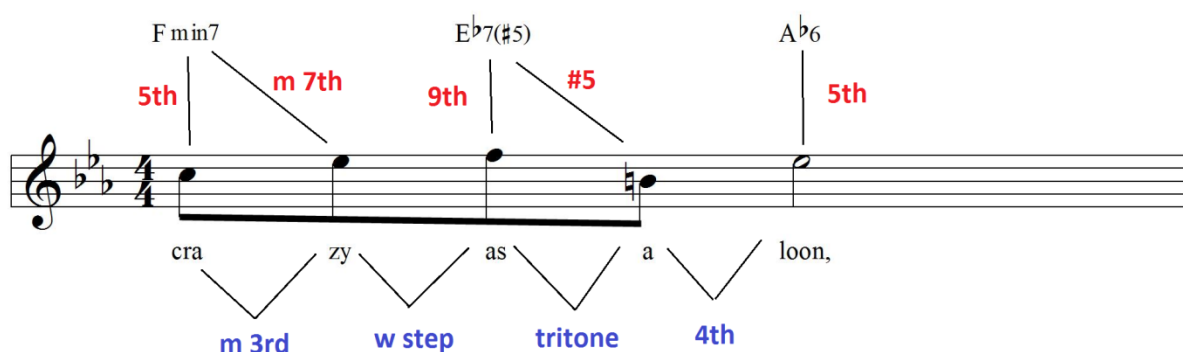
Elizabeth Johnson Schafer, MM, Certificate of Vocology, Voice Instructor, Nashville Jazz Workshop, and Love Revolution Vocal Studio, Nashville, TN

The Vocal Warm-Up, Research Based Techniques for Group Lessons or Choirs

When teaching group voice lessons or rehearsing a choir, the vocal warm-up can either make or break the rest of the rehearsal. Limited rehearsal time often equals less time for the warm-up segment. This in turn, may result in decreased time to activate the necessary musculature critical for healthy singing.

Objective: This workshop will consist of two segments: (1) collaboratively identifying the purpose and the goals of the vocal warm-up and (2) participating in varied vocal warm-up procedures.

Segment One
Drawing from personal and professional experiences, participants will identify the purpose and goals of a warm-up. Discussion topics will include the physical, psychological, and musical benefits of a vocal warm-up.

Segment Two
Utilizing research-based warm-up strategies, workshop attendees will participate in five separate warm–up segments, with each segment followed by a group singing activity. These warm-up strategies will include strictly physical, strictly vocal, combined physical and vocal, individual, and a cappella warm-up segments. Following the warm-up segments, all participants will rank the five warm-up strategies according to which warm-up they felt was most efficient in preparing their voice for singing. Results from the poll will be immediately available to all participants.
Also included in segment two will be interactive warm-up "games" for younger singers.

All workshop attendees will receive a reference list of the warm-up segments used during the session.

Sheri Cook-Cunningham, PhD, Assistant Professor of Music Education, University of Central Arkansas

Melissa Grady, PhD, Assistant Professor of Music Education, Kansas University

Whole Body Resonance: An Expansion of Resonant Voice Therapy

Lessac, Madsen and Verdolini have pioneered our understanding of Resonant Voice Therapy and created the foundation for many voice professionals working to improve vocal production. Traditionally, oropharyngeal resonance is the primary sensory effect that patients are instructed to experience. For many professional voice users, the experience of *whole body* resonance, or, experiencing sound somewhere *other* than the traditional "mask resonance" is an empowering way to connect body, breath and sound. By combining traditional therapeutic modalities and voice pedagogy with chants associated with the physical and energetic centers in the body (known as the chakra system), this workshop will provide an introduction to whole body resonance exercises and practical methods for applying these techniques in the voice studio or clinic.

Carly Bergey, MA, CCC-SLP, Speech Language Pathologist, Bethlehem ENT 3445 High Point Blvd Suite 400

Megan Durham, MM, SVS, RYT-200, Lehigh University, DeSales University & Moravian College Voice Faculty, Affiliate of Bethlehem, ENT

Characters in Your Pocket: An Easy Exploration of Character through Roy Hart's 4 Voices

Using only a piano and the willing participation of the audience, we will use the exercise of the Four Voices, as developed by the progenitor of Roy Hart Theatre, Alfred Wolfsohn, to discover the characters we can easily access with strain or damage to our voices.

Many people associate Roy Hart Theatre voice work with singing, primarily. However, in the newly-burgeoning markets of online gaming, audiobook recording, in addition to more traditional areas of use (Pop Music, musical theatre, classical theatre), a greater variety of human voice sounds are being explored for character work.

A very common example: a voice actor can be asked to create moans, screams and torture response sounds for hours in order to voice a video game. To do this without damaging the vocal instrument is a challenge for many performers.

Using one of the basic exercises of Roy Hart Theatre technique, the Four Voices exercise, the participants of this workshop will expand their range of expression with ease and from their own sense of curiosity and play. They will be given basic tools to increase the plasticity of their sound, find the "game" of the character and work from an embodied whole sense of vocal production, focusing on both sensation and image.

All attendees will be invited to participate.

Amy Chaffee, MFA, BFA, Certified Fitzmaurice Associate Teacher, Lecturer – University of California – Los Angeles, School of Theatre, Film and Television, VASTA, ATHE, PAVA

Voice Training in Trans Men: How to Facilitate the Transition of a Changing Voice

Objective: Sixty-four percent of transmasculine participants studied by Scheidt and colleagues (2004) requested professional support for voice problems that developed with Testosterone Hormone Therapy (THT). Yet for some speech-language pathologists (SLP) and singing teachers (ST), providing voice training to this population is uncharted territory. The purpose of this workshop is to demonstrate and practice pedagogical approaches for developing the transmasculine speaking and singing voice.

Methods/Design: This interactive workshop will utilize discussion, audio recordings, and live demonstration to advance the knowledge and skills of attendees regarding their role in facilitating the vocal transition of trans men. The following workshop schedule is proposed: (1) review changes in laryngeal structure and function with THT and describe THT-related vocal deficits identified in the literature and from practical experience; (2) teach physiologically-based vocal techniques to address vocal deficits and listen to examples of voice training sessions; (3) outline a protocol for speaking and singing voice training; (4) provide a live demonstration of SLP and ST using vocal techniques with a trans man; (5) engage attendees in discussion about their experiences in facilitating the vocal transition of trans men.

Results: Workshop attendees will gain knowledge about voice changes that occur with THT. They will add to their inventory of pedagogical approaches for facilitating the vocal transition of trans men, and leave with a voice training protocol. Finally, attendees will be able to ask questions of the SLP and ST during a demonstration of voice training with a trans man. Audio recordings will be reviewed as well, and a written handout will be provided.

Conclusion: Given that THT can cause negative voice changes, this evidence-based interactive workshop will develop the knowledge and skills of the SLP and ST to work with trans men who request voice services as part of their gender transition.

Aaron Ziegler, PhD, MA, BFA, CCC-SLP, Assistant Professor, Department of Otolaryngology-HNS, Speech-Language Pathologist and Singing Voice Specialist, NW Center for Voice & Swallowing, Oregon Health & Science University, 3181 S.W. Sam Jackson Park Road, SJH01, Portland, OR 97239-3098

Ruth Rainero, MA, BFA, Founder and Teacher, Speak Out! Communication Skills, 1249 7th Avenue, San Francisco, CA 94122

Estill Voice Training: Quick Fixes, Long Term Solutions

Estill Voice Training[TM] (EVT) is an innovative system for teaching voice developed by Jo Estill that integrates pioneering scientific research with the artistic study of voice. The purpose of this workshop is to demonstrate select Figures for Voice and apply them to challenges encountered in the voice studio and clinic. The Figures are unique exercises that address power, source, and filter properties of voice production, and include: False Vocal Fold retraction for healthy voice production; Aryepiglottic Sphincter narrowing for twang resonance in opera, belting, & the rehabilitation of hypofunctional voice disorders; and, Torso and Head/Neck Anchor for stability and support. The presenters have over 30 years of experience integrating EVT into training and treatment of voice and will share the most common Figures that have enhanced the voice of the elite performer as well as restored the injured voice of the teacher. Workshop participants will have the opportunity to produce the Figures, describe the underlying anatomy and physiology, and apply them to drama, music, or voice therapy. Participants are encouraged to volunteer their voices, teaching and/or therapy challenges during the session.

Kimberly Steinhauer, PhD, President, Estill Voice International, Head of Voice, Point Park University, Estill Voice International, 55 Standish Blvd, Pittsburgh, PA 15228

Joan Lader, MA, Voice Coach

Mary McDonald Klimek, MM, MS, CCC-SLP, Vice President, Estill Voice International

The Singing Teacher's Guide to Transgender Voices

It is our experience that many voice teachers do not feel fully prepared to train the singing voices of transgender individuals. Voice training for transgender individuals requires a refined knowledge of the changes that occur both physically and physiologically during transition and demands the use of effective and appropriate language.

Objective: To aid in the development of a successful vocal pedagogy for the training of transgender singers, help the academic community understand the needs of transgender students as it pertains to vocal training, and engage the education community in a broader discussion on the presence of transgender students in classes and how this will affect teaching, curriculum and classroom environment.

Method: This masterclass style workshop will address the differences necessary for training transgender and gender nonconforming singers as well as singing training through medical transition and hormone treatment and creating realistic expectations for training trans singers.

We will also give information about creating a trans-affirming voice studio by discussing transgender-specific terminology, the concept of sex v. gender, the correct use of pronouns and names, what it means to "out" a student, how to take a student history, the concept of masculine and feminine sound, identifying voice type, how to select repertoire, and more.

Conclusion: As transgender individuals gain more visibility, we have a responsibility to prepare singing teachers and voice care teams to serve the transgender communities and help them find their voice.

Brian Kremer, BFA, MM, Assistant Professor of Voice and Music Theatre, Elon University

Liz Jackson Hearns, BA, MM, Owner and Voice Instructor, The Voice Lab, Inc; Executive Director, ResonaTe Trans Voice Center

The Art and Science of Training Resonance, Laughter, Coughing and Throat Clearing with Transgender and Gender Non-Conforming Clients

The nuancing of resonance in vocal modification for transgender clients might be described as the spice in the soup of voice feminization and masculinization. It is the aspect of modification that arguably gives each client their most personal sound, and requires the melding of scientific, clinical and artistic approaches that allow for the development of this sound with confidence.

 Equally, learning how to laugh, cough and clear one's throat reliably and honestly, while maintaining an achieved pitch, intonation and resonance congruent with a person's gender identity, requires a marriage of unique artistic and clinical tools. This workshop will provide participants with hands-on techniques for teaching resonance and "vegetative sounds", as well as a set of specific acoustic solutions to numerous resonance puzzles that face transgender clients.

It is assumed that participants will have some experience working with transgender clients, but the workshop will provide voice clinicians of all levels with creative, fresh, thought-provoking, functional approaches to solving these puzzles. Participants will take home materials that they will be able to put to immediate use.

Sandy Hirsch, MS, CCC/SLP, Clinician/Sole proprietor, Give Voice, 819 31st Avenue, Seattle, WA 98122

How We Do It: Using Principles of the Semi-Occluded Vocal Tract in Voice Therapy

Abstract: There is a long history of using semi-occluded vocal tract principals in voice therapy. We have used such techniques as: forward focus/back focus, mask, resonant voice, vocal unloading, twang, /ol/ buzz, and basic training gestures. The SOVT posture offers many benefits including facilitating more efficient and economic phonation. Examples of current voice therapy techniques using SOVT will be demonstrated for the audience. This hands-on workshop will cover SOVT techniques from 1975-present and allow participants to learn and practice these techniques.

Joseph Stemple, PhD, CCC-SLP, ASHA-F, Professor, University of Kentucky

JoAnna Sloggy, MA, CCC-SLP, Speech-Language Pathologist/Singing Voice Specialist, University of Kentucky Voice & Swallow Clinic

Heather Lyle's Vocal Yoga Method® Workshop

Overview: Teachers of acting, public speaking and singing have to try to find ways to get their students to realize their full, vocal potentials but many find that their students are too bound up with tension throughout their bodies to deeply diaphragmatically breath and proprioceptively feel the correct muscles engaging within their bodies for vocal support. Heather Lyle, the author of *Vocal Yoga, the Joy of Breathing, Singing and Sounding* and creator of Vocal Yoga® is a certified yoga teacher who teaches in India as well as the US. Vocal Yoga® came about through Lyle's study of the autonomic nervous system and the affect of fight or flight on the body and voice. The human body is a matrix of tension put on by the reactions of the sympathetic nervous system. Lyle's combined training in singing, theatre voice, yoga asanas, human anatomy, anatomy trains and vocology led her to explore somatic ways to undo body armor that affects the voice. She discovered that by combining the calling types of voice use used by yogis with specific stretches of muscle groups that are known to be instrumental in breathing and sounding, there was an immediate improvement in the voice.

Objective: To first introduce the singer or speaker to the fight or flight muscles that may be hindering vocal expression. Secondly, to break down ineffectual habits of vocal support and powering of the voice and reintroduce the body to a more natural, integrated way of supporting sound. Thirdly, to increase proprioception of the muscles that naturally power the voice.

Method: This participatory workshop uses specific yoga postures and stretches of myofascial anatomy trains (lines of connective tissue) that target all the different parts of the body that can affect the voice. Some of the postures are partner exercises and some are solo work. Each exercise stretches and releases muscle fibers until the myofascial connective tissue is released. When this occurs it helps to realign any disorganized fibers within the body and the practitioner breathes and sounds freer. One interesting myofascial train targeted is the direct connection of the tongue to the big toe! By adding strong sounds while stretching within the poses, the practitioner is able to feel and hear an instantaneous change in the voice and an immediate connection of what needs to be free and what needs to activate in the body for vocal freedom. Unnecessary muscles of the torso that the speaker or singer habitually activates for support are released as well as unconscious fight or flight holding patterns and the body finds a more natural, integrated way of supporting sound.

Results: There is a measurable increase in loudness, a measurable increase in resonance and an increase in the participant's proprioception of the muscles used in breathing and support for the voice. After a Vocal Yoga® workshop the participant will have more flexibility in his or her torso and an awareness of the available depth and power of the voice as well as an awareness of where he or she tends to unconsciously armor the body. He or she will be able to release holding patterns and feel which specific muscles naturally and healthfully engage when calling out and the ability to know how to reconnect with those muscles when needed.

Conclusion: The participant will leave with a newfound view of his or her body and have valuable yoga exercises to integrate into a personal, vocal warmup.

Heather Lyle, MM, Founder The Heather Lyle Vocal Yoga Method® Adjunct Faculty, USC

Warming Up with Reflux: An Evidence Based Approach

Introduction: Laryngopharyngeal Reflux (LPR) is a prevalent vocal pathology, affecting anywhere from 20-40% of the population. Anecdotal evidence suggests that as many as 75% patients with voice complaints are present with LPR. Singers with LPR often experience dysphonia, pitch breaks, poor voice quality in the morning, prolonged warm-up time and loss of range. In order to address the vocal fold edema and voice symptoms associated with LPR, a systematic approach of vocal exercises is needed.

Method/Design: A series of evidence-based vocal warm-up exercises will be presented in an experiential workshop. The warm-up regimen is specifically designed for the unique challenges of voice production following a recent reflux event or ongoing LPR. Together we will explore a simple way to identify problem areas in the range and then implement a variety of targeted Semi-occluded vocal tract exercises. Participants will have the opportunity to both observe and experience efficient vocal function. In addition, we will discuss recent evidence supporting the efficacy of high pH water in the management of LPR. Thus, a comprehensive, theory-driven, evidence-based approach is presented.

Results/Conclusion: Participants will walk away with strategies to not only warm-up efficiently, but troubleshoot when experiencing reflux symptomology while singing. The concepts are then easily applied for the performer and singing voice teacher.

Kathleen Bell, DMA Candidate, Shenandoah University and Adjunct Instructor of Voice, Mary Baldwin University, 101 E. Frederick Street, Staunton, VA 24401

Resonance/Consonants

Thanks to a clearer understanding of the roles played by vowel formants, voice students are finding an easier path to balanced resonance. This workshop will focus on building awareness of the influence of consonants on the resonant vocal tract (and vice versa), featuring

- Simple distinctions in the kinesthetic perception of alternating and direct current as manifest in voiced/fricative/plosive consonants

- A more nuanced alignment of consonant shape with resonant vowel (including the transition between vowels as syllables change)

- Identification of a degree of second formant resonance required by fricative sounds, and corresponding strategies to either minimize or recalibrate that diction element in order to subsequently achieve a balanced, resonant vowel throughout the vocal range

The incorporation of these consonant-derived concepts into resonance strategies is quickly adapted and habituated by students beginning their classical training at the college level, as well as providing a direct and often heartbreakingly simple solution to an advanced professional's inexplicably problematic passages. Participants will improve consonant resonance in the context of specifically designed vocalises, as well as in prepared repertoire.

Julia Bentley, MM, Artist Diploma in Vocal Performance, Assistant Teaching Professor, Voice and Voice Pedagogy, The University of Missouri – Columbia

Embodying Breath, Voice and Speech through Physical Action

Objective: The development of a working definition of *integration*, that transcends cursory and superficial discussions of release, ease and freedom, rooted in the exploration of physical action.

A theoretical overview and experiential anatomy lesson exploring the moving, breathing, sounding and speaking *centers* and *spaces* of the body.

Increased awareness of the shared physical sensations that make moving, breathing, sounding and speaking possible—*charge/release, contact/withdraw, expand/contract* and *center/periphery*.

Integration of the moving, breathing, sounding and speaking *centers* and *spaces*.

Methods/Design: Participants will explore how the physical sensations of a pelvic centered, *weight-shift* informs a corresponding *breath-shift*, which informs a corresponding *sound-shift*, which informs a corresponding *speech-shift* in the integrated expression of thought and feeling. Rocking, swinging and circling actions in the pelvis will be integrated with sighing, hissing, buzzing, sounding and speaking actions in an experiential exploration of the shared physical sensations that make the expression of thought and feeling possible.

Results and Conclusions: Moving, breathing, sounding and speaking are all physical actions and share a common and relational sensory pattern that can be felt, sensed and structured in the body of the speaker.

Michael Lugering, MFA, Professor UNLV, Founding Director Expressive Actor

Griffin Stanton-Ameisen, MFA, Artistic Director, Revolution Shakespeare, Expressive Actor

Conversation Training Therapy

Conversation Training Therapy (CTT) is a novel voice therapy program developed by a team of expert voice-specialized speech-language pathologists. CTT is the first voice therapy program designed without the use of a traditional therapeutic hierarchy, and that uses patient-led conversations as the sole therapeutic stimulus. A main goal of CTT is to reach therapeutic success, defined as functional voice use in conversation, in *no more than 4 sessions.*

CTT represents a necessary evolution in voice therapy. Despite being the standard-of-care for many of the nearly 140 million people in the United States who suffer from voice disorders, patients claim that current therapies are ineffective at meeting their voice needs. Specifically, data indicate that transfer of target voice techniques to conversation is the most difficult aspect of therapy, and that training techniques in conversation is the most useful aspect of voice therapy. However, traditional voice therapy programs spend little, if any, time training voice techniques in conversation. Instead, traditional voice therapy programs build skills in hierarchical (i.e. from simple to complex), non-functional (i.e. not in conversation) ways that violate principles of motor learning and neuroplasticity, and deter skill learning and retention. This lack of functional specificity in voice therapy may contribute to the estimated 65% attrition rate. In addition, in hierarchical approaches, patients require a protracted time in treatment, costing them personal and healthcare dollars.

The goals of this workshop are to introduce the audience to the theoretical and practical tenets of CTT through hands-on practice and viewing of patient videos that focus on the "aha!" moments of CTT, where patients realize their ability to control their voice production all within the context of conversation. Further, results of an ongoing NIH-funded trial investigating efficacy of CTT in treating patients with lesions and MTD will be revealed.

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Manual Mimicry in Vocal Pedagogy: Exploring Embodiment and Entrainment in the Teaching and Learning of Speech Sounds for Singing

The use of physical gesture is an established practice in the teaching of singing. Vocal pedagogues, including voice teachers and choral conductors, regularly apply gestures 1) to mimic the physical actions and orientations of the vocal apparatus, and 2) to model a desired musical idea, such as a phrase shape, text stress, or articulation. Physical gesturing informs student learning from a dual perspective, providing a visual and a kinesthetic representation for sound, while also supporting retention.

This workshop explores a theoretical framework for the use of manual mimicry in the voice studio and choral rehearsal, based on the principle of phonomimesis, as represented in the Theory of Entrained Manual and Speech Systems (TEMMS) and Dalcroze Eurhythmics. Manual Mimicry adopts principles of embodiment and entrainment to teach articulatory facility and expressive use of text. Participants will experiment with the use of manual gestures to mimic specific vowels and consonant sounds, including the timing of vocal articulation, and prosodic stress. Parallels to the use of hand movements that are spatiotemporally analogous to speech movements in the treatment of speech sound errors will be made. Implications for the use of gestural "self-cuing" in vocal practice will also be discussed.

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Connecting to the Negro Spiritual: Emotionally, Musically and Vocally

The arranged Negro spiritual has become iconic in the world of classical music. It sends messages that are significant today: they speak of experiences that are of value to the human community. This music genre holds historical, cultural, sociological and developmental meanings. Negro spirituals originated in America's "Deep South" among the African slave communities of the 18th century. A real part of communal life is the very sound of music. Negro spirituals speak of life and death, suffering and sorrow, love and judgment, grace and hope, justice and mercy. They express the joy and celebration of Christian faith, and were crucial to the success of the Underground Railroad. Although the Negro spiritual was created in the African-American culture, the spiritual is considered a national treasure. Their texts and rich music texture have no racial specificity; especially in terms of who can sing them. Singing a spiritual is more than singing notes and lyrics. The singer must include expression, emotion and storytelling.

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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The Flow Ball: Promoting Visual Feedback with a Semi-Occluded Vocal Tract

Objective: The flow ball is a device constituted by a squared plastic tube that connects to a plastic basket with a narrow passage. The latter has a hole in the middle through which exhaled air passes, e.g. during phonation. This lifts a small polystyrene ball seating in the basket, which thus provides real-time visual feedback of airflow used for phonation.

Method: This workshop will provide an opportunity for participants to use this tool and its possible applications in learning singing and improving phonation habits. Singers and singing teachers will be invited to bring a song/ aria and experiment the benefits of using this tool in order to overcome difficulties in certain passages of the repertoire and practice specific isotonic and isometric exercises using the flow ball.

Results: The airflow in different types of phonation can be visualized. In other words, the flow ball can be a useful tool for training singers providing kinesthetic as well as visual feedback of flow, generally regarded as a key element for vocal efficiency since flow reflects the combination of subglottal and glottal adduction.

Conclusions: The control of ball height encourages the singer to optimize the relation between glottal adduction and subglottal pressure at different pitches and degrees of vocal loudness, thus promoting awareness of the importance of glottal adduction in singing.

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Pediatric Voice Therapy: Making It Fun

Pediatric voice clients are often perceived as intimidating, as they inherently present with specific challenges that are not encountered within the adult population. Specifically, pediatric voice clientele are labeled as lacking both self awareness of their voice disorders and the ability to self-regulate phonotraumatic voice behaviors. Additionally, children frequently display difficulty with adapting to new vocal techniques, patterns of voice use, and/or implementing voice therapy exercises appropriately. However, studies have shown that, when given the appropriate language to use, children do recognize their vocal disturbances and can explain the effects they are causing, lending to a positive prognosis for change. In the past, pediatric voice disorders of a benign etiology have often been ignored, expected to resolve following puberty. However, recent research has shown that many of these benign lesions left untreated follow children through puberty into adulthood and may potentially cause a lifetime of dysphonia. Therefore, we as clinicians need to understand how to appropriately structure a voice therapy session for a child: how to explain vocal hygiene in pediatric terminology, how to make exercises functional to a child's active lifestyle, and most importantly… how to make it FUN!

This workshop will cover how to discuss vocal hygiene recommendations with both child and caregiver, demonstrate modifications to traditional voice exercises that have been adapted for pediatric clients, and introduce exercises for carry over into functional voicing for the child's daily activities of living. Specific exercise techniques will be taught with an emphasis on how to make the exercises fun in order to increase attention and compliance.

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Vocal Production and Proprioceptive Movement

Workshop Objective
The objective of the workshop is to instill an awareness of the function of vocal production with the use of proprioceptive movement to unlock psycho-physiological blocks.

Background
The awareness of vocal production is triggered through movement by "sensory information from certain proprioceptors (receptors in joints, tendons, muscles), particularly those in muscles and tendons used by the motor system as feedback to guide postural adjustments and control of well-practiced or semiautomatic movements such as those involved in walking." The development of one proprioceptive movement exercise for voice training involves a student executing randomly free movements (involving the legs, arms, head, torso), as he/she communicates specific words (taken from assigned contemporary and classical texts) that provoke images related to a student's proprioceptive movement patterns from childhood, adolescence, and/or young adulthood, which may have caused a student to repress certain emotional responses due to psycho-physiological blocks. Once a student is engaged in the exercise, his/her eyes are closed (but not limited to this action) as the exploration of movement and text occurs to prevent preplanned and self-conscious movements. The key to unlocking repressed emotions stems from the repetition of certain sounds in specific words through movement and rhythmic breath pulses associated with acoustic patterns, phonemic cues, consonants, and vowels. In addition, students also develop the ability to perceive the communication of language by repeating what they have comprehended with a particular word image.

Workshop
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.

Methods of Exploration
Proprioceptive Exercises with the use of consonant and vowel exploration and imagery analysis
Implementation of all the above in "text and response" in an actor-audience relationship

Workshop Requirements
Space for twenty-five to thirty participants

Tamiko Washington, MFA, Associate Professor of Theatre, Chapman University, Orange, California

Using Source-Filter Theory to Explore Timbre Variety in Popular Singing

In Contemporary Commercial Music (CCM), successful vocalists use a wide variety of vocal timbre when singing. This timbre variety is used by singers in order to enhance emotional expression and creative engagement with the music. In the context of a popular song, often, a singer's vocal color and use of timbre variety is what makes him or her compelling as an artist and immediately identifiable and appealing to audiences.

The objectives of this workshop are two-fold. First, through practical application of source-filter theory and experimentation with their own voices, participants will gain an understanding of the human singing voice's capacity for timbre variety. Second, participants will explore how a broad palette of vocal colors can be applied in CCM contexts in support of both musical and emotional goals. Vocal timbres explored will include breathy/clear, dark/bright, light/heavy, loud/quiet, high/low and various combinations of these, and additional, colors. Handouts will be provided for all participants.

The workshop will begin with a brief explanation of the vocal timbres frequently used in CCM singing. The connection between source-filter theory and vocal timbre will be emphasized and demonstrated. Participants will be given tools for exploring these timbres in their own voices and gain a greater appreciation for their own range of vocal colors. As participants experience these timbres, there will be discussion of how vocal color is typically applied in commercial singing. The last portion of the workshop will rely heavily on the active participation of attendees and challenge volunteers to use timbre variety while singing in different improvisational contexts. No prior knowledge of source-filter theory is required for this workshop and participants are not required to bring prepared musical pieces.

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Crossing Over: From Classical to Commercial and Musical Theatre Styles

This workshop will clarify some of the basic functional differences between classical, commercial, and musical theatre singing. Participants will learn about variations in respiration, phonation, resonance, and articulation. Through master class work with singers, participants will explore practical strategies to create authentic vocal production in these styles. The techniques presented can be immediately applied in the studio, are functional in nature, and not associated with any singular pedagogical approach.

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Theory and Practice: Vocal Fry as a Voice Habilitation Task for Singers

Recent public commentary has focused on the detrimental aspects of vocal fry in human speech. Indeed, perceptual studies point towards vocal fry as being an undesirable voice quality and the literature indicates that the habitual use of vocal fry in speech can be hazardous. However, voice research has shown that vocal fry has a number of physiological benefits including, but not limited to: lower subglottal pressure, decreased interarytenoid activity, and epilaryngeal narrowing. These potential benefits to voice production point to the use of vocal fry as a habilitation task for singers and has been discussed by voice researchers.[1]

This workshop will demonstrate the use of vocal fry during a voice lesson both in vocal warmups and in repertoire. It will help audience members to understand and efficiently implement such tasks in the habilitation of singers. A brief handout will be distributed to inform and educate audience members about the evidence-based rationale for using vocal fry to habilitate the singing voice.

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[1] Emerich, K., Titze, I. R., & Nix, J. (2005). "Voice Research and Technology: Application of Vocal Fry to the Training of Singers." *Journal of Singing,* 62 (1), pp. 53-59.

Getting Voices Going…in a Choral Setting

In the choral setting, providing an environment to share information on singing and develop participants' voices might be a suggested outcome addition to the music making and social interactions for a choir or vocal ensemble. Helping people connect to their individual voices might aid in management of vocal issues such as fatigue or lead to more fulfilling musicianship. It seems therefore, given the variability of voices, that addressing multiple perspective of vocal exercises and even multi-modalities of engagement would aid in common goals. In this workshop, I will demonstrate these exercises as Categories for Consideration which allow for flexible approaches while establishing consistent goals.

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