**BSc1**

## Dynamic 3D Parameters from High-Speed Laser Videoendoscopy

Objective: Vibratory asymmetry between the left and right vocal fold is a critical factor for various kinds of dysphonia. However, this asymmetry will not only manifest itself in the two dimensional space (transversal-longitudinal) that can be accessed by conventional videoendoscopy but also in the vertical component. It is therefore necessary to investigate the influence of the additional vertical information in order to adapt the established 2D parameters to new possibilities presented by 3D imaging techniques. Suitable 3D parameters are highly desirable regarding the recognition and quantification of functional disorders characterized by the absence of structural or neurologic pathologies.

Methods: By means of stereo triangulation it is possible to reconstruct the 3D coordinates of the superior vocal fold surface from 2D high-speed recordings in combination with a projected laser pattern. A Nd:YAG laser (532nm, CW) is coupled to an endoscopic projection unit generating a regular laser grid. This projection unit is attached to a standard rigid endoscope (70°). The vocal fold vibration and the projected laser grid (18x18 laser dots) are captured with a high-speed camera (KayPENTAX) at 4000 fps.

In a preliminary study, we recorded five healthy women and men (25-55 years) during sustained phonation of the vowel /i/. Dynamic 3D parameters of maximum vibrational amplitude and velocity in the vertical component were calculated at different longitudinal positions of the vocal folds.

Results and Conclusions: We will present the reconstructed 3D superior vocal fold surface and dynamic 3D parameters. Our results will be discussed and compared to existing studies with differing approaches concerning the calculation of 3D parameters.

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**BSc3**

**Relationships between Acoustic Measures of Voice and Physiologic Measures of Autonomic Arousal during a Cognitively Demanding Speech Task**

Objective: The purpose of this study was to determine the effect of a cognitively demanding task on voice quality and autonomic arousal in healthy adults.

Methods: Sixteen healthy young adults (eight females) orally read 16 sentences. Sentences contained an embedded Stroop task, in which participants were asked to say the font color of the word instead of the word text. Sentences were presented in two conditions: congruent and incongruent. In the incongruent Stroop condition, font color differed from the text shown, which represented an increase in cognitive load relative to the congruent Stroop condition, in which ink color and word text matched. Two spectral and cepstral acoustic measures (cepstral peak prominence, CPP; low-to-high spectral energy ratio, L/H ratio) and measures of autonomic arousal (skin conductance level, skin conductance response, blood pulse volume, and pulse period) were analyzed.

Results: Linear mixed effect models with condition and autonomic arousal measures accounted for 73% and 82% of the variance in the CPP and L/H data, respectively. Skin conductance response (SCR) amplitude was a significant ($p < 0.05$) predictor of both CPP and L/H ratios, whereas blood pulse volume (BPV) and SCR rise time provided differential information. BPV was a significant predictor of CPP, and SCR rise time was a significant predictor of L/H ratios.

Conclusions: Healthy young adults show changes in voice quality in continuous speech produced in a cognitively demanding condition. These effects are correlated with physiologic markers of heightened autonomic arousal, which has been shown to produce destabilizing effects in other speech motor systems. Future work will extend this work to individuals with voice disorders.

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**Movements of the Laryngeal Cartilages during Singing: A 3D Analysis on Professional Singers**

Objective: Based on electromyographic examinations, there are many theories regarding laryngeal muscle activity during singing. Nevertheless, it remains still unclear. Aim of this study was to perform - by a non-invasive technique - a detailed qualitative and descriptive 3D movement analysis of the laryngeal cartilages during singing. Main emphases were the arytenoid cartilages and the cricoid cartilage in order to develop a model explaining laryngeal muscle function. This model may serve as a basis for the comprehension of laryngeal cartilage and muscle biomechanics during singing. Hereby we hope to facilitate a better understanding of the pathophysiology of different vocal fold paralysis pattern or how voice training programs work.

Methods/design: We examined 49 professional female singers. Three HRCT scans were performed during singing F0, 1st octave and 2nd octave. The DICOM data from the scans were rendered and 3D-visualized with the software MIMICS®. By superimposition of the different 3D images, different positions of the laryngeal cartilages got visible.

Results: All laryngeal cartilages were able to visualise on 3D images. From F0 to 1st octave, the cricoid plate moves more backward, than from 1st octave to 2nd octave. From F0 to 1st octave, the arytenoid sits on the shoulder of the cricoid without rotating or rocking and tilts backward with the cricoid. From 1st octave to 2nd octave, the arytenoid rocks inwards and rotates medially. Hereby, the vocal process moves from antero-lateral to postero-inferior.

Conclusions: we conclude that from F0 to 1st octave only the contraction of the cricothyroid muscle leads to an elongation of the vocal folds. And from 1st octave to 2nd octave, the contraction of the lateral cricoarytenoid muscle leads to an additional tensioning by rotating and rocking the vocal process postero- inferior. The Thyroarytenoid muscle might be responsible for the finetuning, probably during singing over both octaves.

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**BSc8**

# Acoustic Perturbation Measures Improve with Increasing Vocal Intensity in Healthy and Pathological Voices

Objective: Instrumental measurements of jitter and shimmer at “comfortable” voice sound pressure level (SPL) are significantly influenced by differences in SPL, gender and vowel in vocally healthy adults and children. Recent work showed a jitter and shimmer reduction in sustained vowels with subjectively “loud” phonation. To date, it is unclear if similar voice SPL effects are present in pathological voices or in additional widely used acoustic parameters such as harmonics-to-noise ratio (HNR). In the present study, voice SPL effects in subjectively “soft”, “comfortable” and “loud” phonations on jitter, shimmer and HNR were investigated in subjects with and without diagnosed voice disorders.

Methods/Design: In a nested case-control study, 59 female voice patients 18–61 years of age (mean 27, SD 12.4) were matched according to approximate age and occupation with 59 vocally healthy women. Diagnoses included nodules (n=39, 66%), polyps (n=5, 9%), and muscle tension dysphonia (MTD, n=15, 25%). All participants sustained the vowel /a/ at “soft”, “comfortable”, and “loud” SPL. Voice SPL (dB SPL), F0 (Hz), jitter (%), shimmer (%) and HNR were computed from acoustic microphone recordings with Praat. Phonation level (soft/comfortable/loud), pathology (healthy/pathological) and diagnosis (nodules/polyps/MTD) effects were assessed using analyses of variance.

Results: In both healthy and patient groups, increasing loudness levels were associated with decreased jitter and shimmer, and increased HNR ($p<0.001$). Voice pathology and differential diagnosis were not linked to higher jitter and shimmer. HNR levels, however, were significantly higher in the patient versus control group in comfortable loudness. Both healthy and pathological voices exhibited a large natural variance in all instrumental measures across loudness conditions.

Conclusions: Uncontrolled voice SPL effects limit the diagnostic value of acoustic perturbation measures. Future studies could investigate whether perturbation and additional instrumental measures (cepstral peak prominence, etc.) are clinically useful outcome measures when voice SPL is adequately controlled for.

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**BSc9**

## Measurement of Vocal Fold Elongation during Singing

Objective: Singers often consult laryngologists with the expectation that information about their vocal folds will help them to make the right choice regarding their voice type. However, standard videostroboscopy does not allow an adequate assessment of the absolute laryngeal dimensions. The distance from the tip of the laryngoscope to the level of the vocal folds and the inclination of the vocal plane, which are both variant during singing, is unknown. The purpose of the present study was to test whether 3D-lasertriangulation allows a precise measurement of the absolute vocal fold length and elongation during singing and therefore overcome these limitations.

Methods: By means of stereo triangulation, 3D-coordinates of the superior vocal fold surface were reconstructed from 2D-videolaryngoscopy using a projected laser pattern. For this purpose an endoscopic projection unit attached to a standard rigid endoscope, generates a regular laser grid from a Nd:YAG laser (532nm, CW). The video recording of laryngeal structures and projected laser grid was made with a Rehder stroboscope camera.

For the present study, 47 female singers were recorded singing the vowel /i/ at five different pitches: mean speaking fundamental frequency, then up by one third, one fifth, an octave, and finally by a tenth.

Results and Conclusions: We will present results obtained from 2D measuring techniques and from 3D reconstruction accounting for changes of the distance between glottis and laryngoscope and of the inclination of the vocal plane during singing. The results show that 3D-lasertriangulation indeed allows a precise measurement of the absolute vocal fold length and elongation during singing. Further studies will have to show whether this information will be helpful for singers.

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**BSc13**

## Variation of the Electroglottogram Waveform with Voice Sound Level

Objective: This study investigates how the electroglottogram (EGG) waveform and spectrum balance are related to the sound pressure level (SPL) in phonating at various effort levels while keeping the fundamental frequency constant.

Background: An increase in vocal loudness while keeping constant articulation can be achieved through manipulating glottal adduction and transglottal pressure. The strategy followed for changing vocal loudness depends on the individual. Some change in the EGG waveform shape must occur as the vibratory state of the vocal folds gradually changes from little or no contact to more contact and more complete glottal closure. However, since the EGG is not an acoustic signal, it is not given that changes in EGG waveform would correspond directly to changes in the produced sound, or vice versa.

Materials and methods: Five male amateur choir singers, aged 20-27, with several years of experience in choirs and no formal training, vocalised softly to loudly on 8 fundamental frequencies with 5 repetitions (5x8x5=200 tokens). The EGG and the airborne acoustic signal were acquired in an acoustically damped room. The signals were analyzed using a cycle-synchronous scheme and the EGG waveform of each cycle was quantified using the DFT (Discrete Fourier Transform) of the low end of the EGG spectrum. An unsupervised clustering algorithm [1] was used to classify EGG waveform shapes and the corresponding per-cluster histograms for SPL and spectral balance (energy between 2kHz and 5kHz over the energy below 1.5 kHz) were calculated.

Results/Conclusion: The EGG waveform shape for all subjects is seen to be directly related to SPL and acoustic spectrum balance. Sinusoidal EGG waveforms correspond to the lower SPL region, <65 dB SPL at 30 cm. In this lower range it can be seen that the SPL is not particularly responsive to changes in the amplitude or the shape of the EGG waveform. EGG waveforms progressively richer in higher harmonics correspond to medium SPLs (65 - 80 dB) and higher SPLs (>80 dB). It was additionally found that when waveforms of different type cannot be differentiated in terms of SPL, the corresponding acoustic signal will typically differ in terms of spectrum balance.

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**BSc16**

## Initial Validation of Formal Psychoacoustic Scales of Vocal Breathiness and Roughness

Objective: Voice quality measurement schemes lack a standard scale with well-defined measurement properties. This limits the accuracy of clinical measures of VQ. A proven approach for the perception of loudness is the Sone scale which ties physical units to the perceptual estimates of loudness magnitude. The Sone unit of loudness is broadly used in acoustics, industry, and in the specifications for consumer goods. Goals of the current work include development of analogous scales for the perception of the voice qualities (VQ) breathiness and roughness.

Methods: The approach parallels development of the Sone scale. First, a single-variable matching task is used quantify VQ in terms of physical units. The relationship between the change in perceived VQ magnitude and the change in physical units along the continuum of each VQ dimension was determined. As an initial attempt to validate these scales, the VQ matching data for breathiness and roughness was transformed to the new scales for breathiness and roughness. Finally, the data from these psychoacoustic scales is compared to estimates of perceived magnitude of breathiness and roughness as determined using a perceptual magnitude estimation experiment with the same stimuli.

Results: The similarity between the new psychoacoustic scales and the ME data will serve as an initial index of the validity of the new scales.

Conclusions: Methods such as Likert ratings, visual analog scales, and magnitude estimation result in arbitrary units, limiting their clinical usefulness. The proposed breathiness and roughness scales result in ratio-level data with standard measurement units that support quantitative comparisons of perceptual judgments. Such judgments can be used, for example, to compare magnitude of change pre- and post-treatment. [Work supported by NIH DC009029].

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**BSc18**

## A Formant Range Profile for Singers

Objective: Singing styles are often differentiated by the timbre of the voice. This timbre may be a simple artistic choice by the vocalist, but it can also be an acoustic requirement, determined by the size of the hall (if singing is unamplified), the instrumental accompaniment, or the dramatic content of the song. Timbre is regulated by the frequency spectrum in the voice. This involves the relative amplitudes of the harmonics, which can easily be modified by the choice of vowels and allophonic variations of these vowels. The purpose of this investigation was to determine the degree to which individuals can stretch the F1-F2 formant space beyond its range in speech in order to produce different timbre as desired by various singing styles.

Methods: Data were gathered as a regular classroom activity during the Summer Vocology Institute conducted at the University of Utah. Participants first produced the speech vowels /i/, /e/, /ɑ/, /o/, and /u/. Then they stretched their vocal tracts to widen the oral cavity to the limit with forward vowels /a/ and /æ/ vowels. Lastly, they stretched their oro-pharynx and narrowed the mouth opening, creating an inverted megaphone shape, to produce the centralized vowels /I/, /ɛ/, /ʌ/, /ɔ/, and /ʊ/. First and second formant frequencies were determined for all utterances.

Results: The F1-F2 contour showed that formant ranges could be extended considerably from standards if stretched vocal tract configurations were included in the speech vowel quadrangle.

Conclusions: A formant range profile (FRP) can be used to determine the best vowel usage for a singer for a given style and a given pitch range. Choosing vocal tract configurations based on the proximity of specific harmonics to specific formants can be useful for producing a desired timbre on a desired vowel.

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**BSc19**

# An Ex Vivo Model for the Prevention of Vocal Fold Dehydration using Prophylactic Aerosolized Saline

Objectives: Ex vivo models of vocal fold surface hydration have established important relationships between hydration state and voice function. The present study employed an ex vivo animal model to determine if prophylactic aerosolized saline could prevent the adverse effects of a laryngeal desiccation challenge on voice production.

Method: Bench-mounted porcine larynges received incremental (1-minute) doses of aerosolized isotonic saline (0.9% $Na^{+}Cl^{-}$) via an ultrasonic nebulizer situated directly above the vocal folds via custom tubing. PTP was measured at 1-minute intervals. Following 15 minutes of aerosolized saline administration, larynges received 1-minute increments of desiccated air (<1% relative humidity). Again. PTP was measured at each 1-minute interval until the vocal folds ceased to vibrate. These results were compared to control larynges receiving 1-minute increments of desiccated air without prophylactic treatment.

Results: Significant decreases in PTP were observed following 15 minutes of aerosolized saline compared to no treatment. Following 5 minutes of laryngeal desiccation, PTP returned to baseline values for larynges treated with aerosolized saline; PTP from control larynges was significantly greater than baseline.

Discussion: The results from this study indicate that aerosolized saline may be used to prevent the adverse effects of laryngeal desiccation on voice function. This study advances important theoretical constructs related to dehydration-related voice disorder prevention in a more physiologically realistic mechanical model.

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**BSc20**

# Source Filter Interaction in Singers

Objective

Titze and collaborators have shown, by theoretical and experimental work,that due to source-filter interaction, instabilities are likely to occur when the first formant frequency is slightly lower than the frequency of the first or second spectrum partial. Sundberg and associates (201 ) measured formant frequencies in scales sung by professional singers, but noted that the singers did not avoid encounter instabilities when this constellation of partial and formant occurred.

Method

The source filter interaction can be strongly increased by phonation into a long hard-walled tube Kågen and Trendelenburg, 1937). We recorded a female and a male subject with trained voices who sang glissandi into a 70 cm long, hard-walled tube, inner diameter 3 cm.

Results

A number of instabilities were observed. Most of these instabilities were eliminated when the resonances of the tube were attenuated by a piece of cotton placed in the open end. Likewise, most instabilities disappeared when the singers nasalized the glissando, possibly due to the effect of attenuation.

Conclusion

The results suggest that by opening a narrow velopharyngeal opening singers can
(1) attenuate the first formant
(2) increase the level of the higher frequency partials and
(3) reduce the risk of instabilities when the first formant coincides with one of the lowest spectrum partials.

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**BSc21**

## Nasal Resonance and Singing

The function of nasal resonance in singing has been a topic of discussion among voice researchers and teachers of singing over several decades, some maintaining that the velopharyngeal port should always be closed for vowels, and others that an appropriately adjusted opening is advantageous.

Using sine sweep excitation from an earphone mounted in the velopharyngeal opening in cadavers, Havel and Sundberg measured the transfer function of the nasal tract and the results were compared with data obtained from hard-walled acoustic models derived from MRI. The transfer function of the nasal tract contains dips at the resonance frequencies of the paranasal cavities. The attenuation of the nasal tract was found to be much lower in the hard-walled models than in the cadavers. Including the complex nasal resonator in the vocal tract by means of velopharyngeal opening adds dips and peaks in its frequency curve.

Gill and associates measured long-term-average spectra of scale exercises sung by graduate student singers with a wide, a narrow and a closed velopharyngeal port. The nasal conditions were documented by analysis of the nasal and oral flow captured by means of a divided flow mask. With a wide velopharyngeal port the LTAS level corresponding to the first formant was attenuated while the level near 3000 Hz was raised. With a narrow velopharyngeal port the first formant peak was only marginally damped, while the enhancement of the level near 3000 Hz remained. In contrast to these two conditions, with the velopharyngeal port completely closed the acoustic energy around 3000 Hz was more damped. Thus, a narrow velopharyngeal opening can increase the prominence of the high frequency content of the voice with little attenuation of the first formant. In addition, the varying sizes of the velopharyngeal opening was found to affect the contact quotient as measured with an electrolaryngograph.

Sundberg and associates measured formant frequencies in professional singers singing scale exercises and vowel sequences. They found that the first formant frequency occasionally equaled the frequency of the first or second partial, depending on the pitch and the vowel. Titze and collaborators have shown, by theoretical and experimental work, that this situation should elicit the risk of instabilities. However, no such instabilities were found in the singers, implying that they have found a way to circumvent this risk. The source-filter interaction can be substantially strengthened by phonation into a long tube. Sundberg and Lã recorded a female and a male subject with trained voices singing glissandi into a 70 cm long, hard-walled tube, inner diameter 3 cm. A number of instabilities were observed. Most of these instabilities were eliminated when the resonances of the tube were attenuated by a piece of cotton placed in the open end. Likewise, most instabilities disappeared when the singers nasalized the glissando, possibly due to the effect of attenuation.

These four investigations show that by opening a narrow velopharyngeal opening singers can

(1) attenuate the first formant
(2) increase the level of the higher frequency partials and
(3) reduce the risk of instabilities when the first formant coincides with one of the lowest spectrum partials.

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**BSc22**

# Speech Produced in Noise: Relationship between Listening Difficulty and Objective Acoustical Measures

**Introduction**: Speech produced in noise can be characterised by increases in intelligibility relative to conversational speech produced in quiet. Loud noise can interfere with communication and cause annoyance. Two important aspects of the annoyance concern the effects on intelligibility and vocal effort (measured as sound pressure level or SPL).

**Objectives**: The objectives were (i) to characterise the relationship between listening difficulty and speech produced in different noise and style conditions and presented at the same Signal-to-Noise Ratio (SNR); and (ii) to evaluate the spectral modifications associated with noise and style conditions.

**Methods**: 20 subjects were instructed to speak at normal and loud volumes in the presence of (i) fan-coil noise at 40.5 dBA and (ii) multi-talker babble at 61 dBA. Subsequently, the speech signal was amplitude-normalised and combined with pink noise to obtain a SNR of -6dB, and presented to 10 raters who judged their listening difficulty.

**Results**: When the combined signals were presented at -6 dB SNR, listening difficulty was lower when the speech was produced (i) in the presence of high level (babble) vs. low level (fan-coil) noise and (ii) at a loud volume vs. a normal volume, suggesting improved intelligibility. Regarding the original signals, SPL was higher for the loud than the normal style, and higher when speech was produced in the presence of high level noise than low level noise. In the babble noise condition, increases were detected in the ratio of spectral energy between 1 and 3.15 kHz and 0 and 1 kHz and in the modulation of fo (and fo expressed in semitones) that were consistent with increases in intelligibility. There was a greater increase in spectral ratio from low to high level noise in females than in males. The speech modifications reported have implications for the improvement of communication in noisy environments.

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**BSc23**

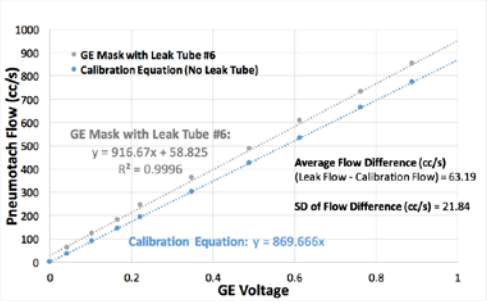
## Mask Rim Leak Effects on Flow Measurement Accuracy

Studies in airflow during speech production typically use a pneumotachographic mask system placed upon the face to measure the expired airflows. Accurate measures of airflow require mask calibration and a complete seal of the mask rim to the face. Literature frequently cites mask rim leaks as causing flow measure inaccuracies, but quantitative studies of inaccuracies are needed.

The purpose of this study was to determine the degree of inaccuracy of flow measurement through a Glottal Enterprises (GE) aerodynamic mask for a variety of leak sizes. The hypothesis was that the greater the air leak area at the rim of the mask, the greater the inaccurate reduction in estimated airflow. For a constant measured voltage from the GE mask system, the upstream airflow the person is producing would be higher with a mask leak. Therefore, with the presence of a mask leak, the actual flow will be higher than the measured flow.

The **Figure** demonstrates the relationship between the GE mask calibration equation (no leak tube condition) and the trend line for the GE mask with a single leak tube with a cross-sectional area of 0.3697 cm^2, which may be considered a moderate leak. The average flow difference between the leak and no leak conditions in the range of 0 – 1000 cc/s was measured at 63.19 cc/s (with a range of 25 cc/s at the lowest flow shown in the figure to 85 cc/s for the highest).

**Figure**: Effect of Glottal Enterprises flow mask leak




Leak effects for six individual tubes and five combinations of tubes (mimicking multiple small leaks) will be measured in various positions around the mask rim spanning cross-sectional areas between 0.0588 cm^2 to 0.8192 cm^2. Measurements will be made using the Glottal Enterprises MSIF-2 mask system (with a PTW-1 pressure transducer for the flow) and a Rudolph pneumotach connected to a Validyne pressure transducer system. Measurements extend to approximately 4,000 cc/s (in the figure above, the data are shown only for the lower end of flow).

Leak effects for all single tube and multiple tube conditions will be measured in a variety of positions around the rim of the mask. Data may allow for generalization of a flow leak effect via an empirical equation relating leak cross-sectional area to flow reduction. Such an equation would be helpful in determining the effects of mask leaks on the DC, average, and inverse filtered flows during speech production.

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**BSc25**

# The Measurement of Sub-glottal Convergence Angle

**Objective:** To explore the sub-glottal convergence angle measurement. Changes to the angle may alter vocal fold stress distribution, which could result in vocal fold pathologies.
**Methods:** Neck CT images of the subjects were gathered, and 3D models of the vocal folds and the airway were rebuilt using Mimics software, through which the sub-glottal convergence angle was measured. We explored the effect of the sub-glottal convergence angle on vibration based on the material oblique section stress analysis which focused on the distribution of pressure and deformation of material in the oblique section material.
**Results:** The sub-glottal convergence angle was effectively measured from the 3D models of the vocal folds and airway. Changes to the sub-glottal convergence angle alter sub-glottal stress distribution in the sub-glottal shear or normal direction by speculating of the material oblique section stress analysis theory. Larger sub-glottal convergence angles might reduce sub-glottal pressure in the shear direction of the below of vocal folds, which would make vibration and vocal fold mucosal wave generation more difficult.
**Conclusion:** 3D model generation from CT data is an effective method of measuring the sub-glottal convergence angle. The sub-glottal convergence angle may affect sub-glottal pressure distribution in the sub-glottal shear or normal direction and influence vocal fold vibration.

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**SLP22**

# Is There a Starting Point for the Lombard Effect?

Introduction: The Lombard effect is an involuntary tendency to raise the level of the voice with an increase in the level of the background noise. In a noisy environment, speakers unconsciously attempt to maintain a level that allows them to be understood by the listener.

Objectives: The objective was to determine if there is a starting point for the Lombard effect in terms of background noise.

Methods: 20 normal-hearing young adult subjects (10 males, 10 females) were instructed to read a passage with the goal of being understood by a listener at 2m, in an IAC sound booth. A loudspeaker, also located 2m in front of the subject, emitted pink noise. This background noise varied in level from 25 dBA (without artificial pink noise) to 70 dBA in 5 dB increments, in a randomised order. The audio-signal was captured by a head-mounted microphone. Subsequently, a regression model was fit with segmented relationships to the data, estimating the slopes and the break-point(s) in the relationship between the response variable, ΔSPL (within-subject normalised SPL), and the explanatory variable, background noise level (Ln).

Results: One break-point was found in the linear model representing the relationship between the ΔSPL and noise level. This break-point is at 48.3 dBA of noise level, with a 95% confidence interval of 46.0 dBA - 50.6 dBA. It was found that the rate of change in vocal level below 48.3 dBA of noise was about 0.24 dB per dBA of noise while the rate of change above 48.3 dBA was nearly 0.5 dB per dBA of noise.

Conclusions: It was found that there was indeed a break-point in the speaker's adaptation to the background noise level, which could be said to mark the starting point of the Lombard Effect, as typically described. Therefore, depending on the environment and the noise of an environment, vocalist will adjust their voices at different Lombard rates.

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**BSc4**

## Humidity and Vocal Loading on the Aging Voice

Objective: The negative effects of prolonged voice use are thought to be greater when speaking loudly, in dry environments, and using non-habitual patterns. This study quantifies the effects of these important variables in vocal loading. Advancing age is a risk factor for developing voice problems. However, little is known about how the aging larynx adapts to vocal loading. The primary goal is to investigate the interaction between humidity and loading on the aging voice. The secondary goal is to investigate whether naïve listeners can detect vocal loading. We hypothesize that 1-hour of vocal loading in low humidity will have more detrimental effects on vocal function as compared to high humidity. Additionally, we hypothesize that naïve healthy individuals will rate the post-loading voice as more tired and severe than pre-loading voice. The loading challenge will combine loudness and pitch variables.

Method: Healthy subjects (males and post-menopausal females) greater than 65 years will participate. Subjects will read aloud in a child friendly voice in the presence of 70 dB multi-talker babble background noise in either low or high humidity condition. The order of the humidities will be counterbalanced across subjects. Vocal function will be assessed before and after the vocal loading challenge using Phonation threshold pressure (PTP), Maximum flow declination rate (MFDR), Cepstral peak prominence (CPP), Low/high spectral ratio (LHR), phonatory effort (PPE), and CAPE-V. Healthy naïve individuals will rate speech for voice tiring and overall severity using 10 inch visual analog scales.

Results: Preliminary findings suggest that older subjects rate phonatory effort at post-loading as higher than pre-loading. Additionally, older adults have a higher LHR post-loading. Additional data collection and analyses are ongoing.

Conclusions: This study furthers our understanding about the aging voice and lays the groundwork for developing an optimal challenge to assess the vocal system.

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# Size Matters – or the Impact of Vocal Fold Elongation on Voice Pitch Depending on Three Crico-Thyroidal Joint Types Assessed by HRCT

Objective: Little is known about the exact elongation of the vocal fold. Yet, no studies have been carried out in-vivo. 49 female singers' larynges were scanned intonating in three different tones. The aim of the study was to analyse the impact of the type of crico-thyroid joint (CTJ) on the elongation of the vocal fold in general, and, specifically, with regard to the different types of CTJ.

Methods/design: Larynges of 49 female singers (alt and soprano) were scanned each in the mean fundamental speaking frequency (MFSF), and both the first as well as the second octave above the MFSF. Materialise Interactive Medical Image Control System (MIMICS®) was used to construct 3D images of the larynx to evaluate the type of CTJ and to analyse the elongation of the vocal folds.

Results: Percentual elongation of the vocal fold over all 49 larynges, irrespective of joint-type, over all (two octaves) was 21%, of which 14% in the first, and, 7% in the second octave. In CTJ type A, specifically, reveals an elongation 24% over all, 16% (first) and 8% (second octave), while in CTJ type B/C the elongation measured 17% over all and 13% (first) and 4% (second) respectively.

Conclusions: Overall and in A, B and C CTJ, the elongation in the first octave is greater than the elongation in the second octave. Furthermore, CTJs type A elongate more than CTJs type B/C. It can be explained by the larger leverage of the joint given the lower pivoting-point of the crico-thyroidal joint.

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**BSc10**

# Benign Vocal Fold Lesions Following Surgical Intervention: Details on the Pathological and Contralateral Vocal Fold Vibration

Introduction: Post-operative voice evaluation using high-speed videoendoscopy (HSV) provides detailed cycle-to-cycle examination of the treated pathological and the contralateral vocal folds.

Purposes: (1) Investigate vocal fold (VF) vibratory properties in unilateral vocal fold lesions and the contralateral vocal fold prior to and following surgery. (2) Compare VF properties of the treated pathological vocal fold and the contralateral vocal fold to normal vocal fold vibrations.

Method: Pre- and post-treatment High-Speed Videoendoscopy (HSV) recordings of ten patients with a diagnosis of unilateral vocal fold polyp were collected. Nine adults without a history of vocal pathology served as controls. Digital kymography (DKG) were utilized to obtain precise vibrogram data at the mid-membranous region of the treated pathological VF and the contralateral VF. Spectral analysis was subsequently applied to the vibrogram to quantify the cycle-to-cycle changes in each vocal fold. VHI-10 scores were collected prior to and following surgery.

Results: Following surgical intervention, post-operative spectral power increased in both the treated-pathological vocal fold as well as the contralateral vocal fold. Despite improved spectral power following surgical intervention, post-surgical vibratory spectrum presented with decreased vibratory amplitude in comparison to normal vibratory spectrum.

Conclusions: HSV allows comparison of specific vibrational characteristics at each vocal fold prior to and following surgical treatment. Although vocal fold vibration improves bilaterally following surgical intervention for unilateral benign vocal fold lesions, vibratory spectrum continues to be decreased in comparison to normal vibratory spectrum. Therefore, voice therapy may be a further option to rehabilitate vocal function.

Key Words: High-speed digital imaging, vocal fold vibration, digital kymography, phonosurgery, voice quality, vocal fold polyp

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**BSc11**

## CPPS Distributional Shape and Parameters as Effective Tools to Discriminate Dysphonic and Healthy Voice

Objective. Voice is the main professional tool for many people, therefore it is important to preserve it and to prevent damages at the vocal apparatus. Voice monitoring and objective measures of the vocal behavior and vocal health can warn a talker against risky situations and highlight existing problems at the vocal apparatus. Previous works have investigated the parameter Cepstral Peak Prominence Smoothed (CPPS) as a possible indicator of vocal health status, giving its mean value and standard deviation as promising results.
The objective of this work is to determine whether the CPPS distributional shape and its parameters can discriminate dysphonic and healthy voice.

Methods. Authors are building a well-assessed vocal database in order to validate the proposed parameters. Vocal data is collected at the San Giovanni Battista hospital in Turin. First, an otolaryngologist performs the laringostroboscopy exam and the perceptual assessment of voice (GIRBAS scale) to voluntary patients. Then, three different speech materials (vocalization, reading and free-speech) are simultaneously acquired at a microphone in air, placed at a fixed distance from the mouth, and at a contact microphone attached at the jugular notch. Last, each patient is asked to fill in a questionnaire about its perception of voice in daily life (PAPV).

Results. At the moment, 25 patients make up our study group and 8 subjects belong to the control group. Recruitment will end in November. Associations between the presence/absence of any type of dysphonia, the values of the CPPS parameters, the perceptual evaluation of voice and the disability level felt in everyday life due to vocal problems will be investigated. Furthermore, new techniques of classification and data mining based on CPPS distributional shape will be performed

Conclusions. The proposed approach can have implications both on clinical practice and on the prevention of vocal problems, especially for voice professionals.

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# High Speed Imaging of Voice Onset Delay: Normal vs. Pathology

Objective: Voice onset delay (VOD) is the time between intent to phonation until steady state phonation. Abnormal VOD may be important in voice disorders. We hypothesize significant differences exist in VOD between normal and patients.

Material and Methods: Fifty subjects were enrolled (normal = 11, vocal fold paralysis =11, Vocal fold scar =11, vocal polyps =9, vocal nodules =5, other =3). High speed laryngoscopy video of phonation alternating with breathing was captured (2,000 frames/sec X 8 seconds, Photron, Pentax Video). Motion analysis was done using digital kymography (DKG). From the DKG, time from approximate vocal fold adduction to initial onset of vibration was recorded as pre –phonatory set delay (PSD). Time from just noticeable vibration to steady state oscillation was recorded as steady state delay (SSD). Adding PSD and SSD resulted in total onset delay (TOD). We compared PSD, SSD, and TOD between normal and pathology.

Results: Normal had a low median time to steady state oscillation (TOD= 52 msec. PSD= 30 msec. SSD= 22 msec.) Pathological voices showed prolonged time to steady state regardless of pathology (median TOD= 185 msec. PSD= 122 msec. SSD= 56 msec.). There were significant differences in all three parameters between normal and abnormal groups but not between pathological groups. Increase in PSD was due to: a) false fold adduction, b) prolonged true vocal fold adduction, and c) time from closure to onset of vocal fold vibration. The causes for SSD delay include: a) slow ramping up to full vocal fold vibration, b) partial vibration, and c) diplophonia with alternating beats before achieving steady state.

Conclusion: VOD abnormalities manifest as increase in PSD, SSD and TOD. PSD is an agnostic finding with little differences between pathologies. Further research is needed to see if patterns of SSD can differentiate between stiffness vs. tension vs. mass.

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**M2**

# How to Manage Reinke's Space Edema or Polypoid Cord in Voice Professionals

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**M3**

# Smoking: Dependence or Addiction in Voice Professionals?

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# Psychogenic Dysphonia: Case Series Presentation with Emphasis on Therapeutic Strategy

## Introduction
Psychogenic dysphonia is a functional disorder with variable clinical manifestation

## Objective
To assess the clinical and vocal characteristics of patients with psychogenic dysphonia in a case series with emphasis on therapeutic strategy.

## Methods
The study includes 14 patients with psychogenic dysphonia, evaluated at the Hadassah Voice Clinic in the past two years. Assessed variables included gender, age, vocal symptoms, videostroboscopic findings and therapy outcomes. Voice therapy was offered to the patients by a single specialized Speech and Language Pathologist.

## Results & Discussion
Fourteen patients (10 females and 4 males) were evaluated. Mean age was 42 (12-76 years). Symptoms duration span form 2 weeks to 5 years with a median of 14 weeks. Most patients (71%) were examined by Otolaryngologists with a variety of diagnoses including laryngitis, inflammation, allergy, reflux and normal. A selection of treatments was attempted including PPI, antibiotics, steroids and voice rest. Three patient underwent voice therapy prior to being evaluated in Hadassah with no benefit. Visdeolaryngostroboscopy showed absence of structural lesions and normal vocal fold mobility. The most common gloottic closure pattern was incomplete closure. All patients underwent a single voice therapy session which resulted in complete vocal recovery. The therapy session was no longer than 2 hours. All patients were followed for a minimum of 3 months with a median follow-up time of 8 months. During the follow-up period 3 patients recurred. Two of them regained their normal voice with repeated therapy however one patient kept recurring to functional dysphonic pattern. Long term success rate was 93%. Although 70% of patients reported related psychological stressogenic events, all overcame their dysphonia with no adjuvant psychotherapy.

## Conclusions
Psychogenic dysphonia is often misdiagnosed resulting in ineffective treatment attempts. Once properly diagnosed, a single voice therapy session may result in complete vocal recovery. This result is achieved regardless of symptoms duration.

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## Anxiety and Depression in Spasmodic Dysphonia Patients

Objective: People used to believe that spasmodic dysphonia (SD) was a psychogenic disorder caused by stress, anxiety, and depression. Although SD is now established as a chronic neurological disorder, the rates of co-morbid anxiety and depression in SD have been reported to be 7.1-72%. Our objective was to study the incidence and risk factors for these mood disorders in SD patients.

Methods/Design: SD patients who presented for botulinum toxin injections from September 2011 to June 2012 were recruited. The Hospital Anxiety and Depression Scale (HADS) was used to measure the symptoms of these mood disorders. Age, gender, professional voice use, employment status, Voice Handicap Index-10 (VHI-10), General Self Efficacy scale (SE), and Consensus Auditory Perceptual Evaluation of Voice (CAPE-V) were collected.

Results: One hundred and forty two patients (age 59.2 ± 13.6 years, 25.4% male, 95.8% adductor SD) had VHI-10 of 26.3 ± 6.9 (mean ± standard deviation), General SE score 33.2 ± 5.8, CAPE-V overall score 43.9 ± 20.9, HADS anxiety score 6.7 ± 3.7, and HADS depression score 3.6 ± 2.8. About 57.0% were employed and 16.9% were professional voice users. About 19 (13.4%) and 4 (2.8%) had symptoms of anxiety and depression respectively. Factors associated with anxiety symptoms were: lower general SE score ($p = 0.02$), higher CAPE-V breathiness score ($p = 0.003$), female gender ($p = 0.04$), younger age ($p = 0.02$), and depressive symptoms ($p = 0.003$). Factors associated with depressive symptoms were: unemployment ($p = 0.03$) and higher CAPE-V breathiness scores ($p = 0.003$).

Conclusions: There are significant incidences of anxiety and depressive symptoms in SD patients. Risks factors include: lower self efficacy, voice breathiness, female gender, younger age, and unemployment. Identifying patients at risk for these mood disorders is the first step towards helping them seek treatment.

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# Laryngopharynx pH Profile in Professional Singers and Nonprofessional Voice Users with Silent Reflux Related to the VHI and Singing VHI as a Tool for Lifestyle and Dietary Change

Objectives/Hypothesis: To examine the rule of oropharyngeale pH Measurement of professional singers and non singers in treatment of silent reflux related to changes in patients VHI, singing VHI and RSI.

Methods: A total of 170 volunteers participated in these retrospective study unterwent a oropharyngeal pH Measurement by the Restech Probe System. They were divided in two groups: 25 high professional singers with singing voice complaints and 145 non-singers with vocal complaints like hoarseness and chronic coughing. Dysphonia impact in voice professionals and non professionals usually is deeply severe and may definitely compromise the career or restrict hobbies or leisure activities. All the patients in our voice clinic, who unterwent a oropharyngeal pH Measurement by Restech Probe prospectively completed the Voice Handicap Index ( VHI), SingingVHI and the Reflux Symptomindex (RSI) at their initial presentation, bevor treatment with PPI, Dietary advices and lifestyle changes and after posttreatmen.

Conclusion: The study will show the correlation between the result oft he pH Measurement and the VHI,SVHI and the RSI scores. That questionnaires proved to be a sensitive tool for the examination process with the oropharyngeal pH Measurement regarding Planing oft the Therapy, Lifestyle and Changes oft he dietary Habits.

Keywords: Voice; Lifestyle Change, dietary Advices, Oropharyngeal Ph-Measurement, VHI, SVHI and RSI Questionnaires

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## A Pain in the Neck – Evaluation of Atypical Throat Pain

Throat pain is a common presenting symptom in the practice of an otolaryngologist, and even more common in a laryngology practice. Once cancer and infection have been ruled out by exam and imaging, the clinician and patient are often confused and stymied by the cause of chronic throat pain. This presentation will evaluate the other possible causes of chronic throat pain including laryngopharyngeal reflux, fibromyalgia, Eagle's Syndrome, carotidnynia, TMJ, cervical spine issues, neuralgia, and other rare causes. An algorithm for evaluation will be presented with options for work-up and treatment.

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**M8**

## Hyaluronic Acid Based Vocal Fold Tissue Engineering: A Review

Background: Vocal fold scarring results in incomplete mucosal wave formation and glottal incompetence. Current treatments do not address the underlying pathology of scarring and are largely ineffective. Tissue engineering and regenerative medicine approaches are promising as they aim to restore the native extracellular matrix (ECM) microenvironment and biomechanical properties of the vocal folds. This review covers advances in tissue engineering of the vocal folds, focusing particularly on hyaluronic acid (HA), a natural glycosaminoglycan responsible for maintaining the viscoelastic properties of the vocal folds.

Methods: PubMed, Google Scholar , Web of Science, and government databases were extensively searched using specific keywords such as 'vocal fold tissue engineering', 'hyaluronic acid', 'vocal fold scarring', 'treatment of vocal fold scar', in various combinations. Data were compiled as a body of literature from these articles.

Results and Discussion: A review of the literature reveals that three main approaches for vocal fold regeneration have emerged: Cell Transplantation, Growth Factors, and Biomimetic Scaffolds. This poster will highlight the advantages and drawbacks of each approach, with an emphasis on biomimetic scaffolds such as HA-based materials. HA based scaffolds are non-immunogenic, biocompatible, and allow for easy modification. Various derivatives of HA have been developed through either chemical modification or covalent cross-linking, and have been tested extensively *in vitro* and *in vivo*. The thiol-modified HA-Gelatin hydrogel reduces vocal fold fibrosis and has clinical promise. Some studies have incorporated collagen and alginate with HA to promote ECM synthesis. Other materials used include polyethylene glycol (PEG) based scaffolds and decellularized ECM scaffolds. Overall, much progress has been made towards designing a hydrogel capable of promoting native structure and restoring biomechanical properties of the vocal folds. This review will effectively summarize the literature and highlight directions for future studies.

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## Phasegram Analysis of Vocal Fold Vibration Documented with Laryngeal High-Speed Video Endoscopy

*Objective*. In a recent publication, the phasegram, a bifurcation diagram over time, has been introduced as an intuitive visualization tool for assessing the vibratory states of oscillating systems. Here, this non-linear dynamics approach is augmented with quantitative analysis parameters, and it is applied to clinical laryngeal high-speed video (HSV) endoscopic recordings of healthy and pathologic phonations.
*Methods/Design.* HSV data from a total of 73 females diagnosed as healthy (n=42), or with functional dysphonia (n=15) or unilateral vocal fold paralysis (n=16), were quantitatively analyzed. Glottal area waveforms (GAW) as well as left and right hemi-GAWs (hGAW) were extracted from the HSV recordings. Based on Poincaré sections through phase space embedded signals, two novel quantitative parameters were computed: The phasegram entropy (PE), and the phasegram complexity estimate (PCE), inspired by signal entropy and correlation dimension computation, respectively.
*Results*. Both PE and PCE assumed higher average values (suggesting more irregular vibrations) for the pathological as compared to the healthy participants, significantly discriminating the healthy from the paralysis group (p=0.02 for both PE and PCE). Comparisons of individual PE or PCE data for the left and right hGAW within each subject resulted in asymmetry measures for the regularity of vocal fold vibration. The PCE-based asymmetry measure revealed significant differences between the healthy and the paralysis group (p=0.03).
*Conclusions*. Quantitative phasegram analysis of GAW and hGAW data is a promising tool for the automated processing of HSV data in research and in clinical practice.

Acknowledgements:
This research was supported by the institutional fund of Palacký University Olomouc (to C.T.H.), the European Social Fund and the state budget of the Czech Republic, projects no. CZ.1.07/2.3.00/30.0004 'POST-UP' (to C.T.H. and J.G.Š.) and OPVK CZ.1.07/2.3.00/20.0057 (to J.G.Š.), and grant no. LO1413/2-2 from Deutsche Forschungsgemeinschaft (to J.U. and J.L.).

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**M10**

## Revision Medialization Laryngoplasty: Patterns of Failure and Surgical Options

Objectives: Revision medialization laryngoplasty is often a challenging procedure. The purpose of this study was to evaluate the patterns of laryngoplasty failures and to describe options for revision procedures.

Methods: A retrospective chart review was performed on 14 patients who underwent revision procedures after failed primary medialization laryngoplasty for unilateral vocal fold paralysis between the years 2010-2015. Demographics, etiology, stroboscopic assessment and surgical approaches were reviewed.

Results: Fourteen patients with complete follow up information underwent 21 revision procedures. Etiologies of the unilateral vocal fold paralysis included idiopathic (8 patients) and iatrogenic (6 patients). Four patterns of medialization failure were identified: undercorrection (43%), overcorrection (7%), implant malposition (29%), and regression of implant benefit over time (21%). Revision techniques included redesign of silastic implant, removal of gore-tex and replacement with a silastic implant, vocal fold injection, adduction arytenopexy or some combination of these procedures. Two patients (14%) required more than one implant revision. Five patients (35%) underwent fat injection after implant revision to produce optimal voice results. One patient underwent adduction arytenopexy.

Conclusions: Revision medialization laryngoplasty remains a challenging procedure and is typically performed due to persistent glottic insufficiency secondary to undercorrection or implant malposition. Successful revision techniques include implant removal and replacement as well as injection medialization when a small amount of glottic insufficiency is present. Arytenoid procedures were performed less frequently in this cohort.

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**M11**

## Management of Periprocedural Pain and Anxiety during In-office Procedures

Background/Objective: Recent advances in technology have contributed to the growth of in-office laryngologic interventions. The benefits of avoiding the operating room and concurrent risks of anesthesia have been widely reported. However, the impact of performing these procedures awake using local anesthesia on patient comfort, pain, tolerance, and satisfaction are only rarely reported. We review the current methods for ameliorating pain and anxiety during in-office awake procedures and identify objective measures of their success.

Methods: Studies of in-office procedure pain management in otolaryngology and other medical and surgical specialties were compiled through queries of Pubmed, Ovid Medline and the Cochrane Library. Methods for measuring and managing pain were assessed. Level of evidence was reviewed for each study.

Results: The available literature in otolaryngology addressing in-office periprocedural pain and anxiety was largely level III-IV with significant heterogeneity in outcome measures. Some validated measures, such the visual analog scale (VAS) were employed sporadically. Most studies used non-validated surveys or outcomes such as procedure completion, patient tolerance and willingness to undergo the procedure again. High-volume studies were most likely to include detailed pain control protocols.

Conclusion: There is a relative paucity of data regarding the treatment of pain and anxiety in patients undergoing awake in-office procedures in otolaryngology. Further investigation into pain control and comfort is essential to the continued growth of in-office procedures in otolaryngology.

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**M12**

## At Risk Ears: Occupational Noise Exposure in College Level Teachers of Singing

Objective: Preliminary studies of noise exposure in college level teachers of singing suggest that they are at risk of exposure to high sound pressure levels in their studios throughout their teaching day. However, it was determined that shirt pocket dosimeters may have overestimated the noise exposure due to their proximity to the piano and the teacher's voice. This paper seeks to determine the actual noise exposure to each of the teachers' ears by placing the dosimeter microphones at the level of the both external auditory canals and comparing it to the pocket level dosimeter. Additionally, the hearing of these teachers was assessed using a portable, calibrated audiometer with masked "over the ear" ear phones.

Methods: Full-time college-level teachers of singing are recruited and loaned two noise dosimeters with microphones positioned at the level of the external auditory canal to wear throughout their normal teaching day as well as a pocket level dosimeter. These data are then analyzed for periods of unsafe noise exposure and overall exposure during a normal working day. An audiogram is performed on each teacher to assess their current level of hearing.

Results: Preliminary results have shown that there are ear specific differences in noise exposure, with the ear closest to the student receiving less overall exposure. The ear closest to the piano, as the teacher's head turns toward student, received more exposure. Hearing loss in that ear has been detected.

Conclusion: While noise exposures incurred by teachers in the choral, rehearsal and performance settings, which are environments they cannot control, are not included in this study, the finding of ear specific noise exposure in the studio, which is one of the few environments that teachers can control, may allow for teachers to protect the "at risk" ear without compromising the auditory acuity needed to practice their profession.

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## Hearing Screening in Healthy Teachers of Singing and Voice Students at a State and Regional NATS Competition

Objectives: Singers are exposed to a wide variety of noise levels during a normal working day and many voice teachers and students complain about auditory symptoms such as tinnitus and subjective loss of hearing. While Hu et al has documented hearing loss in singers presenting with vocal complaints, no formal study has looked at this issue in a generally healthy population. This study is unique in that it seeks to quantify the hearing level in a large sample of generally healthy professional teachers of singing and voice students participating in a State and Mid-Atlantic Regional Competition of the National Association of Teachers of Singing (NATS) to be held February 20, 2016 and March 18 & 19, 2016 and to determine the possible prevalence of hearing loss through the use of a portable calibrated audiometer with "over the ear" ear phones and masked sound delivery which allows for a very high quality hearing test in the field.

Methods: Voice teachers and students participating in the above competitions can volunteer for a hearing screening of 8 standard frequencies in a quiet room environment with the ShoeboxTM audiometer and fill out a brief survey. Informed consent will be obtained. Data will be analyzed for the incidence of hearing loss in teachers and students, severity of hearing loss by age, years of teaching and/or performing, and by voice part utilizing T tests and ANOVA.

Results: Based on the literature and our preliminary work on studio noise exposure in college level teachers of singing, we expect to find a broad range of hearing loss in both voice teachers and students.

Conclusions: Hearing loss in a generally healthy cohort of voice teachers and students may be more widespread than previously thought. Raising awareness in this population which is normally considered to be at minimal risk, may prompt teachers and students to adopt strategies that decrease exposure to high noise levels in a variety of rehearsal and performance settings.

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## Selecting Laryngoscopes and Light Sources for High-Speed Videolaryngoscopic and Videokymographic Imaging

Objective: In contrast to classical video(strobo)laryngoscopy, high speed videolaryngoscopy, including videokymography (VKG), places higher demands on laryngoscopes and light sources; as the image rates are about ten times higher, the captured amount of light (as seen by the camera chip) is decreased by the same factor. Obtaining laryngeal high-speed video recordings of sufficient brightness and quality is therefore not trivial. Since most manufacturers of high-speed cameras do not offer an optimized complete laryngoscopic system, the selection of proper laryngoscope and a suitable light source poses a challenge. This study addresses this issue by investigating the influence of different laryngoscopes and light sources on the image quality of high-speed videolaryngoscopic and VKG recordings.

Methods/Design: Five different laryngoscopes and five high-intensity (three 300 W xenon and two LED) light sources were tested in connection with a high-speed VKG camera (Cymo BV) and five different high-speed cameras. Recordings at the rates of 7200 images per second with different combinations of devices were obtained from one male participant who repeatedly phonated at comfortable pitch and loudness. The image quality of the recordings was evaluated both visually and by quantitative image analysis methods.

Results: The largest differences in image brightness, and subsequently in image quality, were observed when using different laryngoscopes. Some of the laryngoscopes provided insufficient light transparency for high-speed imaging. All the 300 W xenon light sources yielded images of brighter appearance than the LED sources, despite the fact that the maximally achievable LED brightness rapidly increased over the last years. On the other hand, two of the 300 W xenon sources were found to show light intensity fluctuations at 50/60 Hz, which consequently degraded the quality of the respective high-speed videos.

Conclusions: When purchasing high-speed video equipment, proper selection of both a suitable laryngoscope as well as a good light source can have a large impact on the quality of the resulting recordings. In this presentation, illustrative examples of high-speed video recordings captured with different equipment are shown, and an overview of the most important features relevant for high-speed video imaging equipment is given, in accordance with the current *Recommended Protocols for Instrumental Assessment of Voice* prepared by the *ASHA Committee on Instrumental Voice Assessment Protocols* (IVAP).

Acknowledgement: This study was financed by the Technology Agency of the Czech Republic, project no. TA04010877.

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**M15**

# Laryngeal Polyp: Phonotrauma or Predisposition?

Objective: Vocal fold polyps are benign lesions of the vocal folds that occur more often in men. The ethiology is believed to be attributable to phonotrauma that produces a micro-hemorrhage in the Reinke space with subsequent edema and organization with hyalinized stroma. Association of polyps with congenital lesions of the vocal folds have been described. The objective of this work is to revisit the epidemiology of vocal fold polyps as well as to quantify the association of this lession with congenital lessions.

Methods: We made a retrospective study including all the patients with the diagnosis of vocal fold polyp between 2008 and 2015.
Variables studied were demographics, aerodynamic, perceptual and acoustic evaluation of the voice and received treatment. We also quantified the presence of an associated lesion .

Results: 56 patients were included, 13 men (23%) and 43 women (77%). Mean age was 42 years. 52% were profesional voice users and 38 (67%) were smokers. GRBAS scale mean value was 4. 31 (55%) patients underwent surgical treatment. Most often associated lesion of the vocal folds was sulcus vocalis in 23 (41%) patients. In 13 cases diagnosis was made through stroboscopy and in 10 cases it was made in the operating room.

Conclusions: Surprisingly, in our series, vocal fold polyp is a predominantly female pathology. There is a close relationship between laryngeal polyps and congenital lesions, that suggests that patients with underlying vocal fold abnormalities are more predisposed to develop phonotraumatic lesions. The elevated proportion of sulcus vocalis in patients with laryngeal polyps is definitely a highly relevant fact. Phonosurgery in these patients has to be carefully planned because expectations regarding voice results are clearly influenced by the presence of a congenital lesion.

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## Effects of Injectable Substances on Wound Healing in Rabbit Vocal Folds

Objectives: To evaluate the phonatory function of acutely surgically injured rabbit vocal folds following injection treatments. Injected substances consisted of dexamethasone, hyaluronic acid, chitosan and saline (used as a control).

Methods: A microflap procedure was performed on the left vocal fold of 12 rabbits to induce an acute injury. Four different substances (dexamethasone, hyaluronic acid, chitosan and saline as control) were injected in the lamina propria of the vocal fold immediately after the microflap injury. The right fold of each larynx served as uninjured controls. Animals were sacrificed at day 42 post injury. Larynges were harvested *en bloc* and subjected to flow-bench evaluation. Acoustic, aerodynamic, and high-speed digital imaging measurements were performed. Image analysis was performed using software developed at University of Erlangen, Germany (by the group of Professor Dollinger).

Results: Phonation was successfully induced using the flow bench for all larynges. Bifurcation between two bistable modes was observed in the acoustic and pressure data. Vocal folds injected with chitosan and hyaluronic acid demonstrated higher stiffness quotients (0.41±0.02 and 0.38±0.03), compared to the saline controls (0.33±0.02).The Dexamethasone group yielded the lowest stiffness quotient (0.32±0.02), which is similar to that of the saline controls (0.33±0.02). The fundamental frequency in the dexamethasone group was also the lowest (302 ±11.5 Hz), compared to the chitosan (390.34±12.70 Hz), hyaluronic acid (335.82±0.58 Hz) and saline controls (374.27±11.63 Hz).

Conclusion: The excised larynx model yielded significant but fairly variable inter-individual correlation within each group. The decreased vocal fold stiffness found in the dexamethasone treated group suggests that dexamethasone may be a clinically useful intraoperative adjunct to decrease post-operative scarring. An increased sample size would be required to confirm this hypothesis.

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**M17**

## Balance between Environment, Food and Respiratory Allergies

Objective: The voice production depends on various factors to be balanced and proper. Anatomical and physiological structures need to be in healthy conditions to interact with the environment. Epigenetics studies show in different cellular and biochemical levels the non-genetic changes due to the environment. Slight changes in the respiratory or digestive system can affect the quality of voice production. The respiratory and food allergical hyperreactivity can be worse due to environmental factors.

Methods: A statistical analysis of 716 voice patients with allergies signs and symptoms were studied: 374 female and 342 male.
The most frequent respiratory and food allergies in this group of patients is presented
The most frequent voice symptoms are discussed.
Statistical relation is made to the possible relation of the allergies, environment and voice complaints.

Results: Allergies results were 91% trees, 88% grasses,87% yeasts and weeds,85% animals and inhalants and 41% food.
The voice symptoms are dysphonia,phonastenia, respiratory dryness, lack of vocal flexibility, lack of brilliance, throat cleaning and neurovegetative disorders, nasal resonance, posterior nasal drip.
Prevention of these effects is discussed.
Allergological treatment with desensitization was done to the patients.
The harmful effects of the environment can provoke mucosa dryness, if the patient has a right lubrication of the nose, pharynx and larynx helps to avoid more voice complaints.
The allergies examined were to the trees, dust, mites, pollens among others.

Conclusions: Air pollution ,respiratory and food allergies can harm the mucosa of nose, pharynx and larynx disturbing the voice.
Improving the personal immunological systems and balancing the environment and quality of food income are systems to avoid more damage in voice production.

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## Decisions for Indirect Phonosurgical Procedures in Voice Professionals

Objective: Voice professionals need correct and functional vocal folds.There are inflammatory or tumoral lesions that need phonosurgical procedures.In the last 40 years phonosurgical procedures have improved due to better equipments and knowledge of the limitations for the decisions. Recording system , high definition systems, new instruments and experience in clinical and surgical approaches have enriched the decisions for phonosurgery in voice professionals.
Indirect endoscopical phonosurgery is performed in an office-based surgery system. Use of stroboscopical equipment during surgery examining the different pitches and loudness aloud the phonosurgeon to decide the kind of necessities to get the best functional results. The surgeon needs a proper training and an expertise in stroboscopical examination.The recuperation in endoscopical surgery is quicklier than from general anesthesia. The cost is lower and the risks due to hospital staying are not present.

Method: A group of 140 voice professionals patients had statiscal analysis of the details and decisions that were made during phonosurgical procedures. Different pathologies were present : vocal nodules, polyps, cysts, edema, ectasias, granulomas and fibrosis.A complete phoniatrical examination was performed : rigid endoscopy with stroboscopy, acoustical analysis, phonetogram, perceptual auditive examination and voice handicap index.

Results: 40 % of the patients had vocal nodules, 25% were polyps , 30% had different levels of edema. 15% were cysts, 10% presented ectasias 5% granulomas and 5% fibrosis.There were patients with 2 or 3 different lessions.82% of the cases needed microflaps, 25% needed decortication of polyps and 10 % extra tissue due to Reinkes Oedema. 5% Intrachordal mucosa liberation through incissions for fibrosis, desepithelialization were performed due to free edge lesions in 80 % of the cases. 100%the patients had at least two sessions of functional voice therapy before surgery mainly to correct breathing and soften glottal closure. 8 days after surgery the patients had 5 to 20 sessions of voice therapy with different techniques depending on each patient’s voice needs. Singers had vocal couching to improve singing technique

Conclusions: The delicate phonosurgical procedures with cold instruments during indirect endoscopical surgery are important to analyze. Phonosurgical manouvres made in voice professional patients have limits in order to avoid surgical damages that are not necessary. Indirect surgery with stroboscopical equipment help to have vocal function during surgery.Sometimes is better not to take all the lesion away and wait for a second surgery if it necessary.

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## Computational Modeling of Cough Function Following Expiratory Muscle Strength Training (EMST) for Laryngeal Dysfunction

Objective: Cough is an airway protective mechanism resulting from a coordinated series of respiratory, laryngeal, and pharyngeal muscle activity. The cough aerodynamic sequence of inspiration, compression, and expulsion protects the lungs through removal of secretions and foreign material from the airways. Patients with laryngeal/airway disorders often exhibit weakening and slowing of cough which may result in aspiration pneumonia. In this project, we developed a biomechanical model to test laryngeal function by tracking the trajectory of airway penetrants in patients with cough impairment secondary to disease following intervention with an expiratory muscle pressure threshold trainer.

Methods: Computational Fluid Dynamics (CFD) technique was used to simulate fluid flow in the upper airway reconstructed from MRI images acquired from participants. Cough pressure drop, flow velocity, wall pressure and wall shear stress were obtained and compared to healthy controls. The CFD model allowed for turbulent particle interaction, collision, and break up under turbulent cough flow. Penetrants were tracked for pre and post EMST intervention and allowance made for variation on penetrant characteristics including density, size, and texture (solid, liquid). Aspiration risk was determined through measurement of the percentage of particles remaining in the lower airway following cough.

Results/Conclusion: Low velocities and pressures were recorded in patients with Parkinson Disease (PD) and Head and Neck Cancer (HNC), decreasing airway clearance. Analysis of penetrant trajectories revealed reduced clearance of penetrants in patient models (PD and HNC) compared to that observed in healthy controls. Biomechanical modeling is useful for describing cough dynamics within the lower airway/laryngeal valve and increases our understanding of how these dynamics contribute to increased risk of aspiration in patient groups.

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**M20**

# Uptake and Attenuation in PET/CT in Elderly

Objectives/Hypothesis:
To compare the uptake and attenuation on the PET/CT imaging modality at the level of the thyroarytenoid muscle between subjects less than 65years old and subjects older than 65 years old.

Study Design: Retrospective chart review.

Methods:
The PET/CT images of 60 patients aged less than 65 years old and 60 other patients aged more than 65 years old were randomly selected. Demographic data (age and gender) was collected. Both groups were compared with respect to the maximum standardized uptake value and computed tomographic attenuation at the level of bilateral vocal cords.

Results:
In the first group of 60 patients aged less than 65 years old, 23 were males and 37 females. In the second group of 60 patients aged more than 65 years old, 32 were males and 28 females. The mean SUV max at the level of the right vocal cord was 2.09 ±0.8 in the first group compared to 1.9 ±0.6 in the second group. At the level of the left vocal cord, the mean SUV max in the first and second groups was respectively 2 ±0.6 and 1.9 ±0.6. The differences were not statistically significant. As for the computed tomographic attenuation, the mean value at the right thyroarytenoid muscle in the first and second groups was respectively 31.2 ±0.8 HU and 20.8±14.4 HU ($p<0.05$). At the left thyroarytenoid muscle, the mean value was respectively 29.6±9.9 and 22.8 ±15 ($p<0.05$).

Conclusion:
With age, laryngeal muscles are subject to atrophy. CT attenuation measurements can be used for objectively assessing the change in density of aging laryngeal muscles.

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# Changes in Muscle Tension Pattern following Injection Laryngoplasty

Objectives/Hypothesis:
To compare the presence and the different patterns of muscle tension dysphonia in patients diagnosed with glottis insufficiency before and after injection laryngoplasty.

Study Design: Retrospective chart review.

Methods:
The medical records and laryngeal videostroboscopy of 15 patients diagnosed with glottal insufficiency and had an injection laryngoplasty at the American University of Beirut Medical Center were reviewed. Demographic data, the etiology of the glottal insufficiency and information about the injection laryngoplasty procedure were collected. The vocal task consisted of producing several iterations of the vowel/i/ before the procedure and 1 month after. All frames were recorded during the task (60 frames per second) an each frame was analyzed for each of the four muscle tension patterns. A Muscle tension pattern (MTP) score was then computed by calculating the percentages of frames on which one MTP was observed before and after the procedure.

Results:
Nine patients were males and 6 were females. The main cause of glottal insufficiency was unilateral vocal cord paralysis. Twelve patients out of 15 had MTP type 2 before the procedure and 5 had MTP type 3. After the injection laryngoplasty, the subjects with a MTP 2 and 3 were respectively 11 and 6. The mean percentage of frames showing MTP type 2 in affected patients before the injection was 60.03%. It decreased significantly after the injection with a mean of 29.21% ($p<0.005$). The mean percentage of frames showing MTP type 3 in affected subjects before the injection was 71.68%. It decreased significantly after the injection with a mean of 33.63% ($p<0.005$).

Conclusion:
The injection laryngoplasty procedure should be considered as a treatment modality in patients with muscle tension dysphonia secondary to glottal insufficiency.

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## Main Biomechanical Causes of Dysodias in Professional Singers: Preliminary Results of 1,200 Classical and CCM Cases

Purpose: To describe via distal chip endoscopy improper biomovements involved in dysodias of singers.

Method: Transnasal endoscopic flexible evaluation of movements of the upper vocal tract and the glottis, including velopharyngeal sphincter function examination in large cohort of professional Brazilian (San Paulo) singers with dysodias were compared phonatory movements observed in non dysphonic age and gender matched controls.

Results: Observations included vocal folds elongation and shortening, laryngeal elevation and lowering, fold-to-fold compression or spacing, degree of tongue push towards the larynx, patterns of velopharyngeal closing, thyroarytenoid muscle rigidity and/or flaccidity. We classified these observed movements as excessive or inadequate into biomechanical subgroups. These abnormal movements were found more consistently in singers with dysodias, even in very experienced and elite singers.

Impression: Transnasal evaluation of singing is a proper tool to help to diagnose dysodias in singers. Based on our findings, we believe that pathological biomovements can be treated non-invasively by voice therapy and professional voice retraining, and when needed in conjunction with management of underlying medical factors.

Keywords: professional voice, distal chip exam, dysodias, kinematics, treatment

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**M23**

## Flexible Fiberoptic High Speed Imaging of Vocal Fold Vibration

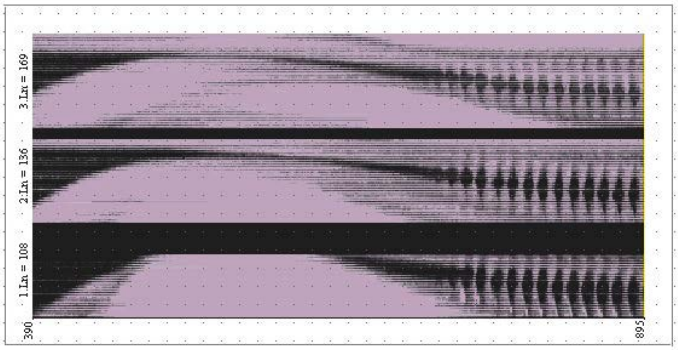
Objective: High speed imaging of vocal fold vibration has been possible only through the rigid endoscope. The development of a fiberscope based high speed imaging system may make research with naturalistic voicing easier.

Material and Methods: Ten subjects were recorded using a commercially available black and white high speed camera (Photron Motion Tools, 256x120 pixel, 2,000 frames per second, 8 second acquisition time). The camera gain is tuned to 6 db. The camera is coupled to a standard fiberoptic laryngoscope (Olympus P-4) with a 300 watt Xenon light. Image acquisition was done by asking the subject to alternate phonation between breathy flow phonation on the vowel "ee" ( ie: hheee…) versus hard attack on the vowel "ee" ( ie: eee…)
Video images was processed using commercial video editing and video noise reduction software (After effects ©, Magix©, and Neat Video©). After video processing, the video images were analyzed using digital Kymography (KSIP-Pentax video).

Results: The raw black and white video acquired by the camera is grey and lacks contrast. By adjustment of image contrast, brightness and using noise reduction software, the flexible laryngoscopy image can be converted to viewable video image files suitable for digital kymography (Figure). The increased noise still makes edge tracking for objective analysis difficult but subjective analysis of DKG is viable.

Conclusion: This is the first report of high speed fiberoptic high speed video acquisition in the un-sedated patient by fiber optic laryngoscopy. Image enhancement and noise reduction allows one to extract a usable digital kymogram (figure 1). Further image enhancement may allow for objective analysis of the vibratory waveform from the fiberscope image.

Figure 1. DKG tracing of voice onset of a patient with vocal fold paralysis

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## Robotic Microlaryngeal Surgery: A New Retractor that Provides Improved Access to the Glottis

Objective: To demonstrate that the Modular Oral Retractor (MOR) system provides improved access to the glottis which increases the ease of use of glottic robotic glottic microlaryngeal surgical instruments.

Methods/Design: Case series: 4 patients underwent robotic microlaryngeal surgery. The MOR system was used for suspension microlaryngoscopy during each procedure. Pictures and videos were taken for each patient with the robotic arms in place in the airway to document the improved access attained using the system. Advantages of microlaryngeal surgery pertaining to glottic surgery are also discussed.

Results: The robot has several advantages to human hands, including removal of tremor and better access to lesions due to increased degree of movement of the articulated instruments. The glottis has rarely been addressed using robotics because access was previously thought to be difficult. The MOR system provides improved access to the glottis that allows robotic glottic microlaryngeal surgery to be more feasible.

Conclusions: Robotic microlaryngeal surgery would be a more precise method with which to address glottic surgery, however, access to this area using a robot is cumbersome and largely ineffective. The MOR system has been shown to allow adequate access to the glottis for the robotic arms to work. Improvements in the robotic instrumentation, however, are still necessary to perform microlaryngeal surgery.

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# Reflux Laryngitis Treatment Review

Background: Traditionally, treatment of reflux laryngitis has been initiated with twice daily dosing of a proton pump inhibitor and concomitant therapy with a bedtime dose of a histamine-2 receptor antagonist. Insurance formulary restrictions have dictated the use of step therapy for the dosing of proton pump inhibitors. More recently, some insurance companies are limiting the number of months a patient can receive any dose of proton pump inhibitors. The purpose of this study is to evaluate the efficacy of proton pump inhibitor therapy for the treatment of reflux laryngitis and to evaluate the efficacy of step therapy using proton pump inhibitors in the treatment of reflux laryngitis.

Methods: A retrospective chart review of all patients treated for reflux laryngitis from September 2011 through December 2013 at a private, tertiary, laryngology practice was performed. Data regarding the co-morbid diagnoses, symptoms, examination findings, medications prescribed, compliance with medications, and complications from the medications were recorded. The data was analyzed using Chi-square analysis and paired samples t-test. If there was no follow-up within the study period, the patient was excluded from the study.

Results: There were 467 patients with a diagnosis of reflux laryngitis. Of these, 323 met the criteria for inclusion, and 223 of these had more than 2 follow-up visits. The mean follow-up time was 48.16 weeks (range 2 – 114 weeks, SD 34.508). 72.4% (158/218) were compliant with the treatment recommendations. There was a significant improvement in reflux symptoms and signs at the last visit ($p < 0.001$). The last dose of proton pump inhibitor prescribed was none in 7.6% (17/223), once daily in 36.8% (82/223), twice daily in 45.7% (102/223), and three times a day in 9.9% (22/223). Of these, an additional 3.6% (8/223) also took Zegerid at bedtime in addition to the twice daily or three times a day other proton-pump inhibitor they were taking. The reflux was described as well controlled in 55.9% (85/152) and as incompletely controlled in 44.1% (67/152) at the last follow-up visit.

Conclusions: Once daily dosing of proton-pump inhibitors for the treatment of reflux laryngitis is clinically effective in 36.8% of the patients with this diagnosis. At least 55.6% of those with reflux laryngitis need twice daily or higher dosing of proton pump inhibitors to control their reflux disease at 48 weeks following initiation of therapy.

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**M27**

## PVFM is Not Alone; Revisiting the Diagnosis

Paradoxical Vocal Fold Motion (PVFM), once considered a rare disorder, is now better understood. Although studies describing the symptomatology of PVFM began to emerge in the 1970s and 1980s, the majority of papers have been published in the last decade. Even though there is increased understanding of the disorder and available treatment options, the diagnosis is still often challenging. The condition is frequently mistaken for asthma or organic upper airway conditions, with resultant mistreatment.

However, there are other are other conditions that have a similar symptomatic presentation as PVFM, but very different laryngeal findings.

This paper will summarize laryngological presentation of PVFM, review clinical records and videostroboscopic analysis of 10 patients with respiratory laryngeal dystonia, and present data on 14 patients with laryngomalacia, and other forms of functional supraglottic airway obstruction. All of these patients were initially misdiagnosed with PVFM. Videostroboscopic examples will be shown to demonstrate the similarities and differences between these conditions. The paper will also emphasize the importance of the use of provocation tests in the differential diagnosis of laryngeal respiratory disorders, and provide specific tasks to include in the routine endoscopic protocol, that can help unmask these lesser known conditions.

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## Comparison of Acoustic Metric Outcome Measures Following Medialization Laryngoplasty

Introduction: The diagnoses of voice disorders, as well as treatment outcomes, are often tracked using visual (e.g. stroboscopic images), auditory (e.g. perceptual ratings), objective (e.g. from acoustic or aerodynamic signals), and patient report (e.g. VHI or VRQOL) measures. Information from several of these measures is often used to make clinical decisions. However, many of these measures are known to have low to moderate sensitivity and specificity for evaluating changes in vocal characteristics, including vocal quality.

Objective: The objective of this study was to test the sensitivity of recently developed algorithms (e.g. estimated pitch strength, cepstral based measures, pitch period entropy), along with more traditional measures (spectral slope, jitter, shimmer) on acoustic changes due to laryngeal medialization intervention.

Methods: The study involves post-hoc analyses of 34 subjects who were recorded (steady vowel and connected speech) before and after surgical/behavioral treatment. Twenty-nine different acoustic metrics were computed for all recordings.

Results: Estimates of pitch and pitch strength, CPP, pitch period entropy and other measures were compared for their ability to detect change from pre- and post-treatment data. Additionally, results will be compared to determine whether estimates may track treatment outcomes for dysphonic voices, across a wide range of underlying diagnoses.

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**Endoscopic False Vocal Fold Flap for Reconstruction of Anterior Glottic Insufficiency**

A 65 year-old man with a history of glottic carcinoma treated with primary resection, neck dissection and radiotherapy presented with severe breathy dysphonia. He failed to improve with voice therapy or left vocal fold lipoimplantation. Due to the history of previous surgery and radiotherapy, free grafting was likely to fail due to compromised vascularity. An alternative approach was sought. In a first procedure the anterior glottic gap was reconstructed endoscopically by raising an anteriorly pedicled false vocal fold flap and sutured to the "freshened defect."

A second procedure several weeks later divided the pedicle and re-secured the inferior border for better glottic competence and height match with the contralateral vocal fold. Substantial improvements in breathiness and volume were noted. This flap should be considered for similar defects of the glottis.

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**Improved Swallow Outcomes Following Injection Laryngoplasty in Unilateral Vocal Fold Motion Impairment**

Objective: Evaluate the clinical impact of percutaneous injection laryngoplasty on reduction of aspiration risk, patient perception of swallowing, and objective swallowing measures in patients with vocal fold motion impairment following head & neck and thoracic surgery.

Methods/Design: Case series with chart review at an academic cancer center.
Patients diagnosed with unilateral vocal fold motion impairment with aspiration and/or penetration as noted on fiberoptic endoscopic evaluation of swallowing who underwent bedside or outpatient vocal fold injection were included in the study. Functional endoscopic evaluation of swallowing, Eating Assessment Tool-10 scores and patient perceptual assessment were evaluated pre- and post-injection.

Results: 11 patients with new onset vocal fold motion impairment who underwent injection were evaluated. All patients reported subjective improvement in dysphagia following injection. Mean Eating Assessment Tool-10 scores post-injection were significantly improved from pre-injection. All patients were advanced from being nil per os to an oral diet without clinical evidence of aspiration, pneumonia, or other complications.

Conclusions: Percutaneous injection laryngoplasty is a safe and effective intervention for improvement of dysphagia in patients with vocal fold motion impairment. A single treatment may markedly reduce or eliminate risk of aspiration and potential sequelae.

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# Inpatient Injection Laryngoplasty for Vocal Fold Motion Impairment: When is it Really Necessary?

Objective: To compare pulmonary and swallow outcomes of injection laryngoplasty when performed in the acute versus subacute setting in head & neck and thoracic cancer patients presenting with new onset unilateral vocal fold motion impairment.

Methods/Design: Case series with chart review at an academic cancer center. Based on swallow evaluation, patients diagnosed with vocal fold motion impairment were grouped either into an unsafe swallow group, who were injected as inpatients, and a safe swallow group, for whom injection laryngoplasty was delayed to the outpatient setting or not performed. Rates of pneumonia, diet recommendations, and swallow outcomes were compared between groups.

Results: 15 patients with new-onset vocal fold motion impairment were evaluated. 4 underwent injection in the inpatient setting, 6 in the outpatient setting, and 5 did not undergo injection. There was no perceived difference in speech and swallow outcomes between the inpatient and outpatient injection groups, nor was there compromise in airway safety, as documented by pneumonia rates.

Conclusion: Injection laryngoplasty shows promise as an effective intervention for reducing aspiration risk and improving diet normalcy in patients with dysphagia as a result of unilateral vocal fold motion impairment. In patients determined to have a safe swallow, delay of injection laryngoplasty does not increase morbidity or diminish swallow outcomes. Avoidance of additional inpatient procedures may represent a health benefit to the patient and a financial benefit to the health system.

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**Laryngoscopy Digital High Speed (LHVN): Does it Change the Management in the Therapeutic Orientation of Benign Lesions of the Larynx**

The vibrations of the vocal cords are under review by "faking " film ( Strobe ). Indeed, the image capture is possible by regular flashes of strobe light. The High Speed Video Laryngoscopy (HSVL) by Digital imaging from 1000 to 4000 frame per second displays not only all the regular vocal cord vibration but also anarchic throat vibrations from the vocal cords to ventricular bands, ary- epiglottic ligaments, arytenoids . For Clinical Research , for biomechanics research and to a better understanding of the vocal folds pathology , The HSVLThis acquisition allows us to better understand the biomechanics laryngeal appearance and the best ask phonochirurgicale indication , and an indication of vocal rehabilitation . Dysphonia, diplophonie , a blown voice will deliver their secrets. Precise analysis of the free edges of the vocal cords during vibration, or phonatory glottal attack, will be decrypted .

Goal: The authors intend to evaluate the dynamic voice Exploration by high-speed digital video: 4000 frames / second compared to the stroboscope. This technique brings incomparable elements to better understand the chrono-laryngeal physiology and biomechanics of the larynx, vocal cords not only but also non cordales laryngeal structures. In this review, the therapeutic orientation of benign lesions of the larynx has been changed in almost 30% of patients examined previously stroboscopy.

Introduction: The vibrations of the vocal cords are under review by "faking" film (Strobe). Indeed, the image capture is possible by regular flashes of strobe light. The Laryngoscopy High Speed Digital 1000-4000 fps displays not only all the regular vocal cord vibration but also anarchic throat vibrations from the vocal cords to ventricular bands, ary-epiglottic ligaments, arytenoids. Clinical This acquisition allows us to better understand the biomechanics laryngeal appearance and the best ask phonochirurgicale indication, and an indication of vocal rehabilitation.

Dysphonia, diplophonie, a blown voice will deliver their secrets. Precise analysis of the free edges of the vocal cords during vibration, or phonatory glottal attack, will be decrypted.

Material and Method: The recordings were performed by high-speed digital video. The material used is the latest generation KayPentax. A 500 watt light is connected to the rigid laryngoscope 70% KayPentax. The latter is coupled to a CCD camera 3 MK2. This technique can capture a sequence of 4 seconds in color at 4000 frames per second, which is 6 gigabytes of space used without compression. The image resolution is 512 x 512 pixels. The collected information is then compared to the strobe appearance (KayPentax).

Subjects are observed to the number of 86 cases.

Conclusion: The LHVN brings a remarkable therapeutic orientation in almost 80% of cases to refine the medical approach in benign lesions of the larynx, especially in voice professionals.

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# Quantifying the Acoustic Hallmarks of Adductor Spasmodic Dysphonia

**Objective**
Patients with Adductor Spasmodic Dysphonia (AdSD) suffer from difficulties communicating as a result of changes to their voice. In this study, we aim to understand how specific acoustic parameters differ in patients with AdSD when compared with healthy controls.
**Methodology**
Data were collected from 23 patients diagnosed with AdSD and 83 healthy volunteers. For each patient, the diagnosis was confirmed after joint clinical evaluation by a laryngologist and speech and language pathologist both of whom have many years' experience of managing patients with AdSD. Each patient was symptomatic at the time of recruitment which occurred immediately prior to treatment with laryngeal botulinum toxin injection and was symptomatic. We used the OperaVOX™ Application (Operavox Ltd, Oxford, UK) running on an Apple iPhone 5 to measure the fundamental frequency (F0), jitter, shimmer and pitch range for each patient and each of the healthy controls.
**Results**
When compared to healthy controls, patients with AdSD have a significantly higher jitter, mean 6.6% (standard deviation 2.7) compared to a mean of 1.1% (1.3) for the healthy controls, $p<0.01$. Similarly, they had a significantly higher shimmer with a mean of 22.1% (14.3) compared to 4.6% (4.1) for healthy controls, $p<0.01$. When reading aloud a phonetically balanced passage, patients with AdSD had a pitch range that was significantly wider than age and sex matched healthy controls.
**Conclusion**
AdSD is characterized by changes in specific acoustic parameters when compared to healthy controls. Using mobile technology, it may be possible to allow patients to collect monitor these parameters longitudinally. Such data may prove useful for the clinician when deciding on the scheduling of interventions, such as botiulinum toxin injections.

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# Use of Transnasal Humidified Rapid-Insufflation Ventilatory Exchange (THRIVE) for Managing the Shared Airway during Phonomicrosurgery

**Background:** Phonomicrosurgery strikes an exacting balance between maintaining adequate ventilation whilst minimising vocal fold movement and maximising surgical access. Different airway management techniques like endotracheal intubation, supraglottic and subglottic jet ventilation, and surgical apnea each have strengths of limitations within this shared-airway setting. We report our early experience with the use of THRIVE as a method of airway management in patients undergoing phonomicrosurgery.

**Methods:** THRIVE was achieved with trans-nasal delivery of 70L/min of humidified oxygen using a special nasal catheter (Optiflow-THRIVE™; Fisher and Paykel Healthcare Ltd, New Zealand). The same catheter was used to pre-oxygenate the patient, to maintain oxygenation during and after induction of anaesthesia, to provide ventilation during the procedure, and to oxygenate the patient after the procedure.

**Results:** There were seven females and three males and mean age at surgery was 40±8 years. Mean body mass index was 28±6. All but one patient had ASA grades of 1-2 and 2 patients had grade 3 laryngoscopy views. The indication for surgery was botulinum toxin injection (n=6), vocal fold cysts (n=2), vocal nodules (n=1) and sulcus vocalis (n=1). Mean apnoea time was 35±10 minutes (range 25-50 minutes) and no patients desaturated below 99% throughout the procedure. Mean post-procedure carbon dioxide level was 58±15mmHg (range 35-86) and no patient suffered from hypoxic or hypercarbic complications. All procedures were performed successfully without the need for intermittent surgical apnea. No airway rescue manoeuvres became necessary.

**Conclusions:** THRIVE is an effective and cost-effective method of maintaining the airway and adequate ventilation during phonomicrosurgery. It achieves a wholly unobstructed motionless surgical field which remains humidified throughout the procedure. It avoids the time, equipment costs and potential trauma associated with anesthetic airway instrumentation during the procedure. We recommend its more widespread use in phonomicrosurgery.

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**SLP23**

## A Comparison of VHI-10 Scores and Voice Grade across Different Levels of Voice Users

Objective: Handicap indices such as the VHI-10 are one of the most valid measures for assessing the effect of an impairment on a patient's well-being. It is assumed that the greater the patient's reliance on their voice, the greater the handicap resulting from a dysphonia. This study compares the VHI-10 scores, and clinician-judged voice grade (Hirano, 1981) across 4 levels of voice users (level 3 being professional voice users).

Methods: The data from 450 sequential voice patients seen at the Eugen Grabscheid Voice Center over a 11 month period were reviewed. Mean and standard deviations of VHI-10 scores for each of the four levels of voice grade (0,1,2,3) were made for each of four categories of voice users.

Results: Two trends emerged as significant. First, there was a strong correlation among VHI-10 scores and voice grade in those patients with a Mild or Moderate level of clinician-judged dysphonia (Hirano Grades 1 and 2) for each of the 4 categories of voice users. Conversely, a great degree of variance between VHI-10 and voice grade was noted between the 4 voice user groups for those with normal quality voices (Hirano Grade 0) and those judged as severely dysphonic (Hirano Grade 3). Second, while there was a loose correlation between an increase in the degree of handicap and voice grade with increasing dependency on professional voice use, those patients who were considered to be most dependent on voice (level 3 - singers, actors, broadcasters, etc), showed significantly less handicap (lower VHI-10 scores) with increasing dysphonia grades.

Conclusion: While increasing dependency on voice correlates with increasing handicap for non-professional voice users (as measured by the VHI-10), professional voice users show the least handicap with increasing dysphonia. This corroborates the assumption that the VHI-10 poorly captures the handicap of level 3 voice users, reinforcing the need to use the more specific SVHI-10. Furthermore, handicap (VHI-10) and symptoms (Grade) are independent variables, especially among patients with greater dependency on their voice, and should be measured separately. This speaks to the importance of separating quality of life (QOL) instruments from symptom indices when assessing patients with dysphonia.

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**BSc5**

## Voice Quality is a Part of Pitch Perception

Introduction: Pitch perception plays a crucial role in speech processing, as pitch conveys important linguistic information such as tone and intonation from a speaker. Since F0 range differs across speakers, phonetic categories (e.g. tonal categories) thus overlap in acoustic signals. Nonetheless, listeners are able to effortlessly uncover intended linguistic pitch by an unfamiliar speaker without any context (e.g., Honorof and Whalen 2005; Lee et al. 2009), which suggests that listeners must use some signal-internal cues other than F0. Based on our language data (Kuang 2013, 2015) and ASR study (Ryant et al. 2014), we speculated that voice quality could be such a cue, since voice quality co-varies with F0 in pitch production and plays important roles in tonal contrasts. Therefore in this study, we designed two pitch classification experiments to test whether listeners integrate voice quality (vocal fry and tense voice) in pitch-range perception.

Experiment 1: A two-alternative-forced-choice task is used to test whether tense voice can facilitate the "high pitch" perception. Stimuli are pitch continua with four different spectral conditions. A tenser voice is indicated by a flatter spectral slope.
Experiment 2: A two-alternative-forced-choice task is used to test whether vocal fry can facilitate the "low pitch" perception. The synthetic vocal fry stimuli vary in the f0 range and the ratio of pulse-to-pulse variability.

Results: We show that the pitch classification function is significantly shifted under different voice quality conditions: Tense voice sounds higher in pitch; vocal fry sounds lower in pitch. This study strongly supports the hypothesis that pitch perception is more than F0 perception, and voice quality cues are direct indicators of pitch range. We will discuss the important implications for the theories of tone and prosody.

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**BSc12**

## Professional Voice Use in High School Classrooms: Relationships between Classroom Acoustics and Voice Parameters of Teachers at the Beginning and at the End of a School Year

Objective: To accurately determine changes in the voice use of teachers along a school year. Furthermore, the relationship between vocal parameters, classroom acoustics and noise is statistically investigated.

Methods: 37 teachers from two high schools in Torino (Italy) participated in this study at the beginning of a school year. 32 of them took part in the study also at the end of the same school year.
In each period teachers were monitored repeatedly, adopting the same procedure, using the Voice Care device, which consists in a contact microphone to be placed at the jugular notch connected to a data logger. Vocal acquisitions contained information on the voice-use for entire lessons, from which plenary lesson monitorings were extracted since they require the highest phonation load. Each teacher performed an interview before each monitoring to obtain a conversational speech level. Sound pressure level (SPL), fundamental frequency ($F_0$) and phonation time percentage ($D_{t\%}$) were evaluated to characterize the vocal behavior and fatigue under different lessons and periods. A perceptual assessment of voice was also performed to investigate changes in the vocal health of teachers along a school year.

Results: Voice parameters were analyzed in relation with the reverberation and noise conditions in which they were measured. Overall, it appeared that teachers adjust their voice significantly with the reverberation time both at the beginning and at the end of the school year, as well as with noise. Moreover, teachers who worked in worst acoustic conditions showed an increase in SPL at the end of the school year.

Conclusions: Classroom acoustics and noise significantly influence teachers' voice throughout an entire school year. To prevent from voice-related pathologies it is therefore important to solve acoustical issues as well as to determine a prevention program that easily allows monitoring the voice status of professionals in their workspaces.

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**BSc14**

# Can Listeners Hear Who Is Singing? The Role of Voice Category Semantic Development

Objective: Previous research has shown that listeners are unable to identify who is singing across pitch when the voices are unfamiliar. Implementing a very short training period, however, greatly improves this ability, but only when voices are of different voice category. This suggests that during training listeners are beginning to form category prototypes rather than storing specific voices. This idea can be tested by answering the question, “Does exposure to voices of varying categories improve voice discrimination across category even with unfamiliar voices?”

Methods/design: This study employs 2 tasks, a training task, and an experimental task. For all tasks, there are 2 sub-sets of stimuli, male (2 baritones and 2 tenors) and female (2 mezzo-sopranos and 2 sopranos) voices recorded on the vowel “ah” across a 1.5 octave range. Voices used in the training task are different from the voices used in the experimental task.

In the training task, participants are allowed to listen to all of the stimuli until they believe they can identify the voices by singer number at which time they proceed to a test procedure where must identify the singer by the singer number. When they are able to identify all the male and female voices they proceed to experimental task.

For the experimental task, all possible pairs of male and female singers were constructed for the lowest pitch and for the highest pitch. The unknown singer was varied across the remaining pitches. Listeners hear two different singers producing "ah" at the identical pitch and an unknown singer producing "ah" at a different pitch and must identify which of the 2 singers is the unknown singer.

Results: Preliminary data suggest that the development of prototypical representations of voice categories will improve the ability to discriminate voices across categories.

Conclusion: Voice category formation may be an important variable in voice discrimination.

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**BSc17**

## Can Listeners Hear Who is Singing? The Role of Onset Cues Revisited

| | |
|---|---|
| Objective/Hypothesis: | To determine the effect of onset on the ability to hear whether two sung stimuli are produced by the same singer or two different singers. |
| Study Design: | Within-subjects signal-detection experiment. |
| Methods: | This study employs a forced choice paradigm where listeners hear two different singers producing /a/ at the identical pitch and an unknown singer producing /a/ at a different pitch. Listeners must identify which singer is the unknown singer. Listeners will complete 2 sub-experiments, one with onset cues intact and another with onset cues removed. Stimuli were recorded from 2 baritones, 2 tenors, 2 mezzo-sopranos, and 2 sopranos across a 1.5 octave range. All possible pairs of singers were constructed for the lowest pitch. The unknown singer was varied across the remaining pitches. |
| Results: | In a preliminary group-design study, onset data improved some participants' ability to identify the correct singer, but there was great inter-subject variability. In this within-subject design, where each participant acts as their own control, a more consistent effect of onset on singer discrimination is expected. |
| Conclusion: | Temporal information present in onset cues could provide additional information useful in identifying individual voices across pitch. |

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**SLP58**

# Correlation between Voice and Auditory Processing

**Objective:** To compare the performance of women with dysphonia and without vocal alterations in auditory processing tests and in the test of voice tone reproduction, and correlate them. **Methods:** 40 women participated in the study. They were aged from 18 to 44 years, and subdivided in two groups: Dysphonic Group (20 women with functional dysphonia) and Non-dysphonic Group (20 non-dysphonic women). The participants underwent interview, audiologic, otorhinolaryngologic and voice assessments (voice register, voice tone reproduction through phonetography) and auditory processing assessment – using the Pitch Pattern Sequence (PPS) and the Sound Duration Pattern Sequence (DPS) tests. The statistical analysis consisted of Mann-Whitney's, Fisher's Exact and Spearman's Correlation ($p<0.05$) tests. **Results**: there were statistically significant differences in the comparison of the performance of the dysphonic and non-dysphonic women in the PPS test ($p=0.000$), in the voice tone reproduction test both in the first attempt ($p=0.025$), and in the total of right answers ($p=0.017$), with the non-dysphonic women presenting better performances. There were positive correlations between the PPS and both the first attempt of voice tone reproduction (RE $r=0.575$ $p=0.000$; LE $r=0.536$ $p=0.000$), and the number of attempts (RE $r=0.650$ $p=0.000$; LE $r=0.729$ $p=0.000$). Regarding the DPS, there was positive correlation in the left ear with the total number of voice tone reproduction attempts ($r=0.399$ $p=0.010$). **Conclusions**: functional dysphonic women presented alterations in the auditory processing ability that involves the discrimination of sound patterns related to the sound pitch. Such alterations suggest the need of a broader diagnosis concerning the dysphonia, considering the auditory processing. The better the performance in the auditory processing assessment, the better was the performance of dysphonic and non-dysphonic women in the voice tone reproduction. Thus, the Voice Tone Reproduction Test may help speech therapists and voice trainers to verify auditory perception difficulties of dysphonic women.

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**SLP57**

# The Effect of the Different Velopharyngeal Postures on Vocal Outcome: a Proposal for Voice Habilitation and Rehabilitation

Introduction: it is well known that the different parts of the vocal tract play an essential role determining the final vocal outcome. In particular, the structures of the velopharyngeal apparatus, besides modelling the shape of the vocal tract, affect the oral-nasal balance, determining different degrees of nasality and changing the vocal acoustic features.

Objective: the aim of this study was to evaluate the role of the different velopharyngeal muscular components in diverse velar positions, assessing four pairs of muscles (tensor veli palatini, levator veli palatini, palatoglossus, palatopharyngeus), investigating their influence on the vocal tract shape as well as on the final vocal outcome.

Methods: in order to detect the widest range of velar movements and placements, 10 professional voice users were evaluated via transnasal and transoral endoscopy and electroacustical analysis. They were requested to vocalize, according each to their own specific style and following a given sequence.

Results: four different velopharyngeal postures were observed, as a result of different synergies between muscular components. Their influence on the shape of rhinopharyngeal as well as oropharyngeal resonance space and on the movements of tongue, pharynx and larynx were detected.

Conclusions: The movement of each singular muscular component was isolated and specific exercises to improve their activity and proprioceptive control were developed. These findings can be useful in voice and speech therapy and could be of relevance in vocal pedagogy as well.

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**SLP56**

# Newscast Communication Protocol

Introduction: The work of Speech Language Pathologists with professional voice users in broadcast television has brought a communication development for these professionals. Although the different backgrounds of journalist and SLP can help this development it can cause a difficult in the evaluation criteria of communication. This paper is justified by the need to standardize guidance to reporters and presenters, publishers, directors and speech therapists when seeking to an effective communication.
Objectives: This study aimed to create an evaluation protocol of professionals who work at RBSTV in Porto Alegre, Brazil, contemplating parameters analyzed by editors, TV news directors and SLPs.
Methods: The protocol was applied on seventy professionals who worked daily at a network. For that, video materials and/or actual presentations of 2 minutes were used. This evaluation was conducted by a group of 5 professionals: editors, directors and SLPs. The group analyzed the video using assessment protocol developed for this purpose and discussed measures to be adopted.
Results: The application of the same protocol as an evaluation tool on TV professionals from different areas and backgrounds standardized and clarified terms used during the guidance of reporters and presenters. Until then, professionals of this television network that were working towards the same goal were using different designations. This standardization has optimized the understanding of the guidance given to reporters and presenters and brought uniformity in the observations made internally by other professionals that are not speech therapists.
Conclusion: The protocol applied enabled to clarify ambiguous terms previously used separately by the group of evaluators. It made possible to translate terms used on television language to speech language pathology area and vice-versa enabling greater clarity of goals implementation and guidance on television communication to reporters and presenters. It also served as a guide in effective communication in the TV Station.

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# The Use of Semi-Occluded Vocal Tract Configurations to Treat Muscle Tension Dysphonia: Straw Phonation vs. Lip Trill

Objective: The purpose of this study is to compare the effect of straw phonation and lip trill therapy in adults with muscle tension dysphonia in order to provide better evidence-based practice voice therapy to those individuals diagnosed with muscle tension dysphonia.

Methods/Design: 14-16 individuals diagnosed with muscle tension dysphonia will undergo 6 weeks of voice therapy with a licensed SLP for a total of six sessions. Pre and Post measurements of the VHI and CAPE-V ratings will be completed. Patients will complete 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: This study is in progress now as part of my dissertation so specific results and conclusions cannot be made today, however we have formed the following hypothesis. *Hypothesis 1($H_1$):* Both subject groups will show meaningful and significant changes in clinical measures. *Hypothesis 2 ($H_2$):* Because straw phonation creates greater vocal tract constriction compared to lip trill, the expectation is that those in the straw phonation therapy will improve significantly more than those in the lip trill therapy group. Alternatively, it may be the case that lip trill is easier to learn and incorporate into daily practice in which case the outcomes might be reversed.

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# Body Pain in Professional Voice Users

Objective: The purpose of this study is to identify, categorize and compare body pains among different professional voice users, their vocal self-assessment, their voice complaints and their sick leave history.

Methods: A total of 399 individuals, 125 men and 274 women (109 teachers, 113 speech-language pathologists, 26 recreational coaches, 32 singers, 50 stockbrokers, and 69 sales associates) participated in the study. Participants' mean age was 36.3 years and age ranging from 18 to 87 years. They answered a self-assessment questionnaire that investigated demographic information, presence of voice problems, voice self-assessment and presence of 13 different body pains. The body pains were rated how often each specific pain occurs using a 5-point scale.

Results: Results show that the most frequent pain among the voice professionals studied is (69.2%, N=276) sore throat (1.87). Sales associate presented with the highest mean number of body pains (4.94) and the group of speech-language pathologists presented with the lowest mean number (3.07). Those with voice complaints presented with higher means of body pains (4.63) when compared to those without voice complaints (3.62). In addition, subjects that reported sick leave had higher means of body pains (4.75).

Conclusion: knowledge of voice use and training, as it is usual in speech-language pathologists, may have a positive effect in reducing pain symptoms in trained professionals.

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**SLP53**

# Cutoff Point for the VHI-10 and the CAPE-V

Objective: Assess the cutoff point of the Voice Handicap Index-10 (VHI-10) and the Consensus Auditory-Perceptual Evaluation of Voice (CAPE-V) in order to determine the discriminating power of the instruments in differentiating the presence or absence of dysphonia (i.e., dysphonic vs. healthy voices).
Methods: Data from 89 subjects (23 males, 67 females, mean age 43.3, age range 11-88), 67 with a diagnosis of dysphonia and 22 vocally healthy individuals were included in the analysis of the Receiver Operating Characteristic (ROC) curve analysis to obtain the coordinates of the curve. A voice specialized speech-language pathologist (SLP) perceptually rated each sample for its overall degree of deviation on a visual-analog scale of 0-100 (Overall severity score from the CAPE-V). Intra-judge reliability for this task was r=0.919; p=.008.
Results: The ROC curve analysis showed that the VHI-10 presented as an excellent classifier based on the area under the curve (AOC 0.936) and on its specificity (.909) and sensitivity (.896), while the CAPE-V presented as a good classifier (AOC .804; specificity .773; sensitivity .731). The cutoff value for the VHI-10 is 5.5 points. The cutoff value for the CAPE-V is 10.5 points.
Conclusion: The VHI-10 is an excellent classifier and the CAPE-V is a good classifier in discriminating individuals with dysphonia from the ones without dysphonia. The VHI-10 can be a very useful tool for voice screening of large populations. The CAPE-V must be used with caution in regards to voice screening.

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# Perceived Influence of the Media on the Use of Vocal Fry in Comparison with other Vocal Characters

A survey on the listener's perceptions of eight vocal characters (vocal fry, rough, breathy, strained, loud, high pitch, low pitch, and soft/weak) was provided to 23 female graduate Speech-Language Pathology students. Training was provided to ensure proficiency in voice identification. Students were asked to name female media performers that use each voice character, rate their influence on society, the influence their voice has had on how others use their voices and which age group was influenced the most. Lastly students were asked to state the percentage of time each voice character is heard in their own voices, their classmates' voices, 50+, 35-49, 20-34. 13-19, and 5-12 year old female groups.

Results: Vocal fry was the only vocal character where all students could name a corresponding female performer in the media. Performers using vocal fry were rated as most influential on societal voice use. The young population (20-34 year old) was rated as being the most influenced age group.

Vocal fry was perceived 25% of the time in the students' own voices, yet 75% of the time in the voices of the 13-19 year olds, 20-34 year olds and their own classmates. Significant positive correlations among the latter three groups indicate a strong relationship in the perceived percent of time vocal fry is used in these groups. In the 35-49 year old group, no vocal characters were perceived to be predominant.

Conclusion: Graduate female students between 20-34 years perceive that female media performers using vocal fry have influenced how females of different age groups use their voices. Vocal fry is perceived as the predominant voice character used by female performers in the media. Vocal fry is perceived primarily in the voices of female teenagers, 20 and some 30 year olds but not by young children, middle aged or older adults.

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**SLP51**

**Perceived Desirability of Vocal Fry among Graduate Female Speech Pathology Students**

A survey evaluating perceptions of eight vocal characters (Vocal Fry, Rough, Breathy, Strained, Loud, High Pitch, Low Pitch, and Soft/Weak) was provided to 23 female graduate Speech-Language Pathology students. Proficiency in voice identification was determined. Students were asked to rate the desirability of 25 adjectives (chosen based on a pilot survey) on a 3-point scale: desirable (3), in between (2) and undesirable (1). Students were allowed to use an unrestricted number of these adjectives to describe the eight vocal characters. A desirability score for each voice character was calculated by averaging the sum of the weighted counts for each adjective used to describe that vocal character.

Results:

1. Ten adjectives were rated as desirable (e.g., cool), two were rated as in between (e.g., sexy) and thirteen were rated as undesirable (e.g., vain)

2. Forty-three percent used only undesirable adjectives to describe Vocal Fry, 43% used a mixture of desirable, in between and undesirable and 13% used only desirable adjectives.

3. The Relative order of desirability of vocal characters was: Low pitch (2.13), High pitch (2.10), Loud (1.89), Vocal Fry (1.81) Breathy (1.75). Soft/weak (1.65), Rough (1.49), Strained (1.07).

4. A vocal character profile for each adjective was created. Vocal Fry was the primary vocal character associated with the adjectives: Vain (56%), Apathetic/Disinterested (48%), Sleepy (38%), Bored/Unengaged (36%), and Relaxed/Chill (38%). Vocal Fry was the secondary vocal character associated with the adjectives: Sexy [26%; preceded by Breathy (35%)] and Cool [23%; preceded by Low Pitch (38%)].

Conclusions:
This study provides an indirect technique to evaluate desirability of Vocal Fry compared to other vocal characters. The implications of these findings in terms of the adjectives they emote and how the speakers are perceived will be discussed.

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**SLP49**

# A Survey of Current Voice and Upper Airway Treatment Patterns by the Speech Language Pathologist

**Objective:** The present study sought to examine practice patterns of speech language pathologists treating people with voice and upper airway disorders. Specifically, to examine the difference in clinical care including duration of therapy and work with the referring physician between practice settings, percent of caseload dedicated to voice and upper airway, and years of experience.
**Methods:** A 30 item anonymous questionnaire via Survey Monkey ™ was sent electronically to members of ASHA's Special Interest Groups 3, Voice and Voice Disorders and ASHA's Private Practitioners Community. Demographic information followed by five case studies asking for responses regarding clinical decisions was included in the survey. A total of 191 questionnaires were returned, 144 completed, a response rate of 75 %. Responses to the clinical decision making questions were analyzed by percent of caseload, years of experience and primary employment setting.
**Results:** Somer's d analysis indicated that the percent of voice caseload was more predictive of the number of therapy sessions to meet goals. Clinicians whose caseloads included a greater amount of voice therapy had more confidence in the therapy, especially for chronic cough and spasmodic dysphonia and provided less therapy sessions than clinicians whose caseloads had a lower percent of voice patients or clinicians with more years of experience. Clinicians working in multidisciplinary settings generally provided the fewest number of therapy sessions to meet goals.
**Conclusion:** There is a significant difference in number of therapy sessions and confidence in in therapy between clinician who see primarily voice patients on their caseloads and those who see fewere than 50% of their caseloads in voice. These results are consistent with previous research by Starmer et al (2014) and Litts et al (2015) that demonstrated improved outcomes and lower costs to healthcare when seen by clinicians who practice in multidisciplinary voice centers.

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**SLP45**

# Development and Validation of the Singing Fatigue Handicap Questionnaire (SFHQ)

In the field of singing voice the vocal fatigue is a very important topic; it involves not only subjects with vocal pathology, but also healthy subjects who daily experience this kind of symptoms because of inadequate vocal technique, environmental features, behavioral habits, musical matters, etc. To date no instruments exist to assess singing voice fatigue in its multidimensional aspects.

The aim of the present study is to develop and validate a psychometric self-assessment questionnaire in order to identify and assess vocal fatigue in singers: the Singing Fatigue Handicap Questionnaire

Methods: the development and the validation have been performed in accordance to the Scientific Advisory Committee of the Medical Outcomes Trust. An initial pool of 89 items was created in accordance with contents in scientific literature, clinical experience expert team, clinical interviews to singers, in order to involve all multidimensional features of this specific field. After a selection of items based on semantic applicability and redundancy elimination, the pool of 98 items was reduced to 60. In order to further reduce items, this last version of the questionnaire has been administered to 148 singers, both healthy and pathologic, with different experience and singing style. Cronbach test, Factor analysis and Cluster analysis has been used to evaluate and to reduce items and also to find potential subscales .

Results: Cronbach test and factor analysis highlighted an excellent internal validity of the 60 item pool and allowed to reduce to 19 items. Four hypothetical new subscales have been found, empirically named: Temporal, Emotional, Behavioural and Technical-Professional.

Conclusion: a new administration of the last version (19 items) is in progress, in order to statistically validate the test, to verify the classification in 4 groups and to assess the validity in clinical, psychological, logopedic and didactic practice.

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**SLP44**

## Linguistic and Cultural Adaptation into Italian of the Long Dispositional Flow Scale: a Specific Application to Voice Performers

Flow is an optimal psychophysiological state that occurs when one is totally involved in the task at hand, feeling strong and positive, not worried about self or of failure, the experience being very rewarding in and of itself. The Long Dispositional Flow Scale is a psychometric tool that evaluates one's individual attitude to experience a flow state during a specific activity, that corresponds to a "state of grace", an important predisposing factor for the occurrence in the sport of so-called "peak performance" (excellent performance). It's identified with a particular condition in which athlete is so involved in competitive action in place to exclude from his mind anything else. This test has been long used in many fields, as specifically the field of sport psychology.

Objective: To linguistically and culturally adapt and to statistically validate the Long Dispositional Flow Scale for voice performers, in order to assess their psychological attitude to reach a "flow state" during the artistic activity and to highlight the influence of voice complaints on the capacity of entering the flow state, because also artistic performances, especially vocal ones, should normally involve the state of flow and the experience of peak performance.

Methods and Results: The adaptation and the validation was performed in accordance to the Scientific Advisory Committee of the Medical Outcomes Trust. The test was administered in several steps only to artistic voice users with at least three years of live performance experience, carrying on a cross-cultural adaptation into Italian and a statistical validation of the above mentioned test.

Conclusion: an optimal cultural adaptation for artistic performers has been demonstrated; a statistical validation is still in process, in order to assess the potential usefulness in clinical, psychological and logopedic practice of this test.

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# The Impact of Referral Model on Voice Therapy Dropout

Objective: To examine treatment initiation and completion of patients referred by physicians within a traditional model (outside physician refers to the speech-language pathologist (SLP)) vs an interprofessional collaborative practice (IPP) setting.

Study Design: Retrospective chart review of all patients referred to SLP for voice therapy through a traditional model from 1/1/2013 through 06/30/2014 (N=168) and all patients seen in an IPP voice center from 1/1/2013 through 06/30/2013 (N=290).

Data collected were gender, age, diagnosis, date of referral, date of speech-language pathology evaluation, V-RQOL raw score, CAPE-V overall score, and status as completer or dropout. Coding for dropout vs. completed consistent with the operational definition described in Hapner et al. (2009). Data analysis was conducted with SPSS version 22.0.

Results: There was a significant effect for referral type, $\chi 2$ (n= 452, df = 3)= 49.98, $p < .001$, $\varphi = .33$., with respect to the proportion of patients who completed, dropped out, or did not initiate therapy. Delay between referral and initiation of SLP services was significantly longer (mean=73 days) in the traditional model than IPP (24 days). Referrals from the IPP setting were more likely to be appropriate for ongoing voice therapy after the evaluation (only .02% of these referrals were not recommended continued therapy vs. 13% of traditional referrals). Age, gender, and diagnosis category, QOL impact, and severity of dysphonia did not differ significantly between groups.

Conclusions: Results demonstrate that referrals to voice therapy from within an IPP setting are more likely to be appropriate for ongoing voice therapy than those made from a traditional referral setting (referring physician outside the SLP's practice). The results demonstrated an increased rate of therapy initiation but not completion among patients referred from an IPP model compared to referrals from a traditional model.

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**SLP41**

## Prospective Study of Voice Therapy in Children: Potential Cognitive Factors

Objective: Determine if cognitive functions can be identified that may predict children's acquisition of a therapeutic voicing pattern, "resonant voice," in voice therapy.

Methods/Design: Eight children ages 4;5-9;2 years, diagnosed with benign vocal fold lesions, participated in the study. All children received a novel, recently vetted voice therapy program," Adventures in Voice" (AIV), typically delivered over a series of 9 sessions in the same number of weeks. Prior to therapy, 19 subtests from the *Developmental Neuropsychological Assessment* (*NEPSY*) -- a battery that assesses a range of cognitive functions in children – was administered to all children. Subtests were selected *a priori* for their potential relevance for motor learning. Degree of "resonant voice" was evaluated perceptually and blindly from pre- and post-therapy audio recordings of children's voices, using sentences from the Consensus Auditory Perceptual Evaluation of Voice (CAPE-V). Data analysis focused on correlations between scores on NEPSY subtests and degree of perceptually evaluated pre-post improvement in "resonant voice."

Results: Results showed that among *NEPSY* subtests administered, raw scores on the "Imitating Hand Position – Dominant Hand" had the greatest correlation with perceived improvement in resonant voice, pre- to post-therapy ($r$ = 0.55). Performance on Finger Tapping Repetitions and Design Fluency also revealed relatively strong correlations ($r$ = 0.34, and 0.33, respectively).

Conclusion: Findings indicate that imitation abilities – in this case manual imitation abilities -- may partially predict children's improvements in resonant voice pre- to post- therapy for benign vocal fold conditions. Future work will extend the investigation to a larger subject pool and also assess other imitation abilities, beyond manual imitation, for their relevance for resonant voice acquisition and thus potentially therapy success.

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**SLP39**

## Voice Care in Telemarketing

A telemarketing job for women is often more than a source of income. Gaining a position within an Information and Communication Technology (ICT), although at the low-end, is a tool of empowerment.

Workers at such position have reported problems with shoulders, neck, head, back, arms, hands and ears, including stress and urinary infections. This paper, however, focuses on voice issues, such as dysphonia, talkativeness, loudness and related gender questions. It gives statistical analysis, possible correlations, with practices and strategies of prevention, touching also on the usual conditions of the workplace, such as quality of air or diet. Hence, the aim is not just to present the current state in the field but to share insight for a better and more efficient environment.

Voice care in telemarketing is important for several reasons. First, as a fast growing industry, it involves a huge population of women who suffer due to the problems listed above, creating a demand for medical treatment, technological innovation and legal regulation. Second, although a low-wage job, it offers autonomy to women who are either traditionally non-workers or in need of community (re)integration, such as immigrants or (former) offenders, thus reducing the need of welfare programs. It also opens up a chance of education and career advancement, without affirmative action scenarios and debates.

The paper builds on studies and questionnaires from Brazil, India and China as well as US and Europe.

Keywords: voice, telemarketing, women, conditions, employment, ICT, immigrants, offenders

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**SLP38**

# Instability of Aerodynamic Onset/Offset across Neurological Dysphonia Compared to Benign and Functional Dysphonias

Objective: This study seeks to aid distinction of neurologic and functional dysphonias by evaluating the stability of peak transglottal pressure and release burst values across repeated /pa/ syllable trains.

Methods: 50 patients with dysphonia due to Spasmodic dysphonia (Group 1), MTD+vocal fold lesion (Group 2) , MTD alone (Group 3), vocal fold lesion alone (Group 4), vocal fold paresis (Group 5), or functional/psychogenic etiology (Group 6) were assessed for aerodynamic control and coordination during onset/offset for /papapapapa/ task in modal voice. Stability of transglottal pressure peak and release burst was determined across the /pa/ syllable task, between subjects and between groups.

Results: Subjects with SD (Group 1) and subjects with MTD+vocal fold lesion (Group 2) were found to have higher peak subglottal pressures and initial release burst values than other diagnostic groups, and higher than normal subjects. Group 2 had more outlier means in both pressure peaks and release burst values than other diagnostic groups.

Conclusions
Subjects with disturbed neural pathways (due to Spasmodic dysphonia) and subjects with complex dysphonia (MTD+vocal fold lesion) share some common patterns of discoordination across /pa/ syllable trains with regard to onset/offset control.

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## Effect of an Interactive iOS App for Voice Therapy on Patient Practice Frequency and Duration

Introduction. Patients report a variety of barriers to voice therapy homework practice, including difficulty remembering to practice and difficulty reproducing and self-evaluating a target voice technique independently. In order to address patient barriers to practice, we developed an iOS based app that reminds patients to practice, plays recordings of individualized voice therapy exercises and session portions, records patients' resulting practice attempts, and provides Cepstral Peak Prominence analysis results to patients.

Objectives: The purpose of this study was to examine the effect of the app on patient practice frequency and duration.

Methods: 12 individuals with hyperfunctional voice disorders were randomized to receive either standard-of-care voice homework instructions (i.e. written) or app-supported homework during a 4-session course of voice therapy. Participants in both groups borrowed an iPod Touch to record their practice, but only the experimental participants were provided with the app

Results: Preliminary data analysis showed that app participants practiced significantly more frequently than those not provided homework support, but practice sessions were shorter in duration. Reduction in practice duration was related to the short duration of pre-recorded models and instructions in the App. Participants did report that "without the app, I would have forgotten what to do and when to do it." Participants did not use all functionalities of the app, leaving the CPP underutilized.

Conclusion: Provision of an interactive mobile iOS app to support adherence influences homework practice. Development of app functionality is indicated to increase the duration of practice and optimize use of the CPP functionality.

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# Using the Borg Physical Exertion Scale as Outcome Measure to Capture Patient-Perceived Vocal Effort

Introduction: Voice therapy for hyperfunctional voice disorders typically addresses the reduction of vocal effort and strain. However, patient-perceived measures of vocal effort are infrequently used to capture outcomes aside from item 14 on the VHI scale "I feel as though I have strain to produce voice." The Borg Category Ratio scale (Borg CR 10) has shown some promise for use in scaling vocal effort (Baldner et al, 2015), although this scale is designed to capture physical exertion due to exercise.

Objectives: The purpose of this study was to 1) determine if the Borg CR 10 could capture patient-perceived treatment-related reduction of vocal effort in adults with hyperfunctional voice disorders, and 2) examine the relationship of the Borg CR-10 to item 14 of the Voice Handicap Index.

Methods: Thirty-five adults ages 21-62 completed the Borg CR-10 at the onset and completion of a 4-session course of voice therapy. Participants were asked to scale vocal effort in reference to two anchors: a score of 10 signified "the greatest strain you've experienced in voice production - perhaps when you've had laryngitis" whereas a score of 0 indicated "the lack of vocal effort you just achieved in therapy."

Results: Borg scores significantly reduced from session 1 to session 4 of therapy. Values were moderately correlated with VHI item 14. At study completion participants noted that their initial session 1 score was too low: in therapy they learned that their initial effort or strain at treatment onset was higher than they realized at that time. Results are inconsistent with the Baldner study in which normal and disordered participants could not be differentiated, but no anchors were provided for self-assessment.

Conclusion: the Borg CR-10 is adequately sensitive to capture patient-perceived treatment-related vocal effort reduction when meaningful anchors are used. The judgment bears some relation to VHI item 14, but the two are not interchangeable.

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**SLP35**

**Immediate Vocal Tract Adjustments to the Resonance Tube in the Water Exercise in Dysphonic Women and Controls – A quantitative MRI study**

Objective: To compare the vocal tract articulators' adjustments before and after resonance tube in the water exercise in dysphonic women and controls during phonation and breathing by magnetic resonance images.

Methods: Twenty women, age 20 to 40 years old, ten dysphonic with vocal nodules (dysphonic group-DG) and ten controls (control group-CG) participated in one MR scan session. They performed a three-minute resonance tube exercise (RTE) during the same session. Four sets of sagittal vocal tract MRI were obtained: (1) pre-RTE breathing, (2) pre-RTE phonation of vowel /ɛ/, (3) post-RTE phonation, and (4) post-RTE breathing. Eleven parameters during breathing and twenty during phonation were compared in these two groups.

Results: Pre-RTE breathing: three measurements were significantly smaller in DG, laryngeal vestibule area ($p=0.026$), epiglottis to pharyngeal posterior wall (PW) ($p=0.011$), and anteroposterior distance of the interarytenoid complex ($p<0.001$). Pre-RTE phonation: four out of five measurements were significantly smaller in DG, laryngeal vestibule area ($p=0.010$), angle between pharyngeal PW and vocal fold ($p=0.002$), epiglottis to pharyngeal PW ($p=0.034$), and anterior commissure of the glottis to hypopharynx PW ($p=0.009$). Tongue area was larger in DG ($p=0.028$). Post-RTE phonation: two measurements were smaller in DG, angle between pharyngeal PW and vocal fold ($p=0.028$) and the membranous portion of the vocal fold length ($p=0.08$). Post-RTE breathing: only the epiglottis to pharyngeal PW distance was significantly smaller in DG ($p=0.028$).

Conclusions: The angle between the pharyngeal PW and vocal folds, a novel parameter, was smaller in the DG compared to CG after RTE, which also changed dysphonic VT measurements to controls' level. These findings suggest that dysphonic patients may have distinct laryngeal behavior, which relies on the vocal tract articulators' interaction, and RTE can promote corrective strategies in these patients. Furthermore, MR imaging should be considered as a useful tool addressing physiopathology and therapy for dysphonia.

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**SLP34**

## Quantitative Analysis of Vocal Fold Vibration using High-Speed Videoendoscopy in Children with and without Bilateral Lesions

Objectives: The objective of this study was to provide data on the measurable vocal fold vibratory differences in children with and without vocal fold lesions.

Methods/design: In a prospective study, 24 participants (8 healthy; 16 with lesions) between the ages of 5 and 10 were examined using rigid monochrome high-speed videoendoscopy (HSV) at the rate of 8,000 frames per second. Participants were asked to sustain phonation at their normal pitch and loudness. Using custom software for dynamically linking HSV to digital kymography, objective vibratory measures of contact and separation, open quotient (OQ), left-right relative phase asymmetry (A), speed index (SI), and speed quotient (SQ) were obtained at three positions along the vocal folds to establish anterior-posterior patterns.

Results: All objective measures showed a difference between vocally healthy and bilateral vocal fold lesion groups. Contact-separation patterns in all vocally healthy girls and young boys exhibited an anterior-posterior contact and posterior-anterior separation pattern (the same pattern seen in adult females); while pre-puberty boys differed. The objective measures of OQ, A, SI and SQ showed linear anterior-posterior patterns within the vocally-healthy group, The bilateral vocal fold lesion group displayed nonlinear anterior-posterior patterns and/or group differences in all objective measures. Age (young child vs. pre-puberty) and lesion-type interactions will be further discussed.

Conclusions: In the vocally healthy group, age-related differences in male vocal fold contact and separation patterns was evidenced, suggesting further investigation of laryngeal development in males from childhood to adulthood. Within the bilateral vocal fold lesion group, although nodules and cysts with a contralateral lesion appear endoscopically very similar, our findings suggest differences in their vocal fold vibratory patterns. This study could serve as a basis for the development of objective clinical measurements of vocal fold vibration in presence of lesions. Further findings could help redefine the theoretical framework of pediatric voice.

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**SLP33**

# Auditory Brainstem Responses Features for Clicks and Speech-Evoked Stimuli in Tuneless People

Background: The auditory feedback is believed to be a critical component for monitoring the vocal production. The literature shows conflicting evidences about the relationship between auditory pitch discrimination and pitch accuracy in phonation, mostly based on observational studies. However, it is possible to measure the neural transcription sound in the brainstem, analyzing auditory brainstem responses to clicks (ABR) and to complex sounds (cABRs).

Objective: to investigate the ABR for clicks and speech-evoked stimuli in people who are considered tuneless.

Methods: 10 male and 10 female volunteers self-reported as tuneless, aged 15 to 55 years, without voice or hearing complaints, answered the Brazilian version of the Voice Symptom Scale and were submitted to a pitch-matching scanning test, to an audiological test battery and to ABR and cABRs tests. The results were analyzed and compared to the normal references.

Results: the ABR waves (I, III and V) and the interwave latencies were normal for all the participants. However, considering the cABR responses for left (LE) and right ears (RE), both showed systematically some differences from the references for normal mean and SD: (i) lower A peak waves amplitude (LE: 0,13μV, ref. = 0,17μV; RE: 0,16μV, ref. = 0,18); (ii) lower D peak waves amplitude (LE: 0,10μV, ref. = 0,16μV; RE: 0,11μV, ref. = 0,15μV); (iii) significant delayed latency for O peak wave for LE (50,38 msec, ref. = 44,93 msec). The observed features were consistent among the tuneless group and seem to be a pattern.

Conclusion: the auditory brainstem responses presented by tuneless people were similar to the normal pattern reference when the stimuli were a click, but systematically presented a pattern slightly different from the expected as normal, with similar features among the responses, when the stimuli were speech-evoked.

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**SLP31**

## The Use of MDVP and VHI-10 as Predictors of Perceptual Voice Deviation

Objective: To investigate whether acoustic parameters from the Multi Dimensional Voice Profile (MDVP) program and Voice Handicap Index-10 (VHI-10) score can be used as predictors of perceptual voice deviation.

Method: Data obtained from 89 subjects (23 males, 67 females, mean age 43.3, age range 11-88), 67 with a diagnosis of dysphonia and 22 vocally healthy individuals. Voice sample was a 5 sec sustained phonation /a/. A voice specialized speech-language pathologist (SLP) perceptually rated each sample for its overall degree of deviation on a visual-analog scale of 0-100 (Overall severity score from the CAPE-V). Intra-judge reliability for this task was r=0.919; p=.008. The same samples were analyzed acoustically with the MDVP program. Statistical analysis: One way ANOVA was used to compare the groups; a stepwise regression model was used to identify the MDVP parameters best associated with overall perceptual voice deviation score. The latter analysis was also used to determine if VHI-10 score is associated with overall voice deviation.

Results: ANOVA revealed no statistical significance across acoustic parameters compared to perceptual analysis, with the exception of vAm (p=.042). VHI-10 was statistically significant (p=.000). Stepwise regression revealed the following parameters, ordered in rank, as perceptual voice quality predictors: Fhi ($R^2$=0.493); APQ ($R^2$=.563), NVB ($R^2$=.603); VHI-10 ($R^2$=.625).

Conclusion: VHI-10 was found to be a predictor of perceptual voice quality. The three MDVP parameters listed above were the best acoustic measure predictors of perceptual voice quality. No other studies support these findings. As such, the authors suggest to interpret the MDVP analysis with caution and to consider it a component of the overall voice evaluation. VHI-10 score is a valuable voice evaluation tool.

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**SLP29**

# The Impact of a Theater Performance on the Voice Quality of Actors

Objective: Actors are a special group of elite vocal performers with a high vocal load. As they are absolutely depending on their voice quality and vocal capacities for their profession, an optimal voice production is very important. However, artists account for 16% of the patients with dysphonia consulting an otorhinolaryngologist. The purpose of this study was to investigate the impact of a theater performance on the voice quality of actors by comparing the objective and subjective voice quality before and after the show.

Methods: At this moment, 30 actors participated to the study. Voice quality was measured before and after a theater performance of 2 hours. Objective (maximum phonation time, acoustic analysis of the vowel /a:/ and connected speech, vocal range, Dysphonia Severity Index, Acoustic Voice Quality Index) and subjective assessment techniques (perceptual analysis, Voice Handicap Index, minimal vocal tract discomfort scale) were used to determine voice quality.

Results: The study continues until November 2015. Results will be analyzed using SPSS. Data before and after the theater performance will be compared using a paired statistical test.

Discussion: The results of this study are important to know more about the impact of a theater performance on the voice quality of actors. In the future these results will help optimizing the guidance of the elite vocal performance.

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**SLP28**

# Perceptual Rating of the Impact of Voice Disorders on Occupation: Is there a Consensus amongst Voice Professionals?

The Royal National Throat Nose and Ear Hospital ENT Speech and Language Therapy (SLT) Department has a high referral rate. It is essential for us to use a robust and fair system to ensure we target those most severely affected in a timely manner. We devised a prioritisation system, taking the following parameters into consideration: Severity of dysphonia; Laryngeal lesion; Occupation; Voice Handicap Index score and Surgery.

Our system has proven effective, but has needed to evolve over time to accommodate occupations and lesions not originally included. Attempting to make it more robust we recognised the need to look at "occupation" more fully and to develop the evidence base of the impact of voice disorder on occupation.

We therefore devised a questionnaire which aimed to determine (a) how professionals working in voice rate the impact of having a voice disorder on a person's occupation, (b) what parameters professionals consider important when completing their rating, (c) whether the ratings are affected by the level of experience the professional has working with a voice caseload and (d) whether there is a difference in how voice professionals across the world perceive the impact of voice disorders on occupation.

For this study we took a sample of 590 referrals to our department, listed and grouped the occupations referred. We sent out a survey asking voice professionals to rate these occupations when considering the impact of a voice disorder. 170 world-wide responses were evaluated.

Results allowed us to rank 71 occupations as rated by our respondents for impact of a voice disorder on occupation. ENTs and SLTs considered the person's ability to complete their occupational role as their main decision-making factor. Level of experience was not statistically significant for the ratings. Voice professionals world-wide agreed on these ratings of occupations.

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**SLP27**

# A Pilot Study Assessing the Therapeutic Potential of a Vibratory Positive Expiratory Pressure (PEP) Device in the Treatment of Voice Disorders

Semi-occluded vocal tract exercises (SOVTE) are routinely used by voice practitioners in rehabilitation of pathological voice. These exercises can take the form of humming, lip or tongue trills, or phonation exercises using narrow straws in air or tubes immersed in water.

Previous research carried out at the Royal National Throat Nose and Ear Hospital (Andrade et al, 2013) proposed two categories of SOVTE: those which involve a single source of vibration into the vocal tract (the vocal folds) or those which involve a dual source of vibration (the vocal folds plus lip/tongue trills or bubbling in water). That study found that single source exercises produced a lowering of the first formant ($F_1$) towards the fundamental ($F_0$), thus in theory promoting easy phonation, whilst the dual source techniques exhibited much higher glottal contact variation and a proposed 'massage effect' for the vocal organs.

A vibratory positive expiratory pressure (PEP) device which generates positive oscillating back pressure has already been developed for the management of patients who have chronic airway clearance difficulty. This device produces a relatively large back pressure (~15 $cmH_2O$) with variable oscillation (8-13Hz). It has not yet, to the knowledge of the authors or the device's manufacturers, been trialled for its potential benefit in voice rehabilitation as a form of SOVTE.

We will report the potential therapeutic implementation of this device in the treatment of voice disorders by comparing it to two other well-established similar techniques using a narrow straw (3mm diameter and 10cm long) for phonation in air and phonation through a silicone tube (9mm diameter and 35cm long) immersed in water. Outcomes will include assessing changes in vocal tract acoustics (pre/post exercise), vocal fold contact quotient (electroglottography) and steady and oscillating intra-oral pressures (aerodynamic and acoustic pressures).

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**SLP24**

**Elicitation of Maximum Pitch and Loudness in Adults with Healthy Voices Using Vocal Glide**

Objective: The present study aimed to determine whether a vocal glide task (VGT) could assess the phonatory capacity, in terms of maximum fundamental frequency and intensity, of an individual with similar results of the standard voice range profile (VRP) elicitation procedure.
The findings should help to determine whether the lengthy VRP recording procedure could be replaced by a shorter vocal glide procedure when eliciting the upper voice range. It was hypothesized that the VGT could elicit maximum fundamental frequency and intensity reliably as with the standard VRP elicitation procedure.

Methods: Thirty participants aged 18 to 45 years (mean = 28.6 years, SD = 7.3 years) with normal voice performed two tasks: 1) Standard VRP, which elicited minimum and maximum fundamental frequency and intensity range using discrete half-steps up and down the frequency range 2) VGT to elicit maximum fundamental frequency and intensity using a glissando.

Results: Paired t-tests showed that the maximum fundamental frequency and intensity were not significantly different when elicited using the two procedures. Pearson correlation coefficient was computed to assess the relationship between the maximum fundamental frequency and intensity elicited with the VRP and VGT. There was a strong positive correlation between the two tasks for maximum frequency ($R=.71$. $p<0.001$) as well as maximum intensity ($R=.73$. $p<0.001$). The test-retest reliability of the VGT was .904 for pitch and .645 for intensity with Intraclass Correlation Coefficient.

Conclusion: The VRP and the VGT protocols elicited maximum fundamental frequency and intensity values with strong correlations and no significant difference. The findings provide support for the VGT to be an appropriate tool for eliciting the upper limits of vocal range in healthy adults. Further research is needed to identify the reliability of the VGT in dysphonic adults, as the VGT protocol may save valuable time and clinical resources.

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**SLP20**

## Evaluation of the Uncertainty of Vocal Dosimeter Devices

Introduction: Voice disorders can be difficult to assess accurately in the clinical setting. They can be much better characterized by long-term ambulatory voice monitoring by means of vocal dosimeters of individuals engaging in their typical daily activities.

Objectives: As not all dosimeter manufacturers specify the precision of the devices in the acquisition of vocal parameters, the reliability of four vocal dosimeter devices in the estimation of Sound Pressure Level (SPL) and fundamental frequency (fo) was assessed. The devices included in the evaluation were the Ambulatory Phonation Monitor (KayPENTAX), VoxLog (Sonvox), VocaLog (Griffin Laboratories) and Voice-Care (PR.O.VOICE).

Methods: 20 subjects were recorded in an IAC sound attenuated booth by means of a head mounted microphone (HMM) while using each dosimeter. They were asked to produce a sustained /a/ vowel and to read a text in three different voice styles (Relaxed, Normal and Raised). On the basis of the difference in the estimation of the parameters between the values acquired from the HMM and the dosimeters, the mean error and the combined uncertainty were calculated.

Results: For the SPL, the dosimeter with the highest mean error was the APM (1.15 dB, U = 1.04 dB), followed by the VoxLog (0.80 dB, U = 0.57 dB), the VocaLog (-0.40 dB, U = 0.83 dB) and the Voice-Care (-0.25 dB, U = 0.74 dB). For the fo, the dosimeter with the highest mean error was the VoxLog (9.6 Hz, U = 3.6 Hz), followed by the Voice-Care (-3.5 Hz, U = 1.5 Hz), and the APM (2.9 Hz, U = 2.4 Hz). Results have implications on monitoring vocal use (e.g. level, frequency) in either performance or clinical settings.

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**SLP19**

# The Influence of Shyness on the Perceived Vocal Handicap

Objective: Investigate the influence of self-reported shyness on perceived vocal handicap. Methods: 443 individuals (92 men, 351 women), between 18-90 years old answered by e-mail two protocols, Voice Handicap Index - VHI-10 and Shyness Scale from Cheek & Buss. VHI-10: self-assessment instrument with 10 questions, investigates the vocal handicap impact. Powerful instrument for vocal screening. Scores above the cutoff value of 7.5 fail and must be submitted to a complete vocal assessment. Shyness Scale: worldwide instrument; it has 13 questions related to communicative behaviors in different routine situations. The last question of the questionnaire is related to public speech situation, it is a filter question and is not computed in the total score. Participants were classified as "not shy", "a bit shy" and "very shy", according to the survey responses. Results: "Shy" and "not shy" individuals presented different answers for the VHI-10 ($p < 0.001$), regardless sex and shyness degree. Men had higher scores for VHI-10 than women ($p < 0.001$); however, for self-reported shyness, there was no difference between the genders ($p = 0.136$). The VHI-10 values were indeed higher ($p < 0.001$) for "shy" (7.6) than for "not shy" (3.67) participants. Considering the VHI-10 cutoff value, 40.9% of the "shy" individuals did not pass the screening, while only 12.7% of "not shy" failed ($p < 0.001$). Some questions of the VHI-10 can be related to shyness and not to vocal health aspects, such as: difficult for people to hear me, voice difficulties restrict personal and social life, voice makes me feel handicap and causes me to lose income. Thus, on shyness suspicion, the VHI-10 can be above the cutoff value with no change in vocal quality, therefore, presence of shyness must be explored. Conclusion: Self-reported shyness may influences negatively the vocal handicap. Shy individuals fail to vocal screening with the VHI-10.

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**SLP18**

## Prevalence of Vocal Tract Discomfort in the Flemish Population without Self-Perceived Voice Disorders

Objectives: The main aim of this study was to assess the prevalence of Vocal Tract Discomfort (VTD) in the Flemish population without self-perceived voice disorders using the VTD scale and to examine the relationship between vocal load and VTD symptoms. In addition, consistency between the VTD scale and the Voice Handicap Index (VHI) and the Corporal Pain scale was evaluated.

Methods: A total of 333 participants completed the VTD scale, the VHI, and the Corporal Pain scale. Patient information about study and voice-related hobbies (for students), state of (non)professional voice user (for employees), smoking, shouting, allergy, and voice therapy was taken into account.

Results: A median number of three VTD symptoms was reported, and 88% of the participants showed at least one symptom of VTD. Dryness (70%), tickling (62%), and lump in the throat (54%) were the most frequently occurring symptoms. The frequency and severity of VTD were significantly higher in participants who followed voice-related studies, played a team sport, were part of a youth movement, shouted frequently, and received voice therapy in the past ($P < 0.05$). Finally, low correlations were obtained between frequency and severity of the VTD scale and total VHI score ($r = 0.226$-$0.411$) or frequency and intensity of the Corporal Pain scale ($r = 0.016$-$0.408$).

Conclusions: The prevalence of VTD is relatively high in the Flemish population without self-perceived voice disorders, although the frequency and severity of the symptoms are rather low. Vocal load seems to influence the frequency and severity of VTD. Finally, the VTD scale seems to reveal clinically important information that cannot be gathered from any other protocol.

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**SLP16**

## Effects of Breathing Instructions on Closed Quotient and Fundamental Frequency

Objective: Breathing instructions have been widely used in voice therapy and the teaching of singing. The relationship between lung volume and both acoustic and perceptual phonatory features has been established previously. No link has been drawn between breathing instructions and closed quotient (CQ), a measurement of vocal fold closure that is related to vocal registers, and fundamental frequency ($F_0$). This study looked at the effects of breathing instructions on CQ derived from electroglottography (EGG) and $F_0$, which are both associated with vocal registers.

Method: 43 healthy and untrained females were asked to produce /a/ for three seconds after being given different breathing instructions that cued for high, habitual, and low lung volume conditions. CQ was measured by EGG with signals analysed using 25% criterion-level method using PhaseComp software.

Results: No significant effects of different breathing instructions on CQ were present however a higher CQ (mean=0.515, S.D.= 0.066) was noted for instructions that cued for the high lung volume condition and a lower CQ (mean=0.510, S.D.=0.060) for the low lung volume condition. Breathing instructions were found to affect $F_0$ significantly as $F_0$ increased from low (mean=230.105, S.D.=27.720) to high (mean=214.349, S.D.=23.016) lung volume conditions ($F$=5.685; $p$=0.022). No correlation was detected between CQ and $F_0$.

Conclusion: This study revealed that the use of breathing instructions did not have a significant impact on CQ, which was unpredicted based on existing literature. This may have been due to (1) the phonatory task, (2) variability in responses to the breathing instructions between individuals, and (3) the measurement of CQ. However, $F_0$ was significantly influenced by the breathing instructions, which implies a possible alternative in cueing pitch in singing pedagogy and voice therapy. Future research may include different phonatory tasks and measurement of absolute lung volume.

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## Modulation of Relative Fundamental Frequency during Transient Emotion States

Introduction: Relative Fundamental Frequency (RFF) is the characteristic vocal fold cycles surrounding voice off-set and on-set during an utterance of a vowel-voiceless consonant-vowel production. The off-set of voicing in preparation for the voiceless consonant and the on-set of voicing following the voiceless consonant relates to the balance of laryngeal muscles and aerodynamic forces within a speaker. RFF has been found to be related to vocal hyperfunction in voice patients and has been known to change following therapy and been correlated with listener perceptions of strain and effort. The modulation of this measure makes it a compelling measure to investigate small but stable changes in voicing due to emotional state. Transient emotional states have a small but significant change in other voice measures such as electroglottography, fundamental frequency, and intensity. However, such changes can be small. The sensitivity of RFF to small vocal changes makes it a compelling measure with which to study voicing during emotion states.

Objective: To investigate if RFF modulates with negative, neutral, and positive emotion states.

Methods/Design: Multiple measure reversal paradigm where participants are exposed to negative, neutral, and positive emotion states while phonating on the utterance /afa/. RFF was extracted from each utterance. Group comparisons on each measure were made. Twenty young healthy adults with no history of a voice disorder will be presented.

Results: RFF shows a complex relationship between negative, neutral, and positive emotion states where evidence of hyperfunction was observed during negative emotion states, but also under positive emotion states.

Conclusions: RFF is a sensitive measure for emotional arousal but differential emotion valence has yet to be concluded.

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**SLP14**

**Voice Therapy with Seniors: Attendance, Outcomes, and Associated Patient Characteristics**

Objective: Several studies have shown low rates of attendance and success in voice therapy, with advanced age being one associated factor. The purpose of this study was to describe: 1) voice therapy attendance and outcomes among seniors and 2) patient factors associated with their attendance and outcomes.

Methods/Design: This retrospective chart review included voice therapy records for 40 consecutively treated seniors (ages 63-90) seen in a small, private practice in a mid-size southern town over a one year period. The attendance/outcome data resulted in the division of patients into 6 groups, including those who were successfully discharged from therapy (Group 1), attended a few sessions, had voices that improved to normal or near normal and then discontinued attendance (Group 2); attended many sessions with some voice gain (Group 3); failed to improve despite attending voice therapy (Group 4); failed to attend voice therapy because it "wasn't for them" (Group 5); or those who failed to attend voice therapy due to their health issues or those of a spouse/significant other (Group 6).

Results: Outcomes for Groups 1-3 (70% of patients) achieved positive voice change while outcomes for Groups 4-6 (30% of patients) were considered unsuccessful. This success rate is significantly higher than that reported in a similar study involving a younger cohort (53%; Smith et al., 2010). If patients in Group 6 (15%) are eliminated from consideration, the voice therapy success rate rises to 82%. Higher VHI scores, more frequent reports of increased stress and past tobacco use, lower daily water intake (<48 oz/day), and higher Reflux Symptom Index scores (>14) were found more often among patients in the unsuccessful versus successful groups.

Conclusions: Seniors can achieve high rates of voice treatment success, with better attendance and outcomes than younger individuals.

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**SLP13**

## Effects of Treatment Compliance on Outcome Measures of Voice Therapy

Objective: The aim of this study is to investigate the effect of compliance with treatment on voice therapy outcome measures.

Methods: Data were derived from an on-going investigation of "flow phonation" exercises on individuals with primary muscle tension dysphonia. Fourteen individuals (11 Females and 3 Males) diagnosed with primary muscle tension dysphonia participated in the study from which data in this analyses were drawn (Rangarathnam et al., 2015). Participants were males (n = 3) and females (n = 11), 16 years and older. Each completed twelve sessions (two times a week/six weeks) of flow phonation voice treatment. Auditory-perceptual, acoustic, aerodynamic and quality-of-life measures were obtained before and after the treatment. Participants were advised to practice the exercises 4x a day at home with 10 repetitions of each exercise (cup bubble blowing, gargling and stretch and flow) and log sheets were provided to document practice.

Results: Subjects with the greatest compliance to the home exercises demonstrated a rebalance/normalization of laryngeal resistance and mean airflow rates most similar to values seen in healthy individuals. Subjects with "good" and "fair" treatment compliance showed substantial gains with a lesser magnitude of improvement than the subjects who were highly compliant. One subject who was "poorly" compliant did not show gains in aerodynamic measures. All the subjects except for the one who was "poorly" compliant demonstrated statistically significant changes in perceptual and quality-of-life measures.

Conclusions: The results demonstrate that treatment compliance is an important variable that could augment positive physiological changes (modification of laryngeal resistance) in addition to improvements in perceptual and quality-of-life scores. The results also demonstrate that aerodynamic variables can be viable outcomes measures to understand treatment effects.

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**SLP12**

## Comparison of Three Programs for Measurement of Cepstral Peak Prominence

Introduction: Cepstral Peak Prominence (CPP) and smoothed Cepstral Peak Prominence (CPPS), are spectral measures of connected speech. Three programs available to calculate CPP and CPPS: Speech Tool, Analysis of Dysphonia in Speech and Voice (ADSV) and VoiceSauce are reported in the literature. To date, no comparison across the three programs has been conducted. They differ in their potential clinic applicability, ease of use, program capabilities and some finer details of CPP calculation. Currently, it is not known if the results across these three programs are equivalent.

Method: Two cohorts of 78 and 33 female non-voice disordered students (mean age 21.5years) recorded a sustained /a/ and the first two sentences of the Rainbow Passage (RP). Samples were analysed in all three programs using default settings. Equivalence of F0, CPP and CPPS was analysed using the ICC two-way mixed model, single measure analysis and Bland Altman plots. A formula was derived between each program using rank ordering and regression to allow approximate comparison of values.

Results: The three programs have different cost, utility and ease of use. There was excellent correlation between Speech Tool and ADSVcalculations of F0 (0.996, 0.997) and CPPS (0.823, 0.872) on the vowel, and good to excellent correlation of F0 (0.898, 0.949) and CPPS ( 0.708, 0.878) for analysis of RP across the two cohorts. Correlation between VoiceSauce and Speech Tool was good across both cohorts for F0 vowel (0.874 & 0.878) but poor for all other measures. Results from both groups were ranked the same and a constant adjustment was calculated between the pairs of programs.

Conclusions: Correlation between Speech Tool, ADSV and VoiceSauce varies despite having a common approach to derivation of CPP measures. Adjustment values from this data set may allow comparison of results across programs when comparing non voice disordered populations.

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# Aerodynamic Characteristics Associated With Breath Holding Behaviors in Patients Referred For Voice Therapy: A Retrospective Study

Objective: A recently published retrospective chart review by Gillespie et al (2013) examined aerodynamic profiles of women with primary muscle tension dysphonia associated with 'breath holding'. They identified distinct subgroups consisting of various relationships between average airflow and estimated subglottal pressure (est-Psub).

The current study expanded the target diagnostic categories to include all voice disorders referred for voice therapy at the Emory Voice Center. Three research questions were proposed. Are there differences in the relationship between mean flow rate and estimated sub-glottal pressure within the disordered population and compared to normative data reported in the literature? Are there subgroups within the disordered population with regards to mean flow rate and estimate sub-glottal pressure relationships? Does medical diagnosis effect these relationships?

Methods: A retrospective chart review of 990 patients seen for acoustic and aerodynamic voice assessment at the Emory Voice Center between January 1, 2013 and December 31, 2014 were examined for aerodynamic measures of mean flow rate and estimated-sub-glottal pressure , of these 192 met the inclusion criteria. Statistical Methods: simple t test, two-step cluster analysis and ANOVA as well as Tukey multiple comparisons were performed using R and SPSS.

Results: Mean est-Psub was significantly greater than for healthy speakers (p-value < 0.001). However, there is not sufficient evidence that mean flow rate was significantly greater than for healthy speaker p-value <0.12). There is not sufficient evidence to detect significant difference in est-Psub or mean flow rate by diagnosis. Subgroups of various relationships between average airflow and estimated subglottal pressure (est-Psub) were identified similar to those identified by Gillespie et al.

Conclusion: Findings suggest that breath holding behaviors occur across voice disorders either as compensatory measures or from preexisting somatic patterns that are exacerbated by dysphonia.

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**SLP6**

# The Role of Surface Hydration on a 30-Minute Vocal Loading Challenge

Objective: Surface hydration is considered to be crucial to optimal laryngeal function. Optimal surface hydration protects vocal fold surface structures, decreases perceived vocal effort, and facilitates efficient oscillation. Therefore, increasing surface hydration may protect the vocal folds from ill-effects of vocal loading. The goal of this study is to investigate whether a 30-minute loading challenge induces more detrimental vocal effects in a low humidity as compared to a high humidity environment. Vocal loading will be induced by an innovative combination of simulated vocal qualities that target frequency range and vibration mode.

Methods: 30 vocally healthy participants (15 male, 15 female) will complete a 30-minute vocal loading challenge in low and high humidity. The order of humidities will be counterbalanced across subjects. The vocal loading task will consist of reading in various vocal qualities in the presence of 70dB ambient, multi-talker babble noise. Acoustic measures, Perceived effort ratings (PPE), and Consensus Auditory-Perceptual Evaluation of Voice (*CAPE-V*) will be collected both pre and post loading in order to measure voice changes in both humid and dry environments. Laryngeal stroboscopy will also be performed pre and post loading in order to visualize any potential laryngeal changes. It is hypothesized that vocal loading will occur in 30 minutes and that the effects of loading will be more severe a low humidity environment.

Results: At the conclusion of the study, we will have data from 30 participants. Preliminary findings demonstrate that the vocal loading challenge increases self-perceived effort.

Conclusions: This study will seek to better understand how the healthy larynx can be loaded and therapeutic effects, if any, of increasing surface hydration.

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**SLP5**

## Patient's Perceptions of Treatments for Spasmodic Dysphonia

Objective: Numerous investigations have been conducted to explore patient's responses to their experiences with the diagnosis and treatment of spasmodic dysphonia (SD) (e.g., Creighton et al., 2015; Patel et al., 2015). However, little is known about patient's perceptions of the assessment/treatment process and their need for assistance in learning how to cope with this disorder. Therefore, a survey was designed to determine treatments of choice and their effectiveness in the treatment of SD.

Methods/Design: Patients diagnosed with spasmodic dysphonia (N=503) from the NSDA database volunteered to answer a 35 item electronic survey about their experiences with the assessment and treatment of SD. Responses were drawn from patients all over the US with 51 responses from patients in Europe, Asia, Latin America and Canada. As expected, 78% of the responses were from middle-age women who were diagnosed with SD in their 30s-50s.

Results: The majority of the respondents reported receiving a diagnosis of SD from an otolaryngologist within 1 year of initiating a search for a diagnosis/treatment of their voice disorder. Endoscopy and speech/voice assessment were key in establishing this diagnosis. Only 53% of the patients reported Botox injections as their primary treatment, with most receiving 3-4 injections per year. Likewise, 34% of patients reported the sole use of voice therapy, which typically lasted for 2-3 weeks at one session per week. Few patients reported use of counseling services and support groups, even though most indicated a need for emotional support in learning to cope with this voice disorder.

Conclusions: A qualitative analysis of patient responses revealed that patients explored many different treatment options, including holistic treatments, counseling, surgery, medications, and various voice treatments in their quest for symptom amelioration. Few of these methods were pursued long-term, suggesting that their effects were largely palliative. Future research directions will be described.

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# Assessing Risk Factors for Voice Problems (Voice Risk Calculator)

Objective: Reducing or eliminating risk factors associated with voice problems is an important concept in the prevention of dysphonia. The present study developed and validated a 16-item questionnaire (Voice Risk Calculator) that assesses the risks associated with the development of phonotraumatic voice problem.

Methods: The Voice Risk Calculator covers three areas (2 items related to vocal health, 8 items related to voice-related behaviors, and 6 items related to psycho-emotional status) and used a five-point categorical scale (0 to 4) for each item. A total of 77 subjects (42 dysphonic speakers with phonotraumatic origins and 35 with normal voices) recruited from a major hospital in Beijing completed the Voice Risk Calculator.

Results: High test-retest reliability ($r_s$ = .97, $p$ < .0001) and internal consistency ($\alpha$ = .88) were found. The concurrent validity of the VRC was supported by its moderate correlations ($r_s$ = .62, $p$ < .0001) with the Voice Handicap Index (VHI-10). A cut off score of 20 was found which could differentiate between subjects with phonotraumatic voice disorders (≥ 20) and non-dysphonic subjects (< 20). The Voice Risk Calculator has a sensitivity of 76% and a specificity of 63%.

Conclusion: The Voice Risk Calculator is of satisfactory reliability and validity that would serve as a useful clinical instrument for assessing risks related to the development of phonotraumatic voice problem. Using this to predict the risk in developing voice problems would help voice clinicians to develop prevention strategies appropriately.

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**SLP2**

## Short-Term Intensive Therapy for Athletes with Paradoxical Vocal Fold Motion Disorder: Respiratory Resistance and Dyspnea Rating Outcomes

Objective: Paradoxical vocal fold motion disorder (PVFMD) describes a condition where the vocal folds adduct and/or the supraglottal structures collapse into the airway during inspiration, causing air hunger. Exercise is a common trigger for PVFMD as reported by Rundell and Spiering (2003) who estimated its prevalence at 5% of elite athletes. In a recently published systematic review of treatment studies for PVFMD conducted through 2013, only two studies provided enough evidence to conclude that therapy is effective (Patel, Venediktov, Schooling & Wang, 2015). Reasons for this include a lack of an established treatment protocol including dosage and a noninvasive method to quantify therapy outcomes. The purpose of this study was to investigate the effectiveness of therapy for athletes with PVFMD through targeting the treatment protocol and providing objective evidence of its outcome.

Methods: A single-subject research design with three female athletes (mean age 16 years), diagnosed through laryngoscopy with PVFMD. Each athlete received individual intensive therapy for three consecutive days, 3 hours per day. A treatment protocol was devised and implemented, modeled upon exercise physiology training principles that incorporated overload, specificity, individuality, and reversibility. The Airflow Perturbation Device (APD; Lausted & Johnson, 1999) noninvasively measured inspiratory and expiratory resistance pre- and post-exercise at three points in time: prior to therapy, on the final day of therapy, and 6 weeks following therapy. Athletes' provided subjective dyspnea ratings while exercising, and rated PVFMD episode severity, frequency, and breathing control.

Results: Results for all three participants showed that while exercise rigor and duration remained constant, they experienced a decrease in respiratory resistance post-therapy that continued to the follow-up session. Additionally their subjective ratings of dyspnea while running, as well as episode frequency, severity, and sense of breathing control improved.

Conclusions: These three athletes with PVFMD responded positively to an intensive well-designed treatment model and experienced a reduced sense of dyspnea while running that coincided with a decrease in respiratory resistance values. This provides support for a pilot, controlled, group research study to further investigate evidence-based treatment for PVFMD.

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**SLP1**

## Self-regulation and Vocal Symptoms

Understanding the factors of self-regulation for patients with dysphonia or vocal symptoms during an evaluation can benefit therapy planning, the patient's daily practical direction, and the generalization and maintenance of gains in the tasks/techniques relating to voice therapy. Objective: There were two study objectives: first, to establish whether people with vocal symptoms have different self-regulation compared to people without vocal symptoms; and, second, to evaluate the existence of a relationship between vocal symptoms and self-regulation. Methods: This cross-sectional, quantitative multicentric study was developed by two higher education institutions. A total of 298 people of both sexes selected from the general population participated; most were female, from various regions in Brazil, aged 31–40 years, did not use their voice professionally, and were both with and without vocal symptoms. Participants responded to both the Short Questionnaire of Self-Regulation and Voice Symptom Scale. Results: All Voice Symptom Scale scores were higher for the group with vocal symptoms and all scores were above the cut-off. The Short Questionnaire of Self-Regulation values for people with vocal symptoms were similar to those in the studies that assessed the self-regulation of people with addictive behaviors. A significant negative correlation was recorded between the Short Questionnaire of Self-Regulation and all Voice Symptom Scale scores, indicating a strong relationship between self-regulation and vocal symptoms. The higher the number of vocal symptoms, the lower the impulse control and establishment of objectives. A relationship between impulsivity, lack of control, and difficulty establishing objectives about specific behaviors—in this case, abusive and harmful vocal behaviors—was noted. Conclusion: Individuals with vocal symptoms have a lower level of self-regulation compared to those with no vocal symptoms; the greater the number of vocal symptoms, the lower the impulse control and establishment of objectives.

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## The Voice of a Child in a Man's Body: Puberphonia Diagnosis and Management

Introduction: Puberphonia refers to the persistence of a high-pitched voice beyond the age at which voice change is expected to have occurred. This is primarily a male problem. It is important that a determination be made first as to whether an organic abnormality is present, specifically adequate laryngeal growth or endocrinological problems. Puberphonia may jeopardize a man's employment status and can negatively affect how he is perceived in society.

Patients and methods: Patient cohort included 11 males ages 16-25. Comprehensive evaluation consisted of VHI10 questionnaires, videolaryngostroboscopy, perceptual voice evaluation and fundamental frequency measurement of voice.

Assessment of the sexual maturity was made by paying attention to physical signs of masculinity. In order to establish the diagnosis a diagnostic maneuvers using reflexive acts were employed.
Results: 10 of 11 patients had normal laryngeal examination. One patient had combination of sulcus vocalis and a functional component. Mean fundamental frequency in this group was 190 (172-226) Hz.
10 of 11 patients had obvious signs of adult male appearance. One of the patients had a slightly more feminine appearance however hormonal screening was normal.
All patients underwent voice therapy by a single speech language pathologist.
Therapy techniques commonly involved using vegetative sounds to initiate voicing, applying external pressure to the larynx, producing loud plosive, pitch exploration through vocal fry, humming and yawning techniques.
All patients achieved decrease of pitch to normal male range. Remarkably this achievement took place during a single therapy session. Follow-up time ranged from 9 months to two years. Patients reported substantial improvement in quality of life.

Conclusion: Puberphonia is a functional voice disorder with devastating emotional and social implications. Proper diagnosis is essential for proper management. Short term voice therapy by an experienced and determined speech language pathologist leads to excellent results and saves the patient unnecessary suffering.

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## Why Consonants Matter - Consonant Resonance and its Effect on Vowels

One of the most frequent complains in Western classical singing is the lack of text intelligibility. Many studies have been conducted investigating the identification of sung vowels by focusing mainly on the effect of the raising fundamental frequency ($f_0$) and the consequential decrease of vowel identification. Although few studies addressed the positive effect of the consonantal environment on vowel intelligibility, one experiment showed that it does not specify vowel identity in singing as clearly as it has been demonstrated for spoken utterances. However, none of these studies addressed the resonance of consonants, the effect of formants on their production and subsequently the kinesiological and biomechanical importance of the production itself and its effect on the vowel.

A vast majority of the technical problems in the quest for great diction with luxurious tone occur when singers combine vowels and consonants. No matter how beautiful our tone is when singing vowels, if we then access the speech template for inadequate consonants, the vowels will surely suffer as a consequence. Consonants carry much of the burden of dramatic interpretation in singing. However, because they are mostly executed at virtually the same speed whether spoken or sung, the singer needs to modify them to have much more resonance and amplitude than those in speech.

This research - which is in part piggybacking on the data from *The Low Mandible Maneuver* - as well as the spectrograms of the great singers do show areas of resonance in the consonants that suggest the same vocal tract set that they use in their spectacular vowels.

The presentation will employ videos, acoustic analysis (spectrography) and stop-action imagery to illustrate the importance of consonant resonance (CR) as well as on how to maneuver the tongue for best results through the biofeedback of ultrasound.

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**SLP10**

# Changes in Objective/Perceptual Voice Measures as Boy Singers Progress from Soprano to Baritone

Objective: The purpose of these case studies is to present laryngeal images and acoustic, aerodynamic, and perceptual voice change measures of three boys as they progress from soprano to baritone in a boychoir. Understanding both the physiologic and perceptual changes is necessary for optimal vocal training.

Methods/Design: 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*

Voice Range Profile measures both fundamental frequency and intensity at the participant's minimum and maximum capacities. Eleven notes spread equidistance throughout the voice range were measured.

*Instrumental Measures/Aerodynamic*

The aerodynamic component provides information related to the valving efficiency of the glottis during phonation, as well as to the respiratory capacity. The primary measures of interest were average airflow and estimated subglottal pressure, obtained for four musical notes.

*Perceptual Analyses*

Three expert judges with greater than 10 years of experience training adolescent singing voices rated the singing samples, which contained 1-3-1/1-5-1/1-8-1 slides and the Star-Spangled Banner. Perceptual ratings included timbre, voice breaks, and vocal quality.

*Endoscopic Laryngeal Examination*

Using the digital stroboscope system (KayPENTAX), a flexible transnasal endoscope obtained laryngeal images as participant sang four discrete frequencies using the vowel "ee".

Results: Original data related to acoustic, aerodynamic, perceptual, and laryngeal imaging measures have been obtained to establish baseline measures for 27 boys, with pre-pubertal, unchanged voices between the ages of 7 to 12 years. Comparison data for three boys who mature to Cooksey mid-voice classification will be presented. Video, audio, and relevant statistical analyses of the data, as well as visual inspection of data trends will be included. Demographic information, singing history, and self-ratings of pubertal development will be discussed.

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

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**SLP21**

# Effect of Training, Style and Tempo on Pitch Accuracy

Introduction: Singers are typically required to sing with a high magnitude of precision in fundamental frequency (fo). Previous research suggests that pitch accuracy decreases when external feedback is masked, when singing in a staccato vs. a legato style, and when singing in a fast vs. a slow tempo. Moreover, it has been reported that professional solo singing education does not significantly affect the contribution of the auditory feedback to pitch control in singing.

Objectives: The objectives of this research were (i) to determine the magnitude of the effects on pitch accuracy of (i) training, (ii) singing style, (iii) tempo and (iv) level of external auditory feedback.

Methods: The subjects were 10 amateur or beginner singers and 10 classically trained professional or semi-professional singers (10 men and 10 women). Subjects sang an arpeggio over two octave bands in two styles (legato and staccato), at two tempi (40 BPM and 160 BPM) and with three different levels of external auditory feedback.

Results: For both groups of singers, beginner and professional, pitch accuracy was higher when singing in legato than staccato style, and at the slow tempo than the fast tempo. The descending part of the arpeggio was less accurate that the ascending one, especially for amateur singers. The highest notes were more accurate for professional singers that for amateur singers.

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**SLP30**

## Voice Symptoms and Risk Factors for Developing Voice Disorders in Future Musical Actors

Musical theater students follow an intensive program of singing, acting and physical excercises (dancing) and are expected to participate in long rehearsals and full performances. As they are absolutely depending on their vocal quality and vocal capacities for their studies and their future profession, an optimal voice coaching is very important. The purpose of this study was to determine the voice quality, voice symptoms and the risk factors for developing voice problems in future elite vocal performers (musical theater performers).

Thirty-one Musical students (7 men and 24 women) with a mean age of 20 years participated to the study. To determine the objective voice quality aerodynamic measurements, voice range profile, acoustic analysis and Dysphonia Severity Index were used. To inventory the voice symptoms and the risk factors for developing voice disorders the Dutch version of the checklists (De Bodt et al. 2008) of Russel et al. (2000) were used. The questionnaires investigate the presence and the frequency (never, daily, weekly, monthly) of voice symptoms and risk factors (vocal abuse, vocal misuse) as reported by the subjects. Psychosocial impact of a voice disorder was investigated using the the Voice Handicap Index and Singing Voice Handicap Index.

The mean DSI in male and female Musical theater students was respectively 3.9 and 5.6, both corresponding with an overall good vocal quality. The results of the VHI showed no important psychosocial impact on the speaking voice. Despite the overall good vocal quality, more than 40% experienced voice symptoms on a regular basis. Vocal misuse and abuse was also frequently reported. Videolaryngostroboscopy revealed a high presence of organic and functional voice disorders.

Note: The objective vocal quality in this group was presented in a poster at the voice conference in Philadelphia in 2015. This presentation focuses on new data regarding the symptoms and risk factors reported by the subjects.

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**SLP48**

# Analysis for Resonance Characteristic in Chinese Peking Opera Actors by Multiple Channel System of Resonance Cavity

**Objective**: Resonance is very important for human voice, especially for the Chinese Peking opera actors, but so far it has not been quite understand yet. So we tested the resonance characteristic of the Peking opera actors during the acting by the Multiple Channel System of Resonance Cavity (MCSR) which we developed before, hoped to find out the differences between the speech and the acting.
**Method:** Examined the acoustic energy contribution in different resonance cavity of 15 male Chinese Peking opera actors during acting and simply pronounced /a/ without resonance skills by means of the MCSR, compared the differences of the energy distribution of the cephalic, laryngeal, thoracic resonance cavity to the peroral acoustic signal in each frequency partition at the same tone. All the subjects were professional actors and accepted 10 years professional training and acting experience at least, the respiratory disease, neurological disorder, and auditory disorder were excluded. They were asked to pronounced/a/ in a same pitch 3 times, each time was sustained over 10s, and then acting the stander sentence which the elder artists judge the actors' skills by their ears for hundred years from the Chinese Peking opera three times. The MCSR were comprised by three surface vibration sensors, a microphone, an external receiver, and the accompanying computer software. The sensors were placed on the forehead (channel 4, CH4), the laminae thyroid cartilage (channel 3, CH3), and the sternal manubrium (channel 1, CH1), the microphone was place 15cm away from the mouth (channel 2, CH2), collected the acoustic signal. All the signals were calculated by the software, revealed as percentage presented the energy distribution in each frequency partition, and generated a visual energy percentage graph. The data were analyzed by SPSS 19.0.
**Results:** There were significant difference of resonance between the acting and speech voice. During acting, the power peak in chest was concentrate in 0-500HZ which was 40.9±5.8 in average. And in the larynx, the power peak was in 500-1000Hz which was 41.2±9.6 in average. And in the oral pharyngeal cavity, there were two peaks observed, one was in 500-1000Hz 21.3±6.3 in average, the other one was in 3000-3500Hz which was 19.3±5.3 in average. In the forehead, the power peak was in 1000-1500Hz which was 35.3±10.2 in average. During speech, the power peaks in the forehead and oral cavity were much lower which were 16.3±6.8 in 3000-3500Hz in the oral pharyngeal cavity and 25.3±9.2 in 1000-1500Hz in the forehead.
**Conclusion:** There are different resonance usages according to the different resonance skills. The cephalic resonance cavity is more sensitive for high pitch acting, and the thoracic resonance cavity is more sensitive for low pitch.

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# The Comparison of Vibrato between Classical Tenors and Gospel Tenors

Objectives
Analyzing the correlation of vocal production and vibrato between tenors of the Classical genre and tenors of the Gospel genre.

Methods
A total of fourteen Gospel tenors and fourteen Classical tenors were analyzed through audio recordings. The recordings consisted of each tenor singing a sustained pitch within the range of Eb4-F4 (311.13-349.23 Hertz) on an open vowel for an extended period of time with minimal accompaniment. Each recording was analyzed using VoceVista. The collected data was categorized into four aspects of vibrato; the mean pitch, the mean vibrato rate, the mean vibrato extent, and vibrato jitter. The two genres were compared in groups according to the four aspects and compared for evaluation.

Results
In consideration of the groups of tenors within the four aspects of vibrato, the Classical tenors had minimal variation within the range of data collected across the board. The Gospel tenors varied widely in every aspect taken under consideration.

Conclusions
Vocal training is necessary for singers no matter the genre. Since Classical training entails stabilizing the breath as well as isolating the muscles that contribute to vocal production to in turn work with each other, singers conditioned in that style show more consistency in the voice which is evident in the vibrato. Most Gospel singers are untrained which is a contributing factor in the variance of their vibrato and supposedly faulty vocal production. Additionally, Gospel singers typically use artistic embellishments and ornamentations more often than other genres which also alters their vibrato and general vocal production.

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**VP2**

## The Voce Faringea, Forgotten Art of the Bel Canto Tenors

In several historical sources from the first half of the 19th century, including both vocal pedagogy literature and physiological and anatomical treatises, a peculiar third register mechanism is mentioned that was in particular characteristic for the tenor voices of that period. This so-called *voce faringea* was often described as an intermediate register or a special mechanism connecting the falsetto and the chest register. Essentially, it is a forgotten historical singing practice used to extend the upper range of the voice whereby the falsetto, typically a weak and often feminine sound, is modified by the singer into a vocal quality that is a more powerful, tenor-like sound. This resulting sound was considered homogenous with that of the lower registers, and is no longer perceived in vocal quality as falsetto voice. Exceptionally high tessituras, often with pitches above C5 and D5 in the operatic tenor repertoire of the early 19th century, present strong evidence for the importance of this special vocal technique for the great great *tenori di grazia*. Based on an evaluation of historical voice register theories, training strategies and the sound ideals of the historical period, an informed discussion of the technique is developed. This study attempts to describe the physiological and acoustic characteristics of the *voce faringea*. Therefore, sound samples of various voice register mechanisms of a professional tenor and countertenor (the author of the present study) were recorded with the software *VoceVista*. Through analyzing audio and EGG signals the peculiarities of the *voce faringea* and a clear distinction from both the chest and falsetto registers is documented.

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# Evidence-Based Frameworks for Teaching and Learning in Classical Singing Training: A Systematic Review

Objectives. The study systematically reviews evidence-based frameworks for the teaching and learning of classical singing.

Methods. A systematic literature search of 15 electronic databases following the PRISMA guidelines was conducted. Eligibility criteria included type of publication, participant characteristics, intervention, and report of outcomes. Quality rating scales were applied to support assessment of the included literature. Data analysis was conducted using meta-aggregation.

Results. Nine papers met the inclusion criteria. No complete evidence-based teaching and learning framework was found. Thematic content analysis showed that studies either (1) identified teaching practices in one-to-one lessons; (2) identified student learning strategies in one-to-one lessons or personal practice sessions; (3) implemented a tool to enhance one specific area of teaching and learning in lessons. Included studies showed that research in music education is not always specific to musical genre or instrumental group, with 4 of the 9 studies including participant teachers and students of classical voice training only. Overall methodological quality ratings were low.

Conclusions. Research in classical singing training has not yet developed an evidence-based framework for classical singing training. This review has found that introductory information on teaching and learning practices has been provided, and tools have been suggested for use in evaluation of the teaching-learning process. High-quality methodological research designs are needed.

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# A Survey of Observation and Mentored Practical Experience During Vocal Pedagogical Training Across Genres

Objectives*:* There are currently no established requirements or set parameters for voice teachers regarding the amount of guided observation (both pedagogical and clinical) or critical pedagogical mentorship required during training. Furthermore, there is no relevant research on the current state of affairs in this area with regard to voice teachers. This is in stark contrast to the health care professions, in which practitioners are typically required to log a significant amount of time observing others as well as undergo critical observation of their own work in order to be certified in a particular field.
This survey is relevant in determining how much practical observation, supervised and otherwise, voice teachers pursue prior to beginning their professional practice.

Methods: An online survey was distributed to over 1,000 voice teachers nationwide. The surveys contained questions about the teachers' backgrounds, observations completed in training and pedagogical mentorship in various genres. Data were analyzed using descriptive analyses and statistical analyses when applicable.

Results/Conclusions: The majority of respondents had advanced degrees in music and over 15 years of teaching experience. Approximately half of the respondents completed over 25 hours of pedagogical observation in classical and music theater genres, but few completed pedagogical observation in other genres. The majority of respondents reported fewer than four hours of critical mentored observation of their own teaching in any genre. The majority of respondents had fewer than four hours of clinical or surgical observation of medical voice colleagues (speech-language pathologists and laryngologists). These results expose a relatively low number of observation hours in pedagogical training, especially in genres other than classical, and in medical voice treatment. This information may help to shape the direction of pedagogy program requirements and the culture of observation in voice pedagogy.

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## Singing as a Physical Therapy: A New Role for the Voice Teacher?

In recent years, the cognitive effects of singing have received much scientific and media attention. However, the physicality required for singing mirrors the physiology of airway clearance and suggests that it can be a useful therapy for respiratory diseases such as COPD, emphysema, asthma and cystic fibrosis. Respiratory medicine publications from the past 15 years were critically reviewed for effective interventions that could be used in the setting of private voice lessons. We will determine roles for the voice teacher in adjunctive treatment of specific pulmonary conditions and to promote general respiratory health.

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**VP6**

# The Ecological Validity of the Singing Power Ratio: Comparison across Venues

Objective: The Singing Power Ratio (SPR) reflects the relative amplitude of the energy in the harmonics between 2000 – 4000 Hz compared to 0 – 2000 Hz. As such, it reveals the presence or absence of the singer's formant. Studies to date have all been conducted in laboratory settings, typically in a sound proof booth, with no accompaniment. This setting does not reflect situations in which the singer's formant is required. This study was designed to assess the consistency of the SPR across venues.

Methods/Design: Fifteen singers participated; all were enrolled in a graduate vocal training program. They represented the following *Fächer*: mezzo-soprano; soubrette and lyric soprano; lyric and leggiero tenor; baritone; and bass-baritone. Singers were recorded in at least two of four venues: a 14' x 22' studio with 14' ceiling; a 42' x 30' rehearsal hall with 20' ceiling; a 250 seat recital hall; and an 800 seat opera house. Singers performed a selection appropriate for their voice type. Singers were recorded on iPads and iPhones with built in microphones for comparison. Results were consistent among the various instruments. A sustained vowel from each recording was subjected to spectral analysis using Praat software. The difference between the strongest harmonic from 0 – 2000 Hz and the strongest harmonic from 2000 to 4000 Hz was calculated. Comparisons of SPR were made across recording venues, and in select singers, with and without accompaniment.

Results and Conclusions: Across singers, the SPR averaged across two to three venues was -12 (*SD* = -5.5) with a range from -5 to -26. The mean SPR across singers for venue 1 and venue 2 was -12.7 and -11.6, respectively. Because the majority of singers performed in two venues, a paired t-test was used to compare differences between recording venues. There was no significant difference in SPR between venues ($p = 0.28$). Five singers were recorded in the same venue with and without piano accompaniment. The mean SPR with and without accompaniment was -15 and -14 respectively. These findings suggest that the SPR is a robust measure across both venues and singing condition.

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# The Use of Inexpensive Technology to Evaluate Singers Auditioning for Voice Graduate Program

Background: Auditions for admission to graduate programs specializing in opera performance are often held in smaller venues, including voice studies, choir rehearsal rooms, or recital halls. The actual opera theatre used for performances is typically unavailable. Evaluating voices in smaller spaces is often misleading. A voice that appears resonant in a small venue may not have the required resonance to project over an orchestra in a larger venue. Inappropriate repertoire and role assignments can be misleading as to *Fach*, and potentially dangerous to vocal health.

Objective: This study was designed to determine the effectiveness of inexpensive, readily available technology in determining the presence or absence of a singer's formant (resonated frequencies in the 2600-3200 Hz range) across a variety of voice types and recording venues.

Methods: Sixteen singers were assessed in four different environments. Singers were two lyric sopranos, three soubrette sopranos, two mezzo-sopranos, six tenors, two baritones, and one bass-baritone. The recording environments were a voice studio, a staging rehearsal room, a 250-seat recital hall, and an 800-seat opera house. In the recital hall, rehearsal room, and opera house, measurements were taken at 25 feet and 50 feet from the singer. In the studio measuring 14.25x22, the recording device was positioned 20 feet from the singer. Recording devices were iPhones and iPads loaded with spectrogram software applications. The devices' built in microphones were used. Environmental noise was not eliminated after recording, in an effort to maintain real-world, ecological validity.

Results

In comparing sound samples from the same individuals in across venues, the spectrographic patterns remained virtually the same. The presence or absence of a singer's formant was easily seen using these readily available devices and software.

Conclusions

Because auditioning often takes place in small venues, the perceptual impression of a singer's vocal power may be inaccurate. The use of readily available, inexpensive technology, illustrating the singer's formant, is an effective supplement to the judge's trained ear.

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## Survey of Vocal Health Referral Practices for Singers

The objective of this study is to provide insights into current vocal health referral practices among private studios, K-12 choral conductors, and collegiate music educators. Appropriate care and management of voices in today's health care system continues to remain controversial. Although some voice users are aware of the risks associated with continued use on an injured laryngeal mechanism, prior research indicates many are unlikely to seek medical attention due to a variety of reasons. In order to better understand current rationale and practices among teachers of singing, a survey was designed to evaluate respondents' student referral practices related to vocal health concerns.

An online survey study will be conducted related to rationale for referring singers to an otolaryngologist, likelihood of referring potential injured students to an alternative medical professional, and specific vocal symptoms which would warrant a referral. The survey link will be provided to professional membership organizations who serve the professional needs of vocal educators.

Professional voice teachers, singers and choral conductors from various vocal genres and member organizations will be asked to fill out the survey. Additional questions will relate to the responder's comfort level training students with a diagnosed laryngeal pathology, comfort level with training students following vocal fold surgery, and the role (and contributing knowledge) of vocal hygiene education in their teaching.

Statistical analysis obtained from the data may lead to a better understanding of referral practices of practitioners, the role vocal educators play in vocal rehabilitation, and whether participants have training in vocal rehabilitation. The results of the survey may also serve to inform current practice in team management of dysphonia in singers, including typical referral patterns (traditional laryngology/SLP approach compared to alternative medical specialist).

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## Changes in Voice Quality among College/University Singing Students over the Course of a Day

Previous studies have analyzed changes in individuals' voice quality throughout a typical day (from morning to afternoon to evening), but few studies have done so through repeated readings in the field. Further, no studies have assessed these daily changes among college/university singing students, a group of highly active voice users with still developing voices. Finally, no study has analyzed these changes both in terms of speaking and singing.

The purpose of this study was to assess the voice quality of college/university singing students ($N$ = 13, ages 18-24 years) who were enrolled in both voice lessons and choir. The assessments were made through measurements of voice quality during singing and speaking vocal tasks acquired at 3 different times of day with an acoustic transducer worn at the neck. Tasks included a spoken /a/, sung /a/, a reading of "The Rainbow Passage" and one verse of the hymn "Amazing Grace." Repeated measurements included a baseline reading in a controlled setting and three consecutive days of field measurements during a normal academic week with classes in session. Voice quality measures included fundamental frequency ($F_0$) LTAS slope, dB SPL, alpha ratio, dB SPL 1-3 kHz, pitch strength, shimmer, jitter, and harmonic-to-noise ratio.

Analysis of these repeated vocal tasks showed that $F_0$ (Hz), dB SPL, and resonance measures increased from morning to afternoon to evening in both speaking and singing tasks, with most significant changes occurring between morning and afternoon. There were, however, no significant changes in voice clarity or perturbation throughout the day.

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**VP10**

# The Effect of Wearing a Necktie on Perceived Phonatory Effort and LTAS

Objective:
Previous research suggests that a necktie can increase intracranial and intraocular pressure in an individual (Jonas, 2005), but no research exists to date on the possible effect of neckties on perceived phonatory effort and choir sound. Therefore, the purpose of this study was to assess acoustically (long-term average spectra) and perceptually (perceived phonatory effort) the effect of wearing a necktie in an all-male choral setting.

Method:
A male choral ensemble (*N*=30) singing Thomas Tallis' motet "If ye love me" was used for the duration of the study.

1. Using a prerecorded projected conductor, the choir was recorded (Edirol R-0HR; .wav, 44.1kHz) singing the Tallis motet without a necktie. This served as a baseline for subsequent recordings.
2. Half the choir (*n* =15) put on a necktie while the other half did not. A spacer on the back of the neck measured consistency of necktie tightness among all singers. The choir rehearsed the piece for ~7 minutes to detract attention from wearing the tie. The choir then sang the motet again with the same videotaped conducting.
3. Each chorister completed a questionnaire consisting of a visual analog scale anchored by "minimum vocal effort" and "maximum vocal effort," and asked to draw a vertical line where they perceived their effort level.
4. Steps two and three were repeated with the other half of the choir wearing a necktie and the original half not.
5. The entire choir (*N*=30) donned neckties to sing the motet again while following the prerecorded conductor.
6. Each of the recordings was analyzed using long-term average spectra (LTAS) (CSL-Model 4500). Questionnaire responses were analyzed using ANOVA (alpha level = .05).

Results:
This study is currently in progress. Results will be discussed in terms of possible effects of neckties on the timbre of choral sound, perceived phonatory effort, and suggestions for future research.

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**VP11**

## Perceptual Changes in Actor Students' Voices After 16 Months of Training

Objective
This study investigates perceptual changes in normal or supranormal voices after 16 months of the Linklater based Voice Training.

Methods
Eleven students in an M.A. acting program were screened three times during a period of 16 months. An unrehearsed reading of a performance piece was recorded in habitual loudness, and assessed by five Finnish voice trainers experienced in working with vocally healthy professional voice users.

Randomized samples were assessed twice, initially directed toward describing voice and speech characteristics freely, and subsequently with a structured questionnaire using a 10 cm visual analogue scale. The following characteristics were evaluated: overall voice quality, audibility, voice production (hypofunctional – hyperfunctional), roughness, resonance (dark – bright; sonority), overall pitch, pitch range, and clarity of articulation (consonants, vowels).

Results
The inter-rater reliability of perceptual evaluation was good (Cronbach's alpha=0.84). The paired t-test showed a significantly larger pitch range ($p=0.003$) and a shift toward less hyperfunctional voice use ($p=0.022$). Voice timbre showed a tendency toward darker ($p= 0.053$) and pitch toward lower ($p=0.075$). The voices, which were assessed as having become darker and more sonorous, and having improved in overall quality, were also described as having become more freely produced, more mature and more expressive. When looking at the results individually, there were a lot of changes in various parameters. Not all of the voices were described as having improved in quality, but as having changed in other characteristics. Open descriptions revealed that when actors chose to make changes in other suprasegmental properties (e.g. intonation/pitch changes, stress, rhythm, tempo) evaluations of the voice quality were affected both positively and negatively.

Conclusion
Decreased hyperfunction, slightly lower pitch and darker timbre suggest a more economic voice production. A larger pitch range suggests increased vocal flexibility. When analyzing normal and supranormal actor students' voices, voice quality is not the only aspect that shifts as a result of voice training. Training results need to be examined with a more holistic scope.

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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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**VP14**

# Choral Blend in Vocal Ensemble Performance: Vibrato Production

Objective

Choral blend is a term commonly used when discussing characteristics of good vocal ensemble performance. However, it is multifaceted and incorporates many aspects of vocal performance, including tuning, vowel matching, loudness, and timing. Directors typically identify vibrato as a feature to be controlled when achieving optimal 'blend', restricting its use for musical effect. Voices with minimal vibrato (particularly upper voice parts) are usually considered to be most appropriate to solo voice ensemble singing, and performers consciously address vibrato in their practise. This study investigates the vibrato production of individual voices within vocal quartets and quintets to assess the extent to which vibrato is adapted to achieve optimal blend.

Method / Design

A number of vocal ensembles were recorded using headworn DPAs and electrolaryngograph electrodes to allow fundamental frequency analysis of the individual voices using SPEECH STUDIO and PRAAT. Once fundamental frequency values were extracted, vibrato analysis was carried out in MATLAB. The same choral material was recorded over several weeks of rehearsal to allow analysis of conscious and subconscious changes to vibrato production over time. As well as their rehearsal discussions being recorded, singers were asked for opinions of vibrato production in connection with blend.

Results / Conclusions

The results indicate that both rate and extent of vibrato are adjusted to some extent by individual singers to improve choral blend, with some instances of synchrony between voice parts. The singers make some conscious alterations to vibrato to improve blend, however these do not always present clearly in the vibrato analysis, suggesting that singers' own perceptions of their performance may be influenced by other acoustic or physical factors.

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**VP15**

# The Effects of Equidistant and Unequal Inter-Singer Spacing Conditions on the Long-term Average Spectra of an SATB Choir

Objectives: Previous research has found significant differences in the long-term average spectra and perceived tone quality of choirs when singers stand with spread inter-singer spacing as opposed to a close, shoulder-to-shoulder stance. Singers, moreover, have consistently reported better ability to hear and monitor their own voices in relation to others with spread inter-singer spacing. Some choral conductors, however, face the practical problem of insufficient room in performance or rehearsal venues to allow all singers spread spacing.

Therefore, the purpose of the present study was to assess the effects of equidistant and unequal inter-singer spacing on the long-term average spectra of an intact, SATB university choir.

Method: Choristers ($N$ = 30) performed from memory an a cappella excerpt (1 min. 39 sec.) as they followed a videotaped conductor (to insure consistency of conductor behaviors and tempo) in each of 4 trials: (a) equidistant, close, shoulder-to-shoulder spacing, (b) equidistant, laterally spread spacing (2 ft. between singers), (c) unequal lateral spacing condition one (women with lateral spacing, men with close spacing), and (d) unequal lateral spacing condition two (men lateral, women close). Data were acquired from two calibrated, omni-directional microphones, placed at (a) a conductor position and (b) an audience position.

Results: There were significant differences ($M$ = 2 - 4 dB SPL) in spectral energy between equidistant close and lateral inter-singer spacing conditions at both microphone locations. However, mean differences in spectral energy at either microphone location between equidistant, laterally spread spacing and the two unequal inter-singer spacing conditions did not exceed 1 dB SPL.

Conclusion: Although results cannot be generalized to all choral ensembles in all venues, choirs without sufficient room for equidistant inter-singing spacing might consider a modified or unequal inter-singer spacing configuration to achieve differences in choir timbre not unlike those achieved through equidistant spacing.

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**VP16**

## A Textual Analysis of Contemporary Commercial Music (CCM) Vocal Pedagogy Books

Abstract: Several authors including Jerome Hines, Richard Miller, Elizabeth Blades-Zeller, and Joan Melton have produced texts that compare and contrast the work of classical and musical theatre pedagogues. However, a literature review was unable to reveal any studies that analyzed the published texts of CCM pedagogues. The current study will analyze CCM vocal pedagogy texts for similarities and difference in the areas of respiration, phonation, resonance, and articulation. The results will provide insight into the pedagogical approaches currently in print and identify areas for further study.

Objective: To examine the methods used by CCM vocal pedagogues for teaching respiration, phonation, resonance, and articulation

Methods/Design: The authors' institutional library has a collection of over one hundred pedagogical texts, with approximately one-third covering CCM styles. The CCM texts will be separated from the classical texts, arranged in alphabetical order, and numbered. A random number generator will be used to select ten texts for analysis. The researchers will individually analyze each text and identify key concepts related to respiration, phonation, resonance, and articulation. Results will be compiled and compared to identify any inconsistencies between the evaluators. Once any inconsistencies have been resolved, the results will be separated into each of the four categories for comparison. Descriptive statistics will be used to analyze each category and draw conclusions.

Results and conclusions: This study is currently in progress. Results from this study will provide insight into pedagogical approaches used by published CCM vocal pedagogues.

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**VP17**

**Considerations for Pelvic Floor Training in Professional Voice Users: An Interdisciplinary Review**

Objective: To determine the importance of specific pelvic floor training for the professional voice user in speech and singing based on the available literature of journals of singing/voice, physical medicine, physical therapy and urology.

Methods: A comprehensive literature review was performed on the use of the pelvic floor/pelvic diaphragm in breathing and during breath management for voice production. Physical medicine, physical therapy, urology and voice journals were included in literature review.

Results: Limited publications were available in the singing/voice journals regarding specific pelvic floor musculature. However, convincing literature was found in journals of physical medicine, neurology and physical therapy supporting the importance of the pelvic floor in breathing and in breath management and the symbiotic relationship between the pelvic floor and the structures of the vocal mechanism and its articulators.

Conclusion: An interdisciplinary literature review suggests that there is an important role of the pelvic floor in breathing and breath management specific to phonation. The information gathered in this literature review warrants dissemination across disciplines specifically to professional voice users. More research is needed in this area of vocal pedagogy.

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# Sing Out, Louise(s)!: A Multi-Disciplinary Review of Current Perception and Practice in Female Adolescent Voice

Adolescent female singers are a significant presence in the voice community, yet historically, there has been a limited amount of research addressing the female changing voice – both physiologically and pedagogically.

Both existing research and our own studio practice suggests that the female developmental period presents significant vocal challenges, potentially distressing to the young singer – particularly those who are unaware of the nature of their vocal instability. As such, this study seeks to determine the level of awareness of the female changing voice in the broader singing voice community, compare and contrast methods between disciplines, and consider these professional perceptions with the experiences and observations of adolescent female singers themselves.

This mixed methods approach will interview and collect data from professionals in the various fields that work with young female singers, including professional and amateur musical theatre, contemporary commercial music, classical performance, and choral performance.

Following this, a small, multi-case study of adolescent females (ages 11-15) will be conducted to better understand their perceptions of their own voice and singing experience during this period of vocal change. Data collection will include interviews with these singers and lesson observations by researchers.

Findings are presented with the aim of contributing to existing knowledge of pedagogical information in training these younger singers in addition to perceptions from their own experiences.

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# Continuing the Conversation: Proposed Dysphonia Screening Protocols for Students in Collegiate Voice Programs

Background: Screenings are implemented in a population to identify the potential presence of undiagnosed disease in individuals who are without signs and symptoms. The long-term goal of a screening is to enable earlier intervention and management to minimize discomfort and hardship from a disease. Though dysphonia screenings have been implemented in several collegiate voice programs, specific and formalized protocols for screening, particularly those based on the availability of resources, have yet to be published. This work is presented as a follow-up to preliminary discussion presented at the 2014 NATS National Conference in Boston, MA. The subject matter was also discussed and received with enthusiasm at the 2015 inaugural PAVA Symposium, further justifying the need for developing formalized screenings for early identification and prevention of dysphonia in this at-risk population.

Objectives: Discuss rationale for early detection of dysphonia in young singers and the potential role of the screening in both early detection and prevention; examine limitations and risks (i.e., false positives/false negatives, false sense of security, biases) of implementing screening protocols in collegiate voice programs; define voice screening and contrast the protocol(s) with the comprehensive voice evaluation; propose discrete tiers of screening protocols to be implemented based on the availability of resources at a given institution; present summary findings of a screening program piloted by the authors at the University of North Carolina at Greensboro School of Music, Theatre and Dance.

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**VP20**

# Determining the Relevant Criteria for 3D Vocal Tract Characterisation


Objective

This work investigates the information that can be retrieved from 3D magnetic resonance imaging (MRI) scans of the vocal tract, and aims to identify which parameters are the most relevant to establish the techniques used to achieve resonance tuning.

MRI methods are particularly useful for the female vocal tract, whose acoustic output is difficult to analyse due to the high fundamental frequencies involved. This work is part of a wider study investigating the techniques used by professional female singers to sing very high notes, using 3D MRI to capture the vocal tract while the singers sustain notes over their entire range, and collecting information on resonance tuning techniques using broad-band excitation of the vocal tract during singing (after [1]).

Methods/Design

The relevant parameters of the vocal tract will be established by examining 3D MRI data collected from professional female singers, and comparing these to measurements of the acoustic resonances of the vocal tract, as well as reviewing previous studies on the female singing voice that have either involved MRI of the vocal tract (2D static and dynamic MRI), or that have attempted to identify the methods used by singers to sing high pitches or employ resonance tuning techniques.

Results/Conclusions

2D MRI studies have considered factors such as lip opening, jaw opening, tongue height, jaw protrusion, oropharynx width, and uvula elevation [2], as well as area functions generated from a midsagittal image. Studies not involving MRI have considered lip opening, lip spreading [3], and larynx height. Extracting this information from the 3D MRI data in this study will allow comparison between results.

The 3D images generated in this research allow data in the transverse as well as midsagittal plane to be collected, leading to more accurate area functions and information such as the width of the pharynx and other adjustable parts of the vocal tract (e.g. tongue), and the volume of the vocal tract.


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**VP21**

# The Effects of the Monthly Menstrual Cycle on Acoustic and Perceptual Measurements Acquired From Trained Female Singers across Three Months at Each of Four Distinct Phases: A Collective Case Study

Introduction: Previous research (e.g. Muerer, et al., 2009) suggests that the monthly menstrual cycle impacts the female speaking voice (jitter, shimmer, harmonic-to-noise ratio [HNR], fundamental frequency). Some other studies have looked at the impact on trained female singers (e.g. Ryan, 2009); however, no study to date has looked at the potential impact of menstruation on trained female singers' speaking and singing voice measured across several months at each of the four distinct phases of the menstrual cycle.

Objective: The purpose of this study is to measure potential acoustic and perceptual changes in both the singing and speaking voices of 3 trained classical singers at each of 4 phases over 3 consecutive menstrual cycles.

Design: Longitudinal Collective Case Study

Methods: Classically trained college-age female singers ($N$=3) who are not currently taking Oral Contraceptive Pills participated in this study. Data collection occurred during four distinct phases of the menstrual cycle (follicular phase [days 6-10], ovulatory phase [days 13-15], premenstrual [days 25-28], and menstrual phase [days 1-3]) as based on the Oxford American Handbook for Obstetrics and Gynecology. Data collected included: (a) a recorded sample of a previously-learned song sung in the same key each time, (b) Evaluation of the Ability to Sing Easily (EASE) questionnaire (c) a Multi-Dimensional Voice Profile Analysis of the sustained vowel /a/, (d) acoustic analysis (LTAS), (e) intonation analysis, and (f) expert listener ratings. Each participant completed ($n$=12) data collection sessions.

Results/Conclusions: This study is currently in progress. Results will be discussed in terms of vocal pedagogy of female singers and directions for future research.

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**VP22**

**Effects of a Straw Phonation Protocol on Acoustic and Perceptual Measures of a Male Barbershop Chorus**

Many voice professionals use semi-occluded vocal tract (SOVT) exercises (e.g., lip trill, bilabial fricative, straw phonation) to promote efficient voicing from their students, choristers, or clients. Researchers have found that these exercises may reduce singer phonation threshold pressure and closed quotient and affect various acoustic measures (i.e., sound pressure level, *f*o, formant intensity, singers/speakers formant cluster spectral prominence) after removal of the semi-occlusion (e.g., Guzman et al., 2013; Schwarz & Cielo, 2009; Titze, 2009).

Until recently, such research has included only individual singers without addressing possible effects of SOVT exercises on group singing timbre. Choristers may employ different resonance strategies than soloists (Ford, 2003) or make unconscious adjustments based on their ability to hear their own voice within a group (Ternstrom, 2003). Therefore, results of these studies may not directly apply to choruses. In one study (Manternach & Daugherty, 2015), long-term average spectra (LTAS) analyses of an SATB choir revealed changes of less than 1 dB across the spectrum after the chorus took part in a group straw phonation protocol. Most choristers, however, felt the group sounded better (78.3%) and that they individually sang more efficiently (73.9%) after the protocol. The researchers recommended follow-up investigations with varied choruses performing in varied styles.

To that end, the purpose of the present study was to measure the effect of a group straw phonation protocol on acoustic changes of conglomerate, choral sound in a male barbershop chorus. Singer participants constituted a barbershop chorus that performed from memory an unaccompanied piece from their performance repertoire. Choristers then participated in a 4-minute straw phonation protocol with a stirring straw before singing the piece again. Videotaped conducting ensured that singers witnessed the same non-verbal conductor behaviors. LTAS analyses provided acoustic data for pre- and posttest comparisons of choral timbre.

*N.B.* This study is currently in progress.

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# The Effect of a Straw-in-Water Phonation Protocol on Acoustic and Perceptual Assessments of University Voice Students

Objective:
Many voice teachers and therapists use semi-occluded vocal tract (SOVT) exercises in their studios or clinics. These exercises involve a variety of means that lengthen and/or narrow the vocal tract (e.g. lip/tongue trills, straw phonation, straw-in-water phonation). Researchers have found that these exercises may affect a singer's phonation threshold pressure, sound pressure level, closed quotient, fundamental frequency, or formant frequencies after removal of the semi-occlusion (e.g. Andrade et al., 2014; Guzman et al., 2013; Titze, 2009). No research study to date has investigated the effects of a straw-in-water protocol using an accessible 500ml water bottle. To that end, the purpose of this study was to measure the effects of such a straw-in-water phonation protocol on (a) formant analyses, (b) vibrato rate and extent, (c) sound pressure level, (d) long-term average spectra, (e) MDVP Advanced data, and (f) perceptions of singers ($N$ = 20) enrolled in a University voice studio.
Method:
The protocol for this study was pretest-treatment-posttest. Each participant completed a 5-token MDVP Advanced protocol, performed an excerpt from "Somewhere Over the Rainbow" from memory, and completed an EASE questionnaire for each test condition. Participants engaged in a straw-in-water phonation protocol through a straw in 2cm depth of water in a 500ml plastic water bottle between testing conditions, including exercises spanning the vocal range, and the melody of "The Star-Spangled Banner".
Results:
Dependent measures included both acoustical (formant analyses, vibrato rate and extent, dB SPL, LTAS, MDVP) and perceptual (EASE questionnaire) assessments.
Conclusions:
Results were discussed in terms of potential effects of straw-in-water phonation on solo vocal production and efficiency. The potential advantages and disadvantages of accessible straw-in-water phonation compared to other SOVT exercises were also addressed.

N.B. This study is currently in progress.

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**VP24**

# "Pulsed, Connected Giggle" - A Treatment Option for Singers with Essential Tremor

Objective:
Singers who present with an uncontrollable tremor in the singing voice often find this neurological voice disorder problematic and possibly disabling for their singing style. A treatment option of connected short pulses of singing in a repeated, supported, and sustained "giggle" can allow these singers to approximate legato singing, partially defeat the annoying tremor, and continue to perform and enjoy singing.

Methods/Design:
A brief review of symptoms and treatment options of tremor in the singing voice will be presented, referencing Julie Barkmeier-Kraemer's 2015 symposium workshop using The Boone Voice Program for Adults, 2nd Edition Pro-Ed (2000). A description of the Singing Voice Specialist's habilitation of 4 patients from different singing styles (church choir singer, classical opera singer, bluegrass singer, and CCM Christian singer) in the "pulsed, connected giggle" technique will follow. Beginning with short, pulsing [ss] sounds, the singer progresses to "puffs" of air vocalizing on sung vowels, and finally to connected pulses, sounding similar to a sustained singing tone. Additionally, the SVS corrects other vocal faults, such as reestablishing abdominal breathing, relaxation of jaw/throat/tongue tension, and enhancing resonance.

Results:
In addition to retraining basic singing techniques, the SVS' instruction of "pulsed, connected giggle" tone allows the singer to create a similar-to-normal legato singing tone, interrupting the tremor-induced wide variation of tone and pitch that is inherent in the voices of people suffering with this disorder.

Conclusions:
With this treatment option available as a tool for singing sustained musical phrases, singers from a variety of singing styles can begin to overcome the unpredictable, yet recurrent interruption that occurs with tremor. Combined with basic retraining in singing technique and increased confidence that develops from using the "pulsed, connected giggle", singers with essential tremor may be able to return to some or all of the singing tasks they love and enjoy.

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**VP25**

## The Effects of Tactile, Singer-Initiated Head and Neck Alignment on Postural, Acoustic, and Perceptual Measures of Male Singers

Objective: Recent research on singer posture noted its effect on vocal quality (e.g., Barnes-Burroughs, et al., 2005; Echternach, et al., 2014; Rollings 2014, 2015), but no study has yet examined tactile guides for singer posture. The purpose of this investigation was to determine the potential effects of a two-handed, singer-initiated head and neck alignment technique on postural (head position, cervical lordosis), acoustical (LTAS, dB SPL), and perceptual (singer questionnaires, expert listener panel) measures of a prepared folk song.

Methods: Singer participants constituted a convenience sample of male singers (N=35) that performed unaccompanied from memory the same folk song in three testing conditions: (a) a pretest condition, (b) a post-protocol condition after participating in a 4-minute two-handed, singer-initiated head and neck alignment technique protocol, and (c) a posttest condition after waiting seven minutes. Among controls instituted: (a) a Countryman E6 omnidirectional head-mounted microphone was positioned on each participant out of the direct air stream, 5 cm from the left side of the participants' lip corner, (b) participants were recorded using a digital Zoom Handy Video Q3 camera and markers placed on the approximate location of the C7 vertebra, on the right tragus, and the nasion, and (c) all singers sang in the same key and received the starting pitch from a pitch pipe prior to singing each task. The microphone was calibrated prior to each subject and the level remained consistent across all participants. Still screenshots from video recordings of participant head positions provided data using an onscreen ruler for pre- and posttest comparisons of singer alignment on the same [ɑ] and [i] vowels. LTAS analyses provided acoustic data for pre- and posttest comparisons of singer spectral events.

Results: Results were discussed in terms of tactile strategies of achieving efficient singer alignment, considerations for vocal music education, limitations of the study, and suggestions for future investigations. Note: this study is currently in progress.

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**VP26**

**Head Over Heels: The Effects of Three Heel Heights, Pitch, Vowel, and Voicing Behavior on the Head Position and Jaw Opening of Female Singers**

Previous research indicates that high-heeled shoes and participant voicing behavior (silent, singing) may elicit alterations in female singer head position and jaw opening (Rollings, 2013, June, 2014a) and that singer head position can alter acoustical and perceptual measures of singing (e.g., Rollings, 2014b, June; Barnes-Burroughs, Watts, Brown, & LoVetri, 2005). Previous studies also suggest that singers may elevate head position and increase jaw opening as pitch ascends or when singing a more open vowel ([ɑ]) compared to a more closed vowel ([i]) (e.g., Austin, 2007; Scotto di Carlo, 1998). However, no study to date has examined the possible effects of all four of these independent variables collectively. The purpose of this current study was to determine the effects, if any, of (a) 3 simulated heel height conditions [0.0 in., 1.5 in., and 3.0 in.], (b) 3 pitch conditions [A3 (low), A4 (medium), and A5 (high)], (c) 2 vowel conditions {[ɑ], [i]}, and (d) 2 behavior conditions [silent, singing] on 2 measures of female voice majors' ($N$ = 35) head position (HP1, HP2) and 1 measure of jaw opening (JO), as well as correlations between all variables.

Primary results indicated that, on average, participants significantly (a) decreased head position and jaw opening as heel height increased, and (b) increased head position and jaw opening as pitch ascended, when singing the vowel [ɑ] compared to [i], and between silent and singing behavior conditions. Data yielded multiple significant interactions between independent variables and indicated significant, moderate to strong, positive relationships between (a) pitch and jaw opening, (b) jaw opening and behavior, and (c) jaw opening and head position angle 1, and significant, moderate, negative correlations between (a) jaw opening and vowel, and (b) heel height and head position angle 1.

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# Comparing Speaking Fundamental Frequencies and Primo Passaggio Pitch Areas of Classical and Musical Theater Undergraduate Female Singers


Objective

This study investigated the speaking fundamental frequencies (SFF) and primo passaggio areas of Classical, undergraduate female singers ($N$ = 30) and Musical Theater, undergraduate female singers ($N$ = 30) to examine the possible relationship between a student's chosen genre concentration and these vocal markers.

Methods/Design

A survey was distributed to query the following:

- How does the singer perceive her own voice (range, comfortable tessitura, timbre)?
- What performing experiences has the singer had (Classical, choral, Musical Theater, other CCM)?
- If the singer had multiple genre performance experiences, why did she choose her current area of concentration?
- What genres of vocal music does she listen to?
- If she studied voice privately before college, what genres of repertoire did she sing?

Real Time Pitch of the Computer Speech Laboratory (KayPENTAX) identified the SFF through an average of three samples: counting, reading a paragraph, and a brief conversation.

Perceptual measurements by two experienced voice teachers, together with singer self-report, identified the pitch area of the primo passaggio using descending, 5-note scales on the vowel /a/. The primo passaggio area was defined by a transition from CT (cricothyroid muscle) dominant vocal production to TA (thyroarytenoid muscle) dominance.

Results and Conclusions

This study began with the question, "Why do people sing what they sing?" As voice teachers, "Why do we choose the classifications and repertoire that we give our singers?" As expected, surveys indicated that many factors contribute to singers' choices in genre, vocal "make-up" being only one. Acoustic and other perceptual data indicate a relationship between SFF, primo passaggio areas, and genre preferences. Pedagogical considerations regarding genre choices are discussed.



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# Developmental Cognizance in Female Voice Change

This article describes personal cognizance in female voice change known as proprioception. Thurman and Grambsch (1991), consider the human voice the primary means through which needs, thoughts, emotions, and wants are communicated. The voice then wields a connection to the essence of humanity and possesses the ability to reveal, *who we are*.

Observations: If the human voice reveals the inner self, it is likely that voice perception and voice change will affect adolescent identity. Susan Monks (2003) found evidentiary studies from multiple sources indicating that vocal sound and self-identity were linked. She cites North and Hargreaves, who demonstrated a positive link between musical ability, adolescent identity, and self-concept. In her longitudinal study designed to assess adolescent vocal identity in both genders, Monks concluded that adolescent singers were actively aware of their vocal changes as they evolved during puberty. The students also perceived that these changes affected their performance.

Further, the inner-self perceives an awareness of physiological mutation, which includes the subtle changes in the vocal mechanism that are difficult for an outside listener to hear in singing. Therefore, girls are aware of their voice changes. Bonnie Blu Williams (1996) in her study on menarcheal girls noted that girls observed the characteristics associated with voice change and were able to articulate their observations. Though the findings of voice researchers like Kahane (1978) concluded that the growth of prepubertal and postpubertal female larynges were similar in size and weight, girls were able to detect the symptoms of mutation early in their vocal evolution. "Early in their evolution," according to the morphological findings evidenced by Wysocki et al. (2008), actually means as young as 7 or 8 years old. Thus, female voice change is observed at a younger age. Not only do girls, especially those who sing, notice the subtle differences in their voice, but also it is likely that they are aware of this transition for the entirety of their own voice change.

Results: Up until adolescence, children develop a sense of who they are in their voice. That is, they have the voice they have always known. This proprioception in premenarcheal and menarcheal females is called *transitional cognizant mutation.*™ TCM (*transitional cognizant mutation*) reflects a durational aspect to female voice change. Girls are aware of voice change while it is happening. This article identifies these changes and the systems researchers have developed to assist singers and teachers. It then provides recommendations for positive growth experiences for young female singers in identity formation, self-image, and normalization of the voice change experience.

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**VP29**

# Evaluation of Singing Vocal Health in Yakshagana Singers


Introduction: Yakshagana is a popular traditional folk art from south Karnataka, traditionally performed at night in open air based on stories from Hindu epics. The singers need to sing as well as conduct the performance in a loud voice to compete with the accompanying percussion musical instruments. They are at a risk of developing voice related problems (Kalaiselvi, 2006; Devadas et al., 2009). To our knowledge, there are no published studies exploring their singing voice handicap.

Method: Cross sectional study was carried out on Bhagwathas during a district level annual health checkup camp. Demographic questionnaire and Singing Voice Handicap Index (SVHI-10) was used. The English SVHI-10 was translated and made available in Kannada language using the standard parallel back translation. Percentages and cross tabulation was used to determine the response distribution. Difference between scores of SVHI between two groups was analyzed using Pearson's Chi-square test.

Results: The number of performances per year ranged from 150 to 280 with duration of each performance ranging from 1 – 10 hours. 70% of the participants directly relied on Yakshagana singing for main source of income. Based on whether they reported of voice problem, they were divided into two groups, voice problem (VP) and no voice problem (NVP). Despite 40% of the singers reporting of voice problem, none of them had received any advice or counselling on vocal hygiene and care. Mean scores of SVHI for VP group were; 5.4(functional), 13(physical), 13.2(emotional) and 31.6 (total) and for NVP group were 3.56(functional), 7.5(physical), 5.5(emotional) and 16.56 (total). On comparison of scores on SVHI using Chi-square test, statistically significant difference was noted for emotional subscale ($\chi^2$= 23.89, df = 11, p = 0.01) and total scores ($\chi^2$= 26.15, df = 15, p = 0.04).

Conclusion: The study draws attention towards the voice handicap which can impact their professional performance. There is a need to carry out more extensive studies as well as have voice care awareness programs for the Yakshagana artists.



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# Clinical Evaluation of Voice using Acoustic Analysis in Indian Classical Singers – A Systematic review and Meta-Analysis

Objective: Studies on western singers have reported of different acoustic evaluations of voice in different singers such as opera, pop, jazz etc. Acoustic analysis forms an important component in the evaluation of voice; however there is lack of studies on Indian classical singers (Carnatic and Hindustani styles). The current study aimed to systematically review literature in support of acoustic evaluation in clinical assessment of Indian classical singers (ICS), further identify parameters studied, instruments and tasks used.

Methods/Design: The authors searched PubMed, Cinahl, IndMED, AIISH Database and Shodhganga from earliest date upto June 2015. Main keywords to develop a search strategy were Indian classical singers, Hindustani, Carnatic, voice assessment, acoustic analysis, fundamental frequency and quality measures. Two authors independently screened and shortlisted abstracts.

Results: Nineteen abstracts were shortlisted; nine full length articles were evaluated to extract data. The instruments used for analysis included Pitch analyzer, Dr. Speech, Vagmi system, Multi Dimensional Voice profile, Lingwaves and Praat. A variety of tasks were used such as singing notes (swaras), phonation of /a/ at different registers and singing a song. Each of the study analyzed a different set of parameters. Heterogeneity on the results of the two studies was assessed by performing a test of heterogeneity (chi-squared test) and the result showed statistically insignificant heterogeneity among studies $I^2$ Statistic was 45%. The pooled mean for the outcome DSI was 3.237 with 95% (2.671, 3.804).

Conclusion: There was heterogeneity among the studies in terms of population studied, tasks, instruments and parameters. There is a need to carry on more methodical sound studies in order to propose a protocol that could be followed for voice evaluation exclusively for singers.

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**Contemporary Commercial Music (CCM) Vocal Pedagogy: Fitting a Square Peg into a Round Hole**

Background: This paper reports preliminary results from a research study of seven prominent CCM pedagogues and the approaches they have developed to train and manage the vocal health of singers wishing to be fluent across the broad range of CCM styles. This is informed by substantial literature on vocal pedagogy which indicates that singing teaching methodologies have become fixed in centuries old traditions despite the fact the landscape of popular musical styles has expanded markedly due to technological advancements and the globalization of popular music culture. CCM, as a pedagogical discourse, emerged in the literature in 2000 when the acronym was coined by Jeanette LoVetri. At this time, LoVetri and other authors pointed to a consistent lack of a specific pedagogical model for singers training in CCM styles. This paper discusses how this could be catastrophic for singers as vocal health was identified in the literature as a problem to applying the inappropriate training.

Method: The larger research study, from which these findings have been drawn, employs a qualitative mixed-method approach. However, the data discussed in this paper was collected from conducting semi structured interviews with seven CCM pedagogues of international repute.

Results: A preliminary analysis identified both commonalties and inconsistencies in the management of singers in CCM styles. The pedagogues were in agreement that efficient vocal instruction must be geared to function and style. Inconsistencies appeared to relate to matters of self-instruction, musical bias, unawareness of musical scope and global musical styles.

Conclusions: In order for pedagogues to recognize and avert potential damage to singer's vocal health, the solution which I will extrapolate on is that CCM vocal pedagogy requires a rigorous, scientific investigation from which a best practice model will emerge. In terms of best practice, the temporal nature of what is contemporary and commercial requires a pedagogical model be fluid, evolving, communally contributed to, debated and updated.

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## Aerobic Exercise as a Warm-up for Singing: Acoustic Impacts

Objectives: This study was designed to explore the potential benefit of aerobic exercise on voice production. Previous work demonstrated that with aerobic exercise, singers significantly increased SPL, primarily by significantly increasing airflow during voicing. This study was designed to assess acoustic changes pre and post aerobic exercise.

Methods/Design: Nineteen students, representing all major Fachs, in an academic vocal performance program participated (15 graduate; 4 undergraduate). Acoustic data during singing were acquired before and after a 30-minute treadmill workout in the singer's aerobic heart range. In full voice, participants sang the first seven notes of the Star Spangled Banner on "pah", repeating the seventh note following an inhalation. Aerodynamic data were captured with a face mask covering the nose and mouth, and a pressure sensing tube positioned behind the lips. Acoustic data were derived from the audio wav file captured during this task. Data were analyzed with Praat to determine the actual fundamental frequency compared with the target fundamental frequency at the midpoint of the vowel. Values were averaged across the middle five syllables of the first set of "pa" repetitions. For eight participants, acoustic data were also analyzed as they sang a scale, with no mask. Pitch accuracy on this task was averaged across eight notes ascending and descending. The Singing Power Ratio was also calculated from the fifth ascending note for females, and from the $7^{th}$ ascending note for males.

Results: Based on the Star Spangled Banner data, there was no significant effect of aerobic exercise on pitch accuracy ($p = .32$; $t = 1.01$; $df = 18$). Descriptive analysis of pitch accuracy on the scales also revealed no effect (.37 vs .40 semitone difference pre and post). Six of eight singers improved the Singing Power Ratio, however, with a pre to post mean of -20 to -15. Analysis of vibrato and registration transitions is currently underway.

Conclusions: It appears that aerobic exercise has less impact on the acoustics of singing than it does on aerodynamics, although in a subsample, the Singing Power Ratio improved.

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## Vocal Health Care Survey among Amateur and Professional Voice Users

Objective: Appropriate care and management of professional voices in today's health care system continues to remain controversial. Although many professional 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 singers a survey was designed.
The aim of this study is to provide insights into current practices related to vocal health among singers.

Methods: Subjects will be solicited via survey links to members of professional vocal arts organizations. Singers from various vocal genres will complete 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 or conditions 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 performers seek financially and timely recovery of dysphonia. The specific practices of singers management of vocal health concerns is expected to show contrasts across genres and geographical locations.

Conclusions:
Traditional and alternative medical approaches to dysphonia appear to be based on available and not always best options for rapid recovery of voice. Ideally, a combination of traditional and alternative management would appear to be the best long-term strategy for voice professionals.

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**VP34**

## Collegiate Graduate Voice Curricula - Analysis of Current Practices

Development of best practices, scope of practice guidelines, and practitioner training are central to the professionalization of any occupation. For singing voice instructors, practitioner training is frequently housed within university music curricula. As in any field, the quality of this training may be variable.

Education curricula in many fields are based on empirically tested findings and theories of learning informed by pedagogical and educational science. This is especially true for high-level human physical performance (kinesiology), rehabilitation (physical therapy and speech-language pathology), and classroom instruction. We hypothesized that voice instructor training may lag behind these fields by relying on a traditional knowledge base rather than incorporating the science of learning and teaching, and basic physiology of voice production.

PAVA, NYSTA, and NATS are currently examining the establishment of best-practices for the instruction of the singing voice. In this study we developed a census of the collegiate voice and voice pedagogy curricula of all graduate degree (MM, PhD, DM, DMA) granting institutions in the United States. Data were gathered from institutional websites and fact-checked with program administrators and with the National Association of Schools of Music databases. Census data were aggregated, and particular attention was paid to specialized training in voice science, pedagogy, and in marketplace-driven skill acquisition. Implications for the acquisition of core competences in Classical and CCM singing voice instruction will be discussed.

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**VP35**

## Characterizing Male Classical Singers using Inverse Filtering and Other Non-invasive Techniques

Paying especial attention to events around the passaggio to the upper range, we recorded scales and arpeggios of eight male singers in The Netherlands who make their living with a combination of professional singing engagements and giving lessons to pupils. Using the software Sopran to extract the glottal flow from the microphone signal via inverse filtering, we examined characteristic glottal behavior and resonance strategies. The results reveal considerable inter-individual variety. The findings are then related to the more routinely recorded non-invasive signals of the microphone and EGG, showing how inferences can be made concerning the details of the effects of glottal flow on the acoustic output.

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**VP36**

## Closed Vowels and Their Effect on Head Register Closed Quotient Values of Male Singers

The purpose of this research is to examine the Closed Quotients ($CQ_{EGG}$) for the closed vowels /i/ and /e/ in the male head registers of tenors and baritones. From the time of Manuel Garcia II, vocal pedagogues have recognized the value of transitioning from closed vowels to more open vowels. This transitioning has often been used to address breathiness in the production of more open vowels and to address a general inefficient use of air during the singing act, especially in the head register. Further objective understanding is needed into how these closed vowels play a role in assisting and training the anatomy of the voice and its process of phonation in the male head register. Thirty male singers will be utilized for this study. The audio signal will be collected using an omni-directional microphone with a flat 20Hz to 20kHz response and the $CQ_{EGG}$ data will be collected using the Glottal Enterprise Electroglottography system. These signals will be displayed and analyzed for spectrographic and closing quotient values using VoceVista and MatLab 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 a closed /e/ and then to an /i/ vowel. Resonance strategies will be monitored during the singing of these examples as it will be paramount that each subject begin and remain in head register for the duration of the exercise.

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**VP37**

**Can Listeners Hear Who Is Singing? What is the Pitch Bandwidth of Singer Discrimination in Experienced Listeners?**

Objective: Previous research has shown that listeners are unable to identify who is singing across pitch when the voices are unfamiliar. Implementing a very short training period, however, greatly improves this ability, but only when voices are of different voice category. This suggests that during training, listeners are beginning to form category prototypes rather than storing specific voices. The objective of this study is to determine whether experienced listeners with knowledge of voice categories can more easily discriminate between singers at a variety of pitch bandwidths.

Method/Design: This study uses a forced-paradigm, where listeners hear two different singers (Singer 1 and Singer 2) singing "ah" at the same pitch. Then, the listener must identify which of the two singers is the producer of a third "ah" at a different pitch. Stimuli were recorded from 2 baritones, 2 tenors, 2 mezzo-sopranos, and 2 sopranos across a 1.5 octave range.

Results: Data is being collected from 50 experienced listeners with normal bilateral hearing and either a Bachelor's degree in music with an emphasis in voice or five or more years of professional classical voice experience.

Conclusions: Based on previous work by Erickson and colleagues, it is predicted that experienced listeners will more accurately discriminate between singers at intervals at or above a $7^{th}$ and that their performance will be most improved over inexperienced listeners when the singers are of different voice category due to their prior knowledge and experience with these categories. If experienced listeners do perform better than their inexperienced counterparts when singers are of different voice categories, but not when they are of the same voice category, it would indicate that familiarity with voice categories, rather than with individual voices, plays a vital role in listeners' ability to predict timbre transformations and discriminate one singer from another.

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**VP38**

## Ehlers-Danlos Syndrome, Postural Orthostatic Tachycardia Syndrome, Dysautonomia and the Young Singer

Ehlers-Danlos syndrome (EDS) comprises a group of related hereditary connective tissue diseases. EDS manifests as joint hypermobility, tissue elasticity and easy bruising. Although affected patients typically present to primary care physicians, orthopedists and rheumatologists, some head and neck symptoms (e.g., dysphonia, dysphagia, and/or temporomandibular joint complaints) may direct patients to an otolaryngologist. Postural Orthostatic Tachycardia Syndrome (POTS) is often a secondary diagnosis with EDS. POTS is one of a group of disorders that have orthostatic intolerance (OI). This condition is caused by a reduced volume of blood returning to the heart after an individual stands up from lying down. Dysautonomia is an autonomic nervous system dysfunction in which severe symptoms manifest that seem to be far out of proportion in regard to any laboratory or objective findings. This can make its diagnoses difficult. Orthostatic intolerance is a subset of dysautonomic disorders.

We describe 18 year old female singer/songwriter, post stem cell transplant who has been diagnosed with EDS, POTS and Dysautonomia. Her desire was to have help with (1) breathing and (2) getting over her voice break to get her singing voice back. This presentation highlights her syndromes, the journey toward diagnoses, and the path toward dealing with the syndromes. Otolaryngologists, singing voice specialists and speech-language pathologists should be familiar with EDS and related conditions, and their implications for voice function and training.

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## Acoustic and Perceptual Measures of Female Singers Singing the Same Sung Material in a Recital Hall and an Individual Practice Room with Virtual Acoustics

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 chaange 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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# EAVOCZ: Development of an Appreciation Scale for the Singing Voice

Audioperceptual voice analysis is essential and common in teaching and clinical practice. There are several singing voice rating scales for different languages however not for European Portuguese (EP). The purpose of this research was to develop a valid and reliable appreciation singing voice scale.

EAVOCZ is a continuous visual analogue scale with a 50mm line to grade (greater deviation=higher score) audioperceptual voice parameters: pitch, loudness, resonance, phonatory and respiratory coordination, precise articulation, roughness, breathiness, asthenia, tension, vibrato, voice projection, timbre, voice emotional expression, tuning voice and global voice appreciation. Four judge groups were used: 10 singing teachers (ST), 10 speech-language pathologists (SLP), 10 Fado singers (FS) and 10 naive listeners (NL).

Content and construct validity were assured by bibliographic review, thematic analysis and a pilot study with 12 judges (3ST+3SLP+3FS+3NL). Concurrent validity was not performed due to EP singing voice scales absence. Intrajudge reliability was assured comparing 38 judgments of 4/20 repeated singing voice samples. Interjudge reliability compared the 4 groups' judgments. *Pearson* correlation, considered good at r>.70, and one-way ANOVA with an α at .05 were used.

Results showed that EAVOCZ's validity was assured as minor changes were proposed by the judges. Interjudge reliability revealed that ST and SLP groups had similar responses as well as groups FS and NL, because there were no significant differences between them ($p$>.05). The 4 groups were clustered into 2 groups: ST+SLP and FS+NL. Intrajudge realiability coefficients were good for loudness (ST+SLP=.86), roughness (ST+SLP=.79; FS+NL=.75), asthenia (ST+SLP=.71; FS+NL=.72) and for gender classification (ST+SLP=.98; FS+NL=.87). Intrajudge reliability was lower for precise articulation (FS+NL=.37) and resonance ($ST+SLP_{Oral}$=.39; $FS+NL_{Nasal}$=.30).

In conclusion, EAVOCZ is a valid and reliable singing voice scale that can help teachers, singers, clinicians and physicians to audioperceptually judge it with scientific rigor. Further research will involve other psychometric assessment as specificity and sensitivity.

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**BSc-P1**

# Comparing Objective Parameters for Voice Typing

Objective: Currently, there are no objective parameters capable of classifying voice signals. Although correlation dimension analysis and spectrum convergence ratio have been proven effective in distinguishing voice signals between type 1, 2, 3, and 4, they have not been used to classify voice signals. The purpose of this study was to establish boundaries for both parameters capable of classifying voice signals objectively.

Methods/design: Two hundred voice samples of the syllable /a/ were randomly selected from the KayPENTAX database. Spectrograms were produced for each sample and subjectively sorted based on Sprecher 2010 by three researchers. Spectrograms that were not unanimously agreed upon were discarded, yielding 128 voice samples. A custom MATLAB program calculated correlation dimension and Spectrogram Convergence Ratio (SCR) for these samples. The following parameters were set and used to objectively classify the samples into one of the four voice signal types.

Correlation Dimension: This parameter was calculated for every embedding dimension up to 13 for each voice sample. The correlation dimensions for each embedding dimension were averaged for each voice type and plotted on a graph. The parameter lines were set to be a midline in between each voice type on the graph and compared to each new sample.

Spectrum Convergence Ratio:
Type 1: $\geq 56.01$
Type 2: 25.01 – 56.00
Type 3: 10.01 – 25.00
Type 4: 0.00 – 10.00

Results: The parameters used for correlation dimension analysis yielded an accuracy of 54.63%, while the parameters used for SCR yielded an accuracy of 82.81%.

Conclusions: The data indicates that both correlation dimension analysis and SCR can be used to objectively classify voice samples, with varying levels of accuracy. We conclude that SCR is an objective metric capable of classifying voice signals.

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**BSc-P2**

## Menstrual Cycle Hormone Profile and Voice Function Measures: Preliminary Evidence

Objective: To determine if vocal function measures and upper airway temperature correlate with hormone levels across four phases of the menstrual cycle.

Methods: All measures were taken at 4 time points associated with 4 phases of the menstrual cycle (i.e., follicular, ovulatory, luteal and ischemic) for two cycles. To establish hormone levels, blood samples were obtained by venipuncture for analysis of estrogen, progesterone, and testosterone and NP-Y values. Upper airway temperature (UAT) data, perceived phonatory effort (PPE), cepstral peak prominence (CPP), and maximum phonatory frequency range in semitones were collected across the four phases of the menstrual cycle. Descriptive statistics will be used to report preliminary findings for a minimum of three participants out of a larger ongoing study.

Preliminary Results: Data collected and analyzed for three participants indicate that premenopausal females who are not taking hormonal contraceptives had UAT values that were variable across the phases of the menstrual cycle and fluctuated as much as 1.7°C during the different phases of the menstrual cycle. The PPE values collected during the follicular and ovulatory phases were higher and then dropped during the luteal phase. CPP's were derived from the first paragraph of the Rainbow Passage. Results thus far are variable and no pattern specific pattern has been observed across the phases. The frequency range data suggest that there might be a greater likelihood of having a decreased range during the follicular or ischemic phases and a greater range during the ovulatory and luteal phases. Preliminary results from the hormone profiles reveal inter and intra participant variability for estrogen, progesterone and testosterone across the different phases of the menstrual cycle.

Conclusions: The goal 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. Current descriptive evidence signals the possibility that there is significant intraparticipant and interparticipant variability in voice function and hormone profiles across the individual phases of the menstrual cycle. Variability is also being observed within participants across more than one phase of the menstrual cycle with regard to hormone and voice function.

Disclosures: The work presented in this poster session was supported by Award Number 1R03DC013664-01A1 from the National Institute on Deafness and Other Communication Disorders (NIDCD). The content of this presentation is solely the responsibility of the authors and does not necessarily represent the official views of the NIDCD or the National Institutes of Health.

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**BSc-P3**

# The Relationship between Relative Fundamental Frequency and a Kinematic Estimate of Laryngeal Stiffness in Healthy Adults

Objective: The purpose of this study was to examine the relationship between an acoustic measure, relative fundamental frequency (RFF), and a kinematic estimate of laryngeal stiffness during self-modulated effort in healthy speakers, to assist in validating RFF as a quantitative indicator of laryngeal tension.

Method: Twelve healthy adults produced repetitions of /ifi/ while varying their self-perceived vocal effort during simultaneous acoustic and nasal-endoscopic recordings. The acoustic measure of RFF was determined from the last ten voicing cycles before the voiceless obstruent (RFF offset) and the first ten voicing cycles of the following vowel (RFF onset). A kinematic estimate of laryngeal stiffness was determined for the gross vocal fold adductory gestures during re-voicing. A kinematic stiffness ratio was calculated by normalizing the maximum angular velocity by the maximum value of the glottic angle during the voiceless obstruent.

Results: A linear mixed effect model found that the RFF offset cycle 10 and first RFF onset cycle 1 were significant predictors of the kinematic stiffness ratios. The model accounted for 52% of the variance in the kinematic data. Individual relationships between RFF and kinematic stiffness ratios varied across subjects, but correlations were generally higher for RFF offset, with 83% of participants exhibiting at least a moderate negative linear relationship ($r$ = -0.5 to -0.91), while only 40% of participants exhibited at least a moderate relationship during onset analyses ($r$ = -0.53 to -0.79).

Conclusion: RFF significantly predicted kinematic estimates of laryngeal stiffness in healthy speakers and has the potential to be a useful clinical indicator of laryngeal tension. Further research is needed in individuals with tension-based voice disorders to determine its utility as a clinical tool.

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**BSc-P4**

## Perceptual and Acoustic Measures of Breathy and Rough Voice Qualities for Multiple Sustained Vowel Categories

Objective: Determine the sensitivity of perceptual and acoustic measures of breathy and rough voice quality of natural stimuli across multiple vowel categories.
Methods: Sustained phonations of /a/, /i/, and /u/ from ten talkers (5 M, 5 F, age: 68.5±9.6 years) with primarily breathy voices and ten talkers (5 M, 5 F, age: 62.0±9.0 years) with primarily rough voices were selected from a large database of dysphonic voices. The voices spanned a wide range of breathiness and roughness based on a previous study of /a/ voices. The breathy voices were judged for breathiness and the rough voices were judged for roughness by ten listeners using a matching task with 5 replicates per condition. Several acoustic measures—pitch strength, cepstral peak, autocorrelation—were applied to models of the perceptual data.
Results: Intra-rater reliability was high for the breathiness and roughness perceptual tasks (ICC(2,k)>0.97 over all listeners), and inter-rater reliability was also high for the breathiness (ICC(2,k)=0.95) and roughness (ICC(2,k)=0.85) perceptual tasks. Breathiness matching among talkers varied from -25 to 0 dB NSR. Breathiness among vowel categories varied from 1.0 to 5.4 dB with no significant difference among vowel categories. Roughness matching among talkers varied from -27 to -13 dB modulation depth. Roughness among vowel categories varied over a relatively wide range of 0.6 to 12.2 dB. The perceived roughness of /a/ was significantly higher than /i/ or /u/ by 4 dB. The acoustic models were in general agreement with each other although some sensitivity to vowel category was observed. Model accuracy was higher for breathiness perception ($R^2$=0.87) than roughness perception ($R^2$=0.72).
Conclusions: Breathiness is more consistently represented across vowels for dysphonic voices as compared to roughness. 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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# Medical Privacy and the Professional Singer: Injury Disclosure and Ramifications on Broadway

Background: Medical privacy is a complicated issue within the performing arts. Many performers believe disclosing injuries may cause reputational damage and even future job loss, therefore they choose to withhold sensitive information from employers. Anecdotal evidence suggests that singers (vs. dancers) are more likely to participate in this behavior. However, many common nondisclosure methods used by performers may result in job termination or litigation.

This is complicated by a lack of information. Medical privacy is not mentioned within the current production contract, standardized individual performer's contracts, or standardized agreements with talent agencies and managers.

Currently, Broadway stage managers and company managers handle personal health information on a case-by-case basis.

Objective: This study aims to further illuminate current privacy practices, usage of illness/injury leave, and a possible stigma surrounding vocal injuries on Broadway.

Methods: In 2015, 30 singers currently employed on Broadway were surveyed. The parameters examined included their level of hesitation, if any, to disclose general physical injuries vs. vocal injuries, awareness of medical privacy rights, and ramifications due to disclosure.

Results: 100% of performers surveyed believe that injuries can cause reputational damage and 93% believe this impacts future employment. Of those, 83% described vocal injuries as being more detrimental. 87% of performers reported misusing illness/ injury leave and 73% reported ramifications due to illness/injury leave practices.

Conclusions: There is a large disparity between intended and practical usage of injury/illness leave on Broadway. There is also a negative stigma surrounding vocal injuries and a high incidence of professional ramifications. Therefore, to effectively sustain performers' career longevity--employers, performers, and healthcare providers must understand and address privacy needs when handling performance related injuries.

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**M-P2**

# Identifying Knowledge Gaps in Clinicians Who Evaluate and Treat Vocal Performing Artists in College Health Settings

**Background:** Vocal performing artists begin education and training in childhood, continuing to refine their skills at the collegiate level. Performance related illness and injuries and the resulting clinical outcomes are dependent upon a variety of factors including the knowledge and expertise of the treating clinician. Delays in appropriate evaluation, treatment, and referral may result in inability to meet academic and performance demands, necessitating additional course work or a change in career path.
**Objective:** Identify knowledge gaps in clinicians who evaluate and treat performing artists for illness and injuries that affect vocal function in college health settings, generate knowledge about available resources to aide in evaluation and treatment, and generate clinical strategies to improve the standard of care.
**Methods:** This pilot study utilized a web-based cross-sectional survey design incorporating innovative clinical scenarios to explore: a) the approach utilized by clinicians practicing in college health settings when evaluating and treating voice complaints in performing artists, b) demographic factors among clinicians that might affect knowledge gaps in the evaluation and treatment of performing artists with voice complaints and c) factors influencing referral patterns to specialists.
**Results:** Approximately 75 clinicians were surveyed. Pilot Survey Data indicate a significant gap in knowledge with 50 % of respondents incorrectly identifying appropriate vocal hygiene measures; 50 % of respondents failing to identify symptoms of vocal fold hemorrhage; 25 % recommending medications that adversely affect vocal function in 2 clinical scenarios; and 50 % of respondents acknowledging unfamiliarity with the Voice Handicap Index, Singers Voice Handicap Index or Reflux Symptom Index.
**Conclusion:** Data elucidate specific knowledge gaps in college health providers who are responsible for evaluating and treating common illness that affect vocal function, and triaging and referring students experiencing symptoms of potential vocal emergencies. Future work is needed to improve the standard of care for this population.

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**M-P3**

## Efficacy of Spinal Correction Surgery for Reflux Symptoms: Case Series

Objective: We previously reported that kyphotic patients have symptoms both of laryngopharyngeal reflux disease (LPRD) and gastroesophageal reflux disease (GERD) significantly common than non-kyphotic people. The aim of this study was to investigate whether spinal correction surgery remedy those reflux symptoms for patients with lumbar kyphosis.

Methods: The study participants consist of 17 patients who underwent the same spinal correction surgery for lumbar kyphosis. All the participants responded to the Reflux symptom index (RSI) and the Frequency Scale for the Symptoms of GERD (FSSG) before and after the surgery. Total RSI value ≥ 13 and total FSSG value ≥ 8 were suggestive of LPRD and GERD, respectively. Data of RSI and FSSG were compared between pre and post surgery in each patient. Statistical analyses were made for comparison in the proportion of the patients with suggestive LPRD and GERD before and after the surgery. Moreover, total RSI and FSSG values were compared between before and after the surgery.

Results: In 15 of the 17 patients (88.2 %), LPR and GER symptoms remained stable or reduced after the spinal correction surgery. After the surgery, the proportion of the patients with suggestive LPRD and GERD dropped from 4/17 to 1/17 and from 5/17 to 3/17, respectively. Total RSI and FSSG values decreased after the surgery, although there was no significant drop (RSI: P=0.168, FSSG: P=0.067).

Conclusion: Spinal correction surgery for kyphotic patients with reflux symptoms might reduce their reflux symptoms. The results failed to clarify that spinal deformity in sagittal alignment was a possible cause of the reflux diseases. Further research should be needed.

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# Laryngeal Symptoms in Weightlifting Athletes

Introduction

Weightlifting, regardless of its type, involves bearing down with a forceful closure of the glottis to build the needed subglottal pressure to support the maximum weight lifted. It also may include an abrupt audible grunt at the time of the lift. The abruptness and sheer force of this kind of vocal fold adduction with or without vibration may be the cause of reported laryngeal symptoms experienced by weightlifting athletes.

Objective

This study aims to determine (1) whether experiencing laryngeal symptoms, including throat pain, change in voice, or globus sensation, is differentially associated with the percentage of weightlifting employed as part of the participants' exercise routine; (2) whether the type of lift performed is related to the occurrence and severity of laryngeal symptoms experienced.

Method

A survey asking about exercise focus, routine, and laryngeal symptoms related to exercising was developed using Qualtrics software. Social media and flier distribution to gyms in the central and southeastern areas of a large Mid-Atlantic state were used to recruit the sample. This resulted in 89 complete survey responses for analysis. Respondents were separated into three exercise groups: primarily cardiovascular, primarily weightlifting, and half/half cardiovascular and weightlifting.

Results

Analysis revealed 46% of weightlifting athletes reported suffering from at least one laryngeal symptom (throat pain, change in voice, or globus sensation), compared to 32% in the half/half group and only 14% in the cardiovascular group. Statistically significant relationships between laryngeal symptoms and the squat clean, power clean, and front squat lifts were also found.

Conclusions

Laryngeal symptoms occur more often in groups that have a higher percentage of weightlifting in their exercise routines. Lifts resulting in a front rack position of the barbell are significantly related to laryngeal symptoms. This preliminary data warrants our follow up laryngeal examination during different types of weightlifting.

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# Vocal Patterns of Humans Communicating with Robotic Dogs and Cats

Objective: People love to communicate with cats, dogs, and toys, yet there is little research on these vocal patterns. This study examines changes in communication (speaking fundamental frequency (SF0), compassion) between baseline and robotic toys. Significant change in SF0 or gender differences in compassion may impact at-risk vocal relationships.

Methods: 15 males and 18 females (mean age 13) with acoustic analysis (mean SF0) for baseline speaking tasks compared to 30-second communication with robotic cat (N=11), robotic dog (N=11), or both robotic cat and robotic dog (N=11). Compassion during robot communication (as determined by speaker message and tone) also determined as a factor to determine differences in gender communication to robotic pets.

Results:
Significantly increased SF0 was more prevalent with dog robot (45%) compared to cat robot (27%), consistent with previous research on live dog/cat communication. Females were judged more compassionate toward the cat robot (72%) compared to males (36%).

Conclusion:
Dysphonic patients need to be monitored for voice use and voice strain, particularly with dogs compared to cats. Pet therapy and animal-assisted therapy tools may be valuable for those needing greater SF0 variability.

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**SLP9**

# The Effect of Voice Therapy for Superior Laryngeal Nerve Paresis on Laryngeal Motor Units During Phonation

Objectives: Injury to the superior laryngeal nerve can result in dysphonia, and in particular, loss of vocal range. It can be a particularly difficult problem to address either with voice therapy or surgical intervention. Some clinicians and scientists suggest that combining vocal exercises with adjunctive neuromuscular electrical stimulation (NMES) may enhance the positive effects of voice therapy for superior laryngeal nerve paresis (SLNP). But the effect of voice therapy without NMES is unknown. The purpose of this retrospective study was to demonstrate the clinical effectiveness of voice therapy for rehabilitating SLNP dysphonia in two subjects, using interspike intervals (ISIs) variability of laryngeal motor units on laryngeal electromyography (LEMG)

Methods: Both patients underwent LEMG and were diagnosed 70% recruitment of cricothyroid muscle (CT), and 70% recruitment of CT and thyroarytenoid muscle (TA), respectively. Both patients received voice therapy for 3months. GRBAS, stroboscopic examination, aerodynamic assessment, acoustic analysis and voice handicap index (VHI) -10 were performed at pre and post voice therapy. Mean ISIs variability during steady phonation was also assessed.

Results: After voice therapy, both patients showed improvement of vocal assessments on acoustic, aerodynamic, GRBAS, and VHI-10 analysis. LEMG indicated shortened ISIs in both cases.

Conclusions: This study suggests that voice therapy for SLNP dysphonia can be a useful tool to improve SLNP and voice quality.

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**SLP17**

**The Impact of a Teaching or Singing Career on the Female Vocal Quality at the Age of 67 Years**

Objective**:** The purpose of the present study was to assess the vocal quality in females aged between 60 and 75 years and to determine the impact of a teacher or singing career on the vocal quality. The author hypothesized that a teaching or singing career can result in an decreased vocal quality at the age of 60+ in comparison with females without a teaching or singing career.

Methods: Seventy-four females with a mean age of 67 years participated in this study. Twenty one females were teachers, 12 females were singers and 40 females were non-vocal professionals. No significant age differences were found between the three groups. To determine the vocal quality, a questionnaire (voice handicap index), subjective (perceptual evaluation) and instrumental assessment techniques (aerodynamic, vocal range, acoustic measurements, Dysphonia Severity Index) were used.

Results: The vocal quality in the non-vocal professionals was characterized by the presence of increased roughness ($p=0.019$) in comparison with the singers and more strained ($p=0.018$) in comparison with the teachers. The vocal performance (intensity and frequency range) of both the singers and the teachers was significantly increased in comparison with the non-vocal professionals. No significant difference was found for the Dysphonia Severity Index between the females with a singing or teacher career and the non-vocal professional females.

Conclusion: At the age of 67 year a teaching or singing career has no negative impact on the female subjective and objective vocal quality.

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**SLP25**

# Whole-body Vibration as a Potential Method to Improve Phonatory Function: A Passive Alternative to Vocal Function Exercise

Objective: Whole body vibration (WBV) is the transmission of movement from a mechanical vibration source through the body. Repeated exposure to WBV has been shown to cause neurogenic adaption of the skeletal muscles and to facilitate muscular function improvement, as well as reduced levels of cortisol (Cardinale & Wakeling, 2005). Phonatory function, in terms of intensity, has been found to improve following WBV at around 10 -15 Hz when compared to vibration below 10 Hz (Yokoyama and Hoshino, 1973). The current project investigated the use of WBV as a passive method of improving phonation (minimum/maximum fundamental frequency, maximum vocal intensity) and self-perception of vocal condition compared to traditional vocal function exercise (VFE). Cortisol was measured to provide a biological explanation of changes in the outcome measures.

Methods: Forty-five females with healthy voices were randomly assigned to one treatment group: WBV only, VFE, or a combined treatment (WBV+VFE). The WBV group phonated /a/ on a vibrating platform (15 Hz, 2mm amplitude). The VFE group performed vocal exercises without vibration. The WBV+VFE group performed vocal function exercises on the vibrating platform. All groups received a total of ten minutes of training.

Results: The VFE group significantly increased their maximum fundamental frequency after the intervention ($p<.05$), with the WBV group showing the same trend. There was no statistically significant change in vocal intensity or salivary cortisol after treatment across all groups. On the self-rating of vocal condition, the WBV group rated it easier to phonate in the low pitch range after treatment compared to the WBV+VFE group ($p < .05$).

Conclusions: Limited changes were observed across groups on the outcome measures. However, the study suggests that WBV may be worth further exploring, because the WBV showed similar gains in vocal function as the well-documented VFE after only ten minutes of training. Further research is being conducted on the use of WBV with dysphonic adults in a nine session treatment program.

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**SLP26**

## Reliability and Validity of the Turkish Version of the Consensus Auditory-Perceptual Evaluation of Voice (CAPE-V)/ Preliminary Results

Objective: The aim of this study is to culturally adapt the CAPE-V to Turkish and evaluate its internal consistency, reliability and validity.

Methods: The permission for adaptating CAPE-V to Turkish language was granted from ASHA copyright department on 08.19.2014. Turkish version of the CAPE-V protocol was constituted by the consensus of a team including SLPs and linguistics. Dysphonic participants' (n=26) voice recordings with healthy matched controls' recordings were taken by Kay Elemetrics Group Computerized Speech Lab. Dysphonic patients included diagnoses of vocal fold nodules, muscle tension dysphonia, mutational falsetto, sulcus vocalis, reinke edema and cyst. The recordings were evaluated audio-perceptually by the professions who are experienced in voice disorders for minimum of five years. Evaluations were made in different two sessions with 48 hours interval according to the CAPE-V and GRBAS protocols.

Results: For searching the validity of the CAPE-V, rates of dysphonic and controls were compared by Independent Samples-Student t test. The difference between the groups for all CAPE-V parameters was found to be statistically significant ($p<0.01$) The degree of association between the CAPE-V and GRBAS judgments was estimated with Spearman's correlations.The highest average correlation between the CAPE-V and GRBAS judgment was found between overall severity and grade (correlation=0.92) and while the lowest was found between the two strain scales. (correlation=0.56).

Conclusions:Although this preliminary data includes a small part of the target total participants, results indicate that Turkish version of CAPE-V appears to be reliable and valid tool for the perceptual analysis of voice. Further studies, including pathological voices of different etiologies with a larger number of participants are needed to further validate the Turkish version of the CAPE-V.

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**SLP32**

## Immediate Effect of the Kinesio Taping® Method on Voice

The Kinesio-Taping® Method is widely used in occupational, physical, and chiropractic therapy to treat various conditions. The therapeutic benefits can be immediate. A thorough literature search revealed no available studies on the method for voice management. These authors previously examined the sole use of the method on voice and found no significant improvement.

Objective: To assess immediate effects of the Kinesio-Taping® Method on voice, with and without voice exercises.

Method: Case study, 36-yo vocally healthy male singer. Voice samples pre- and post-taping application with exercises, and pre- and post exercises only as follows: sustained /a/, and gliding and reading passage in habitual, soft and loud loudness. Vocal function exercises were utilized. A Y-strip application of the tape was placed along the SCM with paper-off stretch (10-15% tension), anchored at the sternum and ended at the mastoid with purpose to inhibit the muscle activity, by dispersing tension through the two tails over the targeted muscle (Application time: 45 minutes). Samples were submitted to perceptual and acoustic analyses. The acoustic parameters measured (Praat) were: MPT, mean F0, jitter and shimmer (local), and HNR on the vowel /a/, and mean, minimum and maximum F0 on vocal gliding and reading passage.

Results: There were no significant differences when pre- and post-measurement for each vocal task were compared (Kinesio and exercises: vowel p=.995; gliding p=.957; reading p=.932. Exercises only: vowel p=.971; gliding p=.976; reading p=.845).

Conclusion: Use of Kinesio Taping® with voice exercises showed no immediate improvement in the selected acoustic parameters under the chosen vocal tasks and conditions. Further studies are required to determine optimal application of Kinesio-Taping® in conjunction with traditional voice therapy, and to develop a protocol for voice management.

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## Linguistic and Cultural Adaptation of the Singing Voice Handicap Index-10 into Italian

The Singing Voice Handicap Index-10 (SVHI-10), originally developed in English, is a self-assessment tool used to measure singers' perceived vocal handicap. Cultural/linguistic adaptation is an essential step of validating a protocol into another language.
Objective: To linguistically and culturally adapt the SVHI-10 into Italian.
Methods: The adaptation was performed in accordance to the Scientific Advisory Committee of the Medical Outcomes Trust. Two independent translations were performed by one bilingual speech-language pathologist/singer aware of the purpose of this project, and one professional bilingual interpreter/singer. The back translation was performed by another bilingual speech-language pathologist, who had not participated in the previous step. A committee composed by three voice-specialized SLP and one laryngologist compared the forward and backward translations, to assess for any discrepancies. A "not applicable" option was included for each item and the protocol was administered to 21 individuals with voice problems, 8 males and 13 females, aged between 21 to 45 years, mean age 32,5.
Results: No participants chose the "not applicable" option. Feedback from the participants included statements such as: "The test adequately reflects problems related to the singing voice", "The test is simple and clear". The SVHI-10 kept the same name and structure as the original version.
Conclusion: The cultural equivalence of the Italian SVHI-10 was demonstrated. The SVHI-10 validation, with determination of a cutoff point for norms, is currently in process.

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**SLP46**

# Voice Analysis of Asymptomatic High-risk Voice Users

Introduction: Voice problems or disorders are noticed by the speaker and/or the listener as difficulty in voicing or hoarseness. The prognosis in treating voice disorders depends on early identification and intervention. However, many patients see their physicians late because their voice problem does not get detected early. It is common for patients to be asymptomatic during the early stages. This study intends to show the significance of early identification in high-risk voice users. Asymptomatic subjects from the high risk group who report normal voicing are currently undergoing voice evaluation. Experiences SLPs will be perceptually rating the audio samples of these subjects. Subjects' self-perception, auditory perceptual evaluation of SLPs, and results of acoustic and endoscopic studies will be compared. The researchers hypothesize discrepancy between these three levels.

Methodology: Vocally healthy subjects will be recorded performing the CAPE-V task, VHI-10, and videostroboscopy. Blinded SLPs experienced in voice analysis will rate audio and video recordings of subjects obtained from CAPE-V and videostroboscopy.

Analysis: VHI-10, SLPs ratings of CAPE-V, and videostroboscopy will be compared to rest for discrepancy.

Results: This project is under progress. Researchers hypothesize that there will be a discrepancy in subjects' perception and findings from voice evaluation.
Conclusions: The results of this project may suggest periodic voice evaluation for high-risk subjects.

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**SLP50**

## Outcomes of Respiratory and Laryngeal Control Therapy for Exercise Induced Paradoxical Vocal Fold Motion

Objective: Exercise induced Paradoxical Vocal Fold Motion (PVFM), a relatively new diagnostic entity, which is becoming increasingly better described in the literature. The condition is characterized dyspneic episodes triggered by mild/moderate or intense physical activity. Clinical presentation may include shortness of breath or dyspnea on exertion, sensation of throat and chest tightness, stridor, dizziness, hoarseness, and episodic dysphagia, among other symptoms. This condition is most common among adolescents and young adults. The objective of this paper is to report outcomes and determine the effectiveness of a therapeutic intervention specifically designed for treatment of exercise induced PVFM by using respiratory retraining and laryngeal control techniques.

Study Design: Prospective, observational and longitudinal study.

Methods: Twenty adolescent athletes ranging in age from 12 to 18, diagnosed with exercise induced PVFM underwent specialized therapy. Number of sessions ranged between 2 and 5.

Results: At this moment there are 15 patients participating in the study, recruitment will end on December 31st. The study will be concluded on March 31st. Preliminary data shows significant improvement in breathing mechanics, decrease in anxiety surrounding dyspnea episodes, decrease in severity and frequency of symptoms and in several patients, complete resolution of the condition. To date, the average number of sessions required is 4. All patients that completed therapy were able to resume sports practice with little to no respiratory difficulty. All participants will be followed for 4 months after completion of treatment.

Conclusions: The respiratory and laryngeal control therapy seems to be an effective and beneficial treatment option in the management of exercise induced PVFM. Further investigation with larger numbers of cases and longer follow-up periods would be required to establish this as a promising treatment method.

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**SLP59**

# Reliability and Validity of the 2nd European Portuguese Version of CAPE-V

Purpose: Any health status and quality-of-life assessment instrument must be valid and reliable, as recommended by Scientific Advisory Committee of the Medical Outcomes Trust (2002). The CAPE-V has been demonstrated to be a reliable and valid instrument for voice quality assessment, in both clinical and research field. CAPE-V was translated into European Portuguese (EP) by Jesus et al. (2009). However this translated version has validity and reliability problems. The purpose of this study was to assure a valid and reliable EP version of CAPE-V, with a re-translation permission granted by ASHA.
14 speech-language pathologists (SLPs) voice experts with >5 years of clinical practice rated 20 voice samples produced by 10 females (mean age=43) and 10 males (mean age=46) classified into two groups: control group (n=10) and dysphonic group (n=10), matched by age and gender. All voice samples were rated in two sessions with one week interval, by SLPs. On the 1st session, samples were rated with 2nd EP CAPE-V and on the 2nd session with GRBAS.
Content validity of the 2nd EP CAPE-V was obtained through the new sentences conceptualized and reviewed by a Portuguese linguist expert. Construct validity was assured by the assumption that there was a significant difference between normal and dysphonic voice productions rated by the SLPs with $\alpha$=.05 for each parameters using One-way ANOVA. Concurrent validity was assured by multiserial correlation degree between 2nd EP CAPE-V and GRBAS parameters with $r$>.07. Reliability of the 2nd EP CAPE-V was performed using internal consistency ($\alpha$-Cronbach), inter-raters reliability (ICC for each parameters), and intra-rater reliability (Pearson's correlation coefficient).
Results and conclusion: Content validity was already warranted. For other psychometric parameters, descriptive statistics revealed that SLPs differently rated normal from dysphonic voices using the 2nd EP CAPE-V. Inferential statistical results will be revealed at the time of the conference.

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**SLP-P1**

## Employer Detection of Spasmodic Dysphonia across Varying Severity Levels

Objective: To determine the ability of human resources personnel (HRP) with experience in phone interviews to detect the presence or absence of adductor spasmodic dysphonia (ADSD) in potential applicants via auditory stimuli alone.

Methods/Design: Thirty HRP were exposed to a brief definition of ADSD. They subsequently performed an auditory-perceptual task in which they were asked to detect the presence of the voice disorder in 20 speakers with ADSD and 20 age- and gender-matched controls. ADSD samples were categorized a priori as perceptually within normal limits (WNL) to mild, moderate, or severe. Frequency counts and percentages were calculated for each speaker that was correctly and incorrectly identified as having ADSD. Mean accuracy ratings, and positive and negative likelihood ratios (LR+ and LR-) also were determined. Accuracy scores were grouped according to severity for ADSD speakers.

Results: On average, listeners were 78.83% accurate in discriminating ADSD speakers, and 90.17% in discriminating controls. Based on group averages, 16 speakers with ADSD were correctly identified as having ADSD, and 4 were incorrectly identified as control speakers (sensitivity = 0.80 or 80%). Based on group averages, 20 out of 20 control speakers were correctly identified as not having a voice disorder (specificity = 1.0 or 100%). HRP were accurate at determining ADSD from 87%-100% of the time for perceptually severe ADSD speakers. In moderate cases, accuracy fell between 77%-100%, and dropped between 10% to 87% accurate for mild speakers. Differences related to severity were statistically significant.

Conclusions: Results suggest that job applicants with more severe forms of ADSD may not be able to escape detection during phone interviews. However, those with mild symptoms may not be identified as having voice disorders.

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**SLP-P2**

# The Influence of Motor Production Experience on Voice Perception

Introduction: Perceptual speech and voice analysis is an essential skill for all speech-language pathologists, but it is a difficult skill to teach. Even the reliability for experienced raters' is often variable. Some training literature in speech-language pathology suggests that imitation of disordered speech or voice quality can be useful for developing perceptual judgement. Evidence in other fields suggests that motor experience influences perception, and several theories of speech production make a connection between motor production and comprehension of speech. Until now the link between production and perception has not been addressed in the area of voice quality. This pilot study hypothesizes that imitating pathological voice samples will improve the perceptual discrimination abilities of naïve listeners.

Methods/Design: Two groups of inexperienced undergraduate listeners will receive training in the perceptual evaluation of voice quality and in administering the GIRBAS (Dejonckere et al., 1996). Participants will complete a pretest, a training session, a homework session and a posttest. In each activity participants will complete perceptual voice evaluations and provide a confidence rating for their scores. The experimental group will be instructed to imitate the voice samples during the study to activate implicit learning, and the control group will complete the training without supplemental motor experience. Ratings of expert listeners will be used to identify anchor samples for the training protocol. These expert ratings will become the consensus GIRBAS ratings for the voice samples used in the study. Data collection will be completed by March 2016.

Results: It is hypothesized that individuals in both listener groups will have improved confidence ratings between the pretest and posttest, with a larger improvement for the experimental group. It is anticipated that individuals in the experimental group will be more accurate in the posttest GIRBAS perceptual voice ratings than members of the control group when compared to consensus ratings of the experts.

Conclusions: If the null hypothesis is rejected, the data will support the conclusion that experience in imitating pathological voice quality can improve vocal perceptual abilities. This conclusion could have implications for training models for teaching perceptual discrimination skills to speech-language pathologists and others who do perceptual voice evaluations.

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**SLP-P3**

# A Systematic Review of Vocal Loading in the Voice Literature

Vocal loading challenges are used in voice studies to assess the health and vulnerability of the laryngeal system. This poster will present a systematic review of the literature on vocal loading and its effects on the healthy and dysphonic voice. The literature reveals that vocal loading challenges differ in duration from ten minutes to over two hours (e.g. Hanschmann, Gaipl & Berger, 2011; Solomon & DiMattia, 2000). Tasks to induce vocal loading are also diverse, ranging from reading to varied vocal tasks (Buekers, 1998), often performed at different pitches and intensities (Gelfer, Andrews & Schmidt, 1991), or in the presence of noise (Neils & Yairi, 1987). Participant populations that have been studied include trained and untrained voice users (Laukkanen et. al, 2004). A wide variety of acoustic, aerodynamic, kinematic, and perceptual measures have been utilized to assess laryngeal biomechanics and physiology after loading. Phonation threshold pressure, an aerodynamic measure, increases after vocal loading, suggesting an increase in vocal fold viscous properties (Chang & Karnell, 2004, Solomon & DiMattia, 2000). Acoustic measures of jitter and fundamental frequency also change with loading challenge (Gelfer, Andrews & Schmidt, 1991; Stemple, Stanley & Lee, 1995; Whitling, Rydell & Ahlander, 2014). Self-perceived vocal effort ratings also increase following vocal loading tasks, indicating that participants may be sensitive to an underlying physiological effect (Chang & Karnell, 2004; Hunter & Titze, 2009; Solomon & DiMattia, 2000). Laryngeal imaging reveals decreased glottal closure following vocal loading (Stemple, Stanley, & Lee, 1995). However, changes in voice measures following vocal loading are not universally observed (Buekers, 1998; Kelchner, Toner, & Lee, 2006; Laukkanen et. al, 2004). Reasons for these mixed findings in the literature include limited sample size, varying subject demographics and occupation, and duration and nature of loading challenges, all of which make comparisons difficult. Additionally, it appears that aerodynamic and acoustic measures may not fully capture self-perceived changes in vocal effort. This poster will summarize relevant literature pertaining to vocal loading and pose questions for future studies.

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**SLP-P4**

## Vocal Amplification: A Voice Protective Strategy in Teachers

Objective: To analyze the effects of using a voice amplifier on teachers' acoustic measurements and self-assessments of their voices.

Methods: This was an intervention study, one-group pretest-posttest evaluator-blind. The subjects were 26 teachers working in the state school system in the city of Salvador, Bahia. The participants used a microphone during classes, for four weeks. The acoustic parameters of the voice (intensity, $F_0$, jitter, shimmer, noise and glottal-to-noise excitation ratio) and the Screening Index for Voice Disorder (SIVD) scores before and after the intervention were compared.

Results: The intensity of teachers' voice decreased significantly after four weeks using portable amplifiers ($p<0.05$). No statistically significant variations ($p>0.05$) were observed in comparing the means of the other acoustic indicators. The SIVD presented a decrease in the mean score, without statistical significance ($p=0.864$).

Conclusions: The results suggest that using a voice amplifier may diminish the phonatory attrition and reduce the voice overload, thus forming a possible strategy for protection against dysphonia in the population investigated.

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**SLP-P5**

## Perceptual Error Analysis of Human and Synthesized Voices

Objective: Assess the quality of synthesized voices, through listeners' skills in discriminating human and synthesized voices, with different types and degree of deviation. Methods: Selection of 36 stimuli, sustained vowel, 18 human and 18 synthesized, male and female. Human voices: three voice specialists selected from a vocal database rough, breathy and strain voices, with different degrees of deviation. Synthesized samples: same deviations as the human voices (VoiceSim system); manipulated parameters were vocal frequency perturbation (roughness); additive noise (breathiness) and by increasing tension and subglottal pressure and decreasing vocal folds separation (strain). Total of 269 listeners, three groups: voice specialists - VS, general speech language pathologists, SLP and naive listeners, NL. The listeners rated the samples with 50% of repetition; VS and SLP listeners also indicated the type and degree of deviation. 99 listeners were not consistent and were excluded, remaining 170 subjects (58 VS, 51 SLP, 61 NL). Results: Listeners misclassified 39.3% of the voices, synthesized (42.3%) and human (36.4%) samples (p=0.001). VS produced the lowest percentage of error for the voice nature (34.6%); SLP and NL identified almost half of the synthesized samples as human (46.9%, 45.6%). Male voices were more susceptible for misidentification, regardless the type or degree of deviation; synthesized breathy samples were generated greater perceptual confusion; severe deviation seemed to be more susceptible for error; female human and synthesized strain showed lower percentage of error. NL had higher perceptual confusion and VS identified better the synthesized samples. Synthesized female deviations were correctly classified; male samples only for roughness; male breathiness and strain were identified as roughness. Conclusion: VoiceSim produced stimuli very similar to dysphonic patient voices. VS had better ability to classify human and synthesized samples. VoiceSim is better to simulate vocal breathiness and female deviations; male samples need adjustment.

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## Exploring the Validity of the Phonation Quotient

Objective: The Phonation Quotient (PQ) provides an estimate of airflow by dividing the vital capacity (in mL) by the maximum phonation time. The purpose of this study was twofold (1) to examine the relationship between the PQ obtained using a handheld spirometer and MPT versus the PQ calculated via the Phonatory Aerodynamic System and the Maximum Sustained Phonation protocol; and (2) investigate whether the PQ relates to speech airflow measured using a pneumotachograph

Methods: Participants were 50 healthy young adults (25 male and 25 females) between the ages 18 and 30 years (M = 21.52 years, SD = 2.57) with typical voice that did not significantly deviate from expectations in quality, pitch, and loudness and matched the participant's gender, height and age. Participants were tested using a Phonatory Aerodynamic System (PAS Model 6600, Pentax Medical Inc., Montville, NJ), handheld Micro Spirometer (Vacumed, Ventura, California), disposable cardboard tubes manufactured by Vacumed, nose clips, and a Seiko stop watch (Seiko Watch Corporation, Minato, Tokyo) during one session lasting approximately twenty minutes.

Subjects were asked to complete the following tasks: Vital Capacity using Handheld Spirometer; Maximum Phonation Time using Stop Watch; Vital Capacity Protocol using PAS; Maximum Phonation Time Protocol using PAS; PAS Voicing Efficiency Protocol

Results: Strong, positive correlations in between each method for VC (r = 0.93) and MPT (r = 0.91) resulted in a reasonably strong correlation for the measured Phonation Quotient (0.85). While 2-way ANOVA results for the PQ measurement, indicated a significant difference between the methods used in testing (handheld versus PAS), the high correlation signifies that handheld spirometers/stopwatches can be used to provide reasonable aerodynamic assessment if the expensive/clinical device is not applicable. Predictive formulas were computed via linear regression analyses that could be used to estimate PQ obtained via one method (e.g., handheld spirometry and stopwatch) from an alternative method (e.g., PQ obtained via PAS hardware/software). In addition, a moderately strong Pearson's correlation of $r = 0.64$ ($p < .001$) was observed between $PQ_{Handheld}$ vs. speech airflow indicating a moderate strength prediction of speech airflow using a sustained airflow task.

Conclusions: The results of this study validate the PQ as a low-cost method which has the ability to provide valid and reliable estimates of phonatory airflow. In particular, estimates of airflow are strong for vowel production (r = 0.85). While PQ measures of airflow are somewhat weaker for estimates of speech airflow (r = 0.64), these estimates may provide a general indication of the rate of airflow via the glottis that can then be confirmed via more expensive hardware such as the PAS. Complete description of methods, results, and conclusions will be provided.

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**SLP-P7**

# The Use of Video Modeling in the Treatment of Voice Disorders

Objective: This study examines the use of a self-video model for home practice of voice therapy exercises. Documentation of the effectiveness of video modeling in assisting therapy in children with autism appears extensively in the communication sciences literature and has potential applications for patients with voice disorders. Previous work in this area (Van Leer & Connor, 2012) demonstrate that video models may improve patient motivation and adherence. Other recent work demonstrates that video models can effectively prepare patients with Parkinson's disease for voice therapy (Kopf, Graetzer, & Huh, 2015). The various types of video modeling techniques would be discussed such as peer models and self-modeling.

Methods/Design: The enrollment projection for the current study is 20 college-age females with no previous singing experience or knowledge of voice therapy techniques. Currently, 9 participants are enrolled in the study. All participants are taught vocal function exercises (VFEs) at their first research session by an experienced voice clinician. Participants are randomly assigned to an experimental (video model) or control (no video model) group. All participants receive written instructions for daily home practice of the VFE. The experimental group also receives a video recording on their initial therapy session and the control group is instructed to download a mobile app of a piano to use for home practice. Current participants have completed one follow-up session (1 week after the initial) and will complete one additional follow-up (3 weeks after the initial).

Results/Conclusions: Dependent variables for this study include adherence rates to home practice and improvement of performance on the VFE power exercises. Future analyses of this data will include examination of qualitative assessment of self-efficacy in performing exercises independently. The examination of video modeling is important for potential use in telehealth and telepractice service delivery and the implications of this work will be discussed.

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**SLP-P8**

# Validation of Semi-Occluded Face Mask Methods

Objective: Traditional semi-occluded vocal tract (SOVT) exercises involve phonating directly into a resonance tube, which can improve vocal efficiency but fails to allow for continuous speech production. A semi-occluded face mask could overcome this limitation by placing the occlusion distal to the mouth. The purpose of this study is to show that a semi-occluded face mask will have a similar effect on vocal economy as an oral semi-occlusion.

Methods/Design: Aerodynamic and acoustic data were collected for 30 excised canine larynges. The larynges were subjected to two extensions (15 and 30 cm) and two constrictions (6.9 and 11.5 mm) within each method. A control was conducted before and after applying these conditions to allow for the investigation of temporal effects. Five trials were conducted for each condition.

Statistical Analysis: All data were recorded and saved using a customized LabVIEW program. Average phonation threshold pressure (PTP) and phonation threshold flow (PTF) were obtained manually from pressure and flow traces. Mean values of PTP and PTF were compared between each method using a two-sample t-test. If a given data set failed the normality test, a Mann-Whitney rank sum test was used in place of a t-test.

Results: Comparing PTP between the two methods for the 6.9 mm constriction, 11.5 mm constriction, 15 cm extension, and 30 cm extension yielded p-values of 0.755, 0.755, 0.986, and 0.489, respectively. Comparing PTF in the same manner resulted in p-values of 0.315, 0.784, 0.958, and 0.552.

Conclusions: The data indicate that aerodynamic measures are not significantly different between trials conducted with a face mask and trials conducted with a resonance tube. We conclude that it would be appropriate to begin testing the use of a semi-occluded face mask in human subjects.

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**SLP-P9**

## Protective Strategies against Dysphonia in Teachers: Preliminary Results Comparing Voice Amplification and Direct Hydration

Objective: To compare the effects of two protective strategies, voice amplification (VA) and direct hydration (DH), on the vocal function of teachers in the school work setting.

Methods: Fifty three volunteer teachers from two public high schools were each assigned to one of the two protective strategies (treatments) for 4 weeks. To be included in the study teachers had to lecture for at least 20 hours per week, not be enrolled in voice therapy, and not be experiencing an upper respiratory infection or allergies. Vocal function was assessed in a sound-treated booth before and after the 4-week treatment period and included: auditory-perceptual assessment (CAPE-V), acoustic analysis (f0, SPL, and measures related to voice quality) of the sustained vowel /ɛ:/ (Voxmetria), and self-evaluation (SIVD). Data were statistically evaluated using SPSS (version 22) with a significance level of $p \leq 0.05$.

Results: There were no statistically significant differences between the two treatment groups in terms of age (47.38±10.97 years), gender (62.3% female), years of teaching (19.29±9.55 years), and weekly teaching workload (34.88±11.33 hours/week). There were also no pre-intervention differences between the two groups on any of the vocal function measures, except average SPL (VA=57.85±4.59, DH=55.40±3.69). Post-intervention, the DH group displayed significantly lower (better) SIVD scores (VA=3.27±2.99; DH=1.23±2.03, p=0.006), and the VA group had significantly lower acoustic irregularity (VA=3.19±0.72, DH=1.23±2.03, p=0.027).

Conclusion: Results will be discussed in terms of their potential impact on reducing the prevalence of voice disorders in the vulnerable teaching profession, and in terms of designing future studies.

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**SLP-P10**

## Amplification of the Teacher's Voice: Effect on Vocal Dose

Objective: To investigate the dose effects of the use of vocal amplification by teachers during classes.

Method/Design: Case study AB design with two female teachers from a public high school. The teachers had their voices monitored with a dosimeter (APM 3200 KayPentax) during all their working hours for two weeks. In the first week, a baseline was set without vocal amplification. In the second one, the teachers wore a portable voice amplifier (SUPERVOZ II 1210) during classes and continued being monitored by the dosimeter. The phonation time, fundamental frequency, intensity, cycle dose and distance dose were measured.

Results: The measures of intensity, fundamental frequency, and distance dose of both teachers were reduced during the week of voice amplification. Teacher (1) had a greater decrease in intensity (-12 dB) and distance dose (-456 m), and an increase in cycle dose (+ 221 kcycles) caused by the longer phonation time during the week she wore the voice amplifier. Teacher (2) had a greater decrease in fundamental frequency (-36 Hz) and in cycle dose (-20 kcycles).

Conclusions: Vocal amplification has shown decrease in the vocal overload to which the teachers were exposed. It can be understood as a protection factor for their voices, especially for the teacher who had fewer complaints, and more time speaking. Studies with a larger number of participants should be conducted in order to confirm these results.

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**SLP-P11**

# Self-Report Effect of Direct Hydration on Teachers' Vocal Quality: An Interventional Study

Introduction: It is found a high prevalence of voice disorders in teachers, requiring the adoption of vocal protective measures.

Objective: This study aimed to assess the effects of direct hydration in the vocal quality according to teachers' self-perception.

Methods/Design: It was a pretest and posttest intervention study with a single group of 27 teachers, examiner-blind. Sociodemographic characteristics and work questionnaire, Screening Index for Voice Disorder (SIVD), Vocal Severity Rating Scale (VSRS), Expected Effects Pre-intervention, Perceived Effects Post-intervention and Post-intervention Perception instruments were applied. The intervention lasted 4 weeks and consisted of 5 minutes of nebulization with saline solution (0.9% NaCl), after 10 minutes of mouth dehydration prior teaching. After intervention, teachers were divided into groups according to their degree of adherence to the intervention: G0(Hidratação≤79%) and G1(Hidratação≥80%).

Results: SIVD scores demonstrated statistically significant intragroup reduction (G0:p=0.006; G1:p=0.028). Self-reported frequency of voice disorders of VSRS intragroup was reduced. Within the Frequency of Expected Effects Before and Effect Perceived post-intervention, vocal quality improvement (40.7%), vocal comfort (40.7%) and vocal folds hydration (37%) were the most highlighted. Post-Intervention Perception instrument reported moderate improvement of vocal symptoms (G0 = 53.3% G1 = 66.7%); clearer voice (G0 = 53.3% G1 = 58.37%); and ease when speaking (G0 = 46.7% G1 = 50%) between groups.

Conclusion: Direct hydration with saline solution promoted improvement in teachers' vocal quality, mainly in G1.

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**SLP-P12**

## Socioeconomic Barriers to Voice Therapy

Objectives: To identify socioeconomic barriers inhibiting patients from attending voice therapy (VT).

Methods/Design: Retrospective cohort study was conducted in an academic tertiary referral laryngology practice. Adult patients evaluated for voice complaints from March 2013 to May 2014 and referred to speech-language pathology (SLP) were included. Outcome measures were pursuit of VT (defined as attending an initial evaluation) and adherence to VT (defined as $\geq$ 2 visits).

Results: A total of 230 patients were eligible for the study. Forty-six percent pursued VT and 36.5% were adherent. In univariate analyses, patients significantly less likely to pursue and adhere to VT ($p < 0.05$) were older aged, non-professional voice users, non-Caucasian (adherence only), non-English speaking, unemployed, lower median household income, shorter distance to VT, and lack of insurance coverage. Gender and VHI-10 were not significant. After multivariate analysis, patients who were male (OR [95% CI]: 2.05[1.07–3.93]) and had a longer distance to SLP (OR[95% CI]: 7.81 [3.13 – 19.49]) were more likely to pursue VT, while non-Caucasian patients (OR[95% CI]: 0.31[0.16–0.61]) and older patients (OR[95% CI]: 0.97[0.96–0.99]) were less likely to pursue VT. Non-Caucasian patients (OR[95% CI]: 0.32[0.16–0.63]), and older patients (OR[95% CI]: 0.97[0.96–0.99]) also were less likely to adhere to VT. Patients in the 3rd quartile distance to VT were most likely to adhere (OR[95% CI]: 5.85[2.32–14.73]).

Conclusions: Multiple socioeconomic factors influence a patient's ability to pursue and adhere to VT. Identifying those barriers can stimulate solutions to improve attendance.

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**SLP-P13**

# Reading versus Repetition for Voice Analysis

Introduction: Voice analysis includes auditory perceptual evaluation and acoustic analysis. Steady state phonation, spontaneous speech, and repetition of sentences are predominantly used. Commonly, during repetition, patients tend to imitate the clinicians' intonation and pitch. This raises the question; do these samples reflect the patients' comfortable levels of speech?

Methodology: 20 vocally healthy subjects were recorded performing the CAPE-V task. The protocol included subjects reading the sentences, repeating the same sentences after the clinician, and repeating sentences following clinician's exaggerated intonation. Each task was performed with a gap of minimum sixty minutes. The audio files were then digitized, grouped, and saved as .wav files. These samples were perceptually rated by experienced listeners for any change in rendering due to repetition or exaggerated demonstration.

Preliminary results: Data shows that patients repeating after clinicians often imitate the intonation of the clinician. The subjects also imitated the exaggerated intonation pattern demonstrated by the clinician.
Conclusions: Data analysis is still in progress; however, preliminary results imply that repetition after clinicians may not reflect patients true levels of voice production.

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**SLP-P14**

## Listener Perceptions of Attractiveness and Dominance of Female Voices

Introduction: Human voice conveys important biological, linguistic and paralinguistic information about a speaker. Although a number of studies have focused on the relationship between acoustic features and perceived vocal attractiveness (Belin et al., 2011; Ferdenzi et al., 2012), effects of listener age/gender are unknown. In addition, very few studies have examined vocal dominance (Borkowska et al., 2011).

Objective: The purpose of this study was to determine a) effects of listener age and gender on perceptions of attractiveness/dominance of female voices and b) coexistence of attractive and dominant qualities.

Hypothesis**:** Voices in the middle of the female pitch range will be perceived as both attractive and dominant. Voices with low fundamental frequency (F0) will be perceived as socially dominant only. Voices with high F0 will be perceived as attractive only. Voices with the least F0 and a vocal fry quality will be perceived at the bottom end of the continuum for perceptual attributes of both attractiveness and dominance

.

Methods: Thirty native English females (19-27) participated in the study. All speakers were heterosexual by self-report, under contraceptive medications and had no history of cigarette smoking. Phonation samples of /a/ and a sentence ("We were away a year ago") were recorded from each speaker. A subset of speakers who demonstrated vocal fry were selected based on perceptual and spectrographic analysis by two expert voice clinicians/researchers.

Results/Discussion: The perceptual experiment is currently being administered online via Qualtrics portal to 20 male/20 female listeners in the age groups: 18-30, 31-50 and 51-65 years. Listeners judge voices on a 5 point Likert scale. Findings will inform us about trends in perceptions of vocal attractiveness and dominance. Further, perceptual ratings of vocal fry will help us develop counseling plans that involve knowledge beyond conventional vocal hygiene such as employability.

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**SLP-P15**

## Long Term Effect of the Lax Vox in Functional Dysphonia: Glottal and Supraglottal Parameters and Voice-Related Quality of Life

Objective: To analyze glottal, supraglottal parameters and subjects' auto perception of vocal quality pre and post prolonged and exclusive use of Lax Vox in adults with functional dysphonia. Method: Eigth women and two men with functional dysphonia received eight voice therapy sessions using exclusively Lax Vox. The Voice-Related Quality of Life (V-RQOL) questionnaire was applied pre and post therapeutic intervention. The glottal aspects analyzed are: fundamental frequency mean, jitter, shimmer, harmonic-to-noise ratio, H1-H2, spectral emphasis and formants. The supraglottal parameters consisted in vocal tract distance images collected during videofluoroscopic as following: absolute lip and jaw opening measures, apex of the back part of the tongue to the hard palate, tongue root to C2, horizontal and vertical length of the vocal tract, glottal level and epiglottis to C3. The parameters were analyzed from the phonation of the sustained vowel [a] before (first session) and after treatment (at the end of eighth session). Results: Linear Discriminant Analysis statistical method showed a high level of prediction in characterizing both moments: 91.7 % of accuracy in predicting the set of measures obtained before intervention and 83.4 % of all after-intervention measures. Paired t-test showed statistical significance for isolated analysis to jitter ($p=0,04$) indicating stabilization of glottal cycles after prolonged and exclusive use of Lax Vox, and increased mean F0 for the male group. The supraglottal distance measurements showed an increase, especially in the area of oral cavity, but without statistical significance. The V-RQOL (T-Test, $p<0,05$) revealed differences in the Socio-emotional, Physical and Total domains, indicating an improvement in subjects 'perception of the voice-related quality of life.

Conclusion: The long term use of Lax Vox in subjects with functional dysphonia had produced changes in glottal and supraglottal measures and improvement of participants' auto-perception of quality of life and voice.

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**SLP-P16**

# The Efficacy of Video Modeling as Supplemental Home Practice Instruction of Vocal Function Exercises


Objectives

Video as a means of assessment and treatment is increasingly used in voice therapy. Little data exist regarding the efficacy of video modeling as a supplemental form of home practice instruction for Vocal Function Exercises. The purpose of this study was to examine the impact of video modeling on number of cues and time required for exercise instruction, objective measures of phonation frequency range and mean phonation times, and subjective assessment of participant confidence in treatment, motivation, self-efficacy, and practice frequency during weekly in-person treatment sessions.

Methods

Preliminary data were collected on follow up therapy sessions after weeks 1 and 2 of initial instruction in Vocal Function Exercise. Participants included 5 patients of the Miami University Voice Clinic.

Results

Preliminary data have yielded variable results regarding the effects of video modeling on parameters of vocal function and self-efficacy. Experimental participants have exhibited increased practice frequency as compared to control participants; however, the limited number of subjects begs for caution, as this finding could be the result of individual characteristics.

Conclusions

The efficacy of video modeling as a supplemental form of home practice instruction of Vocal Function exercises remains unclear. Further data collection will provide evidence of potential significance.



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**SLP-P17**

## Vocal Health Actions for Singers

Objective: to verify the effectiveness of FOB-USP´s Voice Workshop for singers.

Method: Twenty four singers (19 females and 5 males) in the age range 25-60 years, mean 43 yrs and SD 4 yrs, who attended the Voice Workshop for singers, participated in this study. The Voice Workshop was offered by the students of the speech therapy course, in six fortnightly meetings with two hours each. The topics were: voice and speech production, vocal health, vocal warm-up, vocal cool down and body and voice expressiveness for singing. Before and after the Voice Workshop, the singers filled the MSHI protocol (Modern Singing Handicap Index) and a questionnaire on voice harmful habits, and later, a satisfaction survey of their participation in the Voice Workshop.

Results: A significant improvement ($P<0.05$) was seen in the mean scores of singers in all areas of the MSHI protocol, following the Voice Workshop. The results of the voice harmful habits questionnaire showed a decreased occurrence in 15 of the 18 habits investigated, with a significant difference ($P<0.05$) in 5 of them. The Satisfaction questionnaire on the participation in the Voice Workshop showed an improvement in professional performance for most participants, who reported decreased hoarseness, increased vocal range, and improved breathing and expressiveness. The practice of the exercises proposed in the Voice Workshop was reported by 79.1% of the singers and 95.8% of them showed the desire to start with or keep those practices.

Conclusion: FOB-USP´s Voice Workshop significantly improved the quality of life and professional performance and reduced habits which are harmful to the voice.

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**SLP-P18**

## Effectiveness of Protocols of Quality of Life and Voice in Singers

Objective: To investigate the effectiveness of protocols aimed at assessing the quality of life and voice of singers prior to and after a Voice Workshop.

Method: Twenty 24 singers, 19 females and 5 males, in the age range 25-60 yrs and a mean of 43 yrs and SD of 4 yrs, participated in this study. All singers attended the Voice workshops for singers, vocal health action group which consisted of six two-hour meetings. Before and after the workshop, the singers filled 4 protocols of quality of life and voice: V-RQOL (Voice Related Quality Of Life), VHI (Voice Handicap Index), VAPP (Vocal Activity and Participation Profile) and the MSHI (Modern Singing Handicap Index). The scores of the protocols were compared before and after the voice workshop for singers and the individual scores, indicative of dysphonic voices, analyzed.

Results: In the pre and post Voice Workshop comparison, the V-RQOL protocol was not significantly different ($p > 0.05$); significant improvement ($P < 0.05$) was seen after the Voice workshops in all areas of the VHI in six of the eight of VAPP and in all domains of the MSHI. In the individual analysis of the scores, 3 participants who presented, before the workshop, scores indicative of dysphonic voices (3 on V-RQOL, 1 on VHI, and 3 on VAPP), following the workshop showed scores of healthy voices in all protocols.

Conclusion: Protocols VHI, VAPP and MSHI were efficient in showing the improvement in the quality of life and voice of the singers after the voice workshop. Although V-RQOL was not sensitive to show a significant improvement in the scores´ average, it was sensitive in identifying dysphonic voices, as much as VAPP. In this aspect, VHI showed lower sensitivity.

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**SLP-P19**

## Nonlinear Acoustic Analysis of the Vocal Dynamic Visual Patterns (VDVP) in Adult Men

Purpose: To describe the nonlinear dynamics of voices of adult men without vocal complaints using Vocal Dynamics Visual Patterns (VDVP).

Methods: Seventy seven men in the age range 20-40 yrs (mean 30 yrs ±5.54 yrs), participated. The Phase Space Reconstruction Method was adopted for the non linear analysis, and a two-dimensional graph was generated from a routine developed on MatLab ® 10.0. This graph was qualitatively analyzed by the VDVP technique, which considers: number of orbit loops, irregularity and spacing of the tracings. Irregularity and spacing were classified in a scale ranging from 4 to 0, from the best to the worst configuration. This is a cross-sectional, descriptive and quantitative study.

Results: VDVP results showed number of orbit loops with degree 4 which refers to 4 or more loops, in 85.71% of the subjects, with an average of 3.84 (±0.40) loops. As for the irregularity of the tracings, 40.26% of the individuals were classified with degree 0, which refersto discrete irregularity and 40.26% with degree 1, discrete to average irregularity, the mean of irregularities being 0.88 (±0.95). In the tracing spacing parameter, 58.44% of the subjects were classified with degree 1, spacing small to average and the mean 1.05 (±0.76) was found.

Conclusion: The nonlinear dynamics of the normal voices of adult men with no vocal complaints through VDVP showed number of loops in degree 4, irregularity in degrees 0 and 1, and spacing in degree 1.

Keywords: Voice; Voice Quality; Nonlinear Dynamics; Speech Acoustics.

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**SLP-P20**

# A Study of Voice Therapy Dropout: A Decade Later, What has Changed?


Objective:

Treatment dropout is a consistent problem amongst behavior change therapies, and dropout rates in voice therapy are reported at 20-65% (Starmer, Sanguineti, Marur, & Gourin, 2011; Hapner, Portone-Maira, & Johns, 2009; Portone, Johns, & Hapner, 2008; Smith, Kempster, & Sims, 2010). This study seeks to update the evidence base on current voice therapy completion, as large-scale voice therapy dropout rates were last quantified with data collected nearly a decade ago and must be re-evaluated in light of the ever-changing health care landscape (Cornett, Burkard, McNeilly, Patashnik, Peach, Rao, Rogers, & Shepard, 2012).

Methods/design:

Retrospective chart review of all new patients referred for voice therapy from an interprofessional practice setting specialty voice center in Atlanta, GA from 1/1/2013 to 6/3/2013. Data collected were gender, age, diagnosis, date of referral, date of speech-language pathology evaluation, and status as completer or dropout. Patients were classified as completers or dropouts based on an operational definition published by Hapner et al. in 2009.

Results:

A total of 165 charts were reviewed. Of those, 78% initiated voice therapy with an evaluation. 73% went on to attend additional therapy session(s). Of those, 54% completed therapy, which represents 30% of the initial pool of patients. Although the 45% dropout rate in this study remains high, it represents a significant reduction from the 65% rate reported in the 2009 study by these authors, using the same operational definition of dropout. Patient demographics and diagnoses were consistent between the two studies, indicating they were examining a similar population.

Future research directions should investigate the level of satisfaction patients coded as dropouts had with respect to their voices; perhaps the plan for additional therapy sessions was not shared by the patient, and a change in the conversation about scheduling additional sessions would change the dropout rate.



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# Singers' Perception of Vocal Handicap, Impairment and Immediate Impact of Voice Use

Objective: To compare singer perception of vocal handicap, impairment and perceived impact of increase in vocal demand. Methods: 127 Brazilian singers were evaluated, 50 professionals and 77 amateurs singers, 67 women and 60 men, mean age of 34 years old (minimum 18 y-o and maximum 66 y-o). Self-perceived voice handicap was assessed through self-assessment protocol - VHI-10, used as a screening tool, with a cutoff value of 7.5 points. Vocal disorder signs and symptoms were evaluated by the VoiSS (cutoff score of 16 points). The perceived immediate impact of voice use on vocal function was assessed by the EASE-BR. Results: 21 singers of the sample met the criteria for vocal disorder in the VHI-10 (10 professionals and 11 amateurs singers). 70 singers failed in the VoiSS, mostly amateur singers (42). Difference among VHI-10 and the other two scales was significant. The EASE-BR and the VoiSS scores were highly significantly different. All 21 singers who failed in the VHI-10 also failed in the VoiSS. In addition, 21 other singers had maximum score for the three positive issues of the EASE-BR, which means that they observe positive voice aspects with demand increasing. All of these passed on the VHI-10. Conclusions: The three protocols evaluate different aspects of the voice. The singers can have vocal impairment signs and symptoms, though they do not necessarily perceive vocal handicap. On the other hand, singers with self-perceived vocal handicap have more vocal symptoms than the general population. The singers who reported positive changes in their vocal function after an increase in vocal demand regardless of also observing negative aspects, did not perceive vocal handicap.

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**SLP-P22**

# Vocal Danger Zone in Teaching Education Majors

Objective: This study was designed to investigate indications of vocal risks in Teacher Education majors 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. Fifty six university students with age ranging from 18 to 36 years responded to questions related to their vocal lifestyle habits and feelings regarding their voice usage. Fourty-one participants were female and nineteen were male, all pursuing college degrees in Teacher Education. 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, a relatively low daily ingestion of water was observed overall, as well as a fairly high consumption of caffeine among respondents. Statistically significant correlations between reported symptoms of voice disorders and detrimental vocal behaviors suggested a relationship between phonotrauma and voice health. For example, positive correlations were detected between hoarseness and excessive vocal behaviors such as shouting over students and frequent throat clearring. This indicates that higher levels of hoarseness were related to higher levels of phonotraumatic behaviors. Positive correlations were also found among symptoms of voice fatigue and laryngeal-impacting lifestyle choices, including tobaco usage and alcohol consumption.
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 educators.

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**SLP-P23**

## The Association between Supraglottic Activity and Glottal Stops at the Sentence Level

At one time, false vocal fold compression while voicing was considered a sign of a hyperfunctional voice disorder or a maladaptive compensation for vocal fold paralysis. However, Stager et al. (2000, 2002) found frequent brief compressions of the false vocal folds during production of glottal stops (i.e. vowel initiated words) by normal subjects when they recited short phrases. The present study was designed to further investigate supraglottic activity in specific linguistic contexts where glottal stops have been known to occur: vowel-initial words, /t/ final words, and punctuation and phrase boundaries.

Nasendoscopic and audio recordings were obtained from eight healthy subjects (2M; 6F) during production of selected sentence stimuli. The audio recordings were rated by two judges to detect the location of glottal stops, which were defined as brief audible cessations of airflow. The video images were analyzed to categorize the presence of dynamic and static false vocal fold (FVF) or anterior posterior (AP) compressions at the time of the perceived glottal stops.

The data were examined to determine (a) how frequently glottal stops occurred during production of the samples of 18 sentences and phrases, (b) if the glottal stops that were identified perceptually from audio recordings were associated with supraglottic activity as judged from nasendoscopic recordings, (c) if supraglottic activity was more likely to occur during vowel-initial words or consonant-initial words, (d) how frequently supraglottic compressions occurred after a phrase boundary in a complex or compound sentence, (e) if placement of a punctuation mark was associated with increased occurrence of supraglottic compressions, (f) how frequently supraglottic activity occurred at /t/-final words, and (g) which phoneme was associated with the maximum degree of supraglottic activity.

Despite the idiosyncratic patterns of supraglottic activity between subjects across speech tasks, subjects frequently demonstrated dynamic AP compressions at aurally perceived glottal stops, which were produced during vowel-initial words, /t/-final words and phrase boundaries. Many of these dynamic AP compressions, occurred in conjunction with dynamic or static FVF compressions. A high incidence of dynamic AP and FVF compressions were observed at mid-phrase boundaries that were followed by a coma or a colon and a vowel-initial word, suggesting that punctuation marks and the nature of the phonemes might play an important role in inducing dynamic supraglottic activity.

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**SLP-P24**

# Harmonic Amplitude Differences Before and After Voice Treatment in Parkinson Disease

Differences in harmonic amplitudes found at H1, H2, and at the harmonic located at the third formant frequency (HF3) have been shown to be significant acoustic indicators of voice quality in normal and disordered speakers. This retrospective study employed two existing data sets (Halpern et al, 2012; Cannito et al, 2012) to examine harmonic amplitude differences in acoustic spectra of vowels produced by speakers with Parkinson's Disease (PD) before and after voice treatment targeting increased vocal loudness, specifically LSVT LOUD™. The Halpern et al data set included 16 speakers with Parkinson's Disease before and after LSVT®, as supplemented with the LSVT® Companion™ system. An immediate treatment onset group was compared with a delayed treatment onset control group. As expected, dB levels increased from pre-to-post treatment for both groups of patients. Harmonic amplitude differences (H1-H2, H1-F3) did not differ between treatment groups in the pre-treatment condition. Harmonic amplitude differences decreased significantly from pre-to-post treatment, and remained so at follow up, for both treatment groups. There was no significant interaction of treatment condition with specific vowels for either harmonic amplitude difference measure. Post-treatment changes were associated with a general upward redistribution of vowel spectral energy (decreased spectral tilt) that is indicative of increased glottal closure and improved periodicity of vocal fold vibration. The Cannito et al data set examined 8 speakers with PD before and after standard LSVT LOUD and demonstrated significant pre-to-post treatment changes in H1-H2 and H1-F3. This data set included sentence intelligibility data from a rigorously controlled listening study. Change in sentence intelligibility was found to be significantly correlated with change in harmonic amplitude difference for H1-F3, $r = -.845$ ($r^2 = .714$). This indicates that as spectral tilt decreased, sentence intelligibility increased. Such changes have significant implications for both improved voice quality and speech intelligibility following voice treatment.

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**SLP-P25**

## Effectiveness of Online Videos about Vocal Health for Teachers

**Purpose**: investigate whether the online videos about vocal health assisted on the professional performance and if they increase the quality of life of the teachers. **Methods**: was made available to teachers in virtual platform three videos, made by the authors of this study: "Discovering the secrets of voice and speech", "Vocal Health" and "Taking Care of the Professional Voice". The videos have 4, 13 and 12 minutes long, respectively. Participated in this study 28 teachers from five schools of the city of Bauru who responded to the protocols Screening Index for Voice Disorder (SIVD) and to the Vocal Activity and Participation Profile (VAPP) before and after watching the audiovisual material. **Results**: according to the SIVD, there was a significant reduction ($P<0,05$) of the number of teachers with dysphonia and in the number of vocal and laryngeal symptoms of the participants after the educational videos. There was also a significant reduction ($P<0,05$) of hoarseness, breaking voice, voice loss, low-pitched voice, dry cough, pain and strain when speaking. In the analysis of the VAPP occurred a reduction of the score in all categories of the protocol. The comparisons were statistically significant for the categories of total score, effect on daily communication, SAL and SPR scores ($P<0,05$). **Conclusions**: the results corroborate with the chance of assimilation of the content transmitted through the online videos of vocal health that promoted the practice of vocal hygiene habits, reduction of vocal complaints and vocal symptoms, also as the improvement of the quality of life of the teachers.

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**SLP-P26**

## Spasmodic Dysphonia Before and After the "Gold Standard": Two Experiences

Abstract: The history of medicine proceeds in fits and starts, influenced by tools available, the treatments doctors invent and the culture in which they are applied. After Dr. Herbert H. Dedo cut the recurrent laryngeal nerve of Mildred Younger (September 1975), what happened to his "simple surgery" to treat "Spastic Dysphonia"? And where are we today? A 1984 Dr. Herbert Dedo patient and a 2011 Dr. Gerald Berke patient present themselves and their perspectives for the consideration of Voice Specialists attending the 45th Symposium.

Objective: To advance understanding of Spasmodic Dysphonia by exploring the life experiences and perspectives of two individuals who chose surgical intervention, one before and one after the introduction of Botox-A.

Methods/Design: Two post-surgical consumers (male, 51 and female, 64) whose SD surgeries took place in 1984 and 2011 participate in this poster highlighting their personal experiences, outcomes and ongoing involvement with the field to illuminate the issues impacting treatment and research issues today. The presenters' personal experiences those of other members of the National Spasmodic Dysphonia Association are shared. What do patients say they need and what tools are Voice Specialists using to help them find it?

Results: Unmet data needs will be highlighted. In combination with a summary of research on current information sources, clinical practices and publications, a picture of the state-of-the-art from the treatment-seeker's perspective emerges. The colorful history of Spasmodic Dysphonia is told as a human story, as well as a case study of this orphan disorder.

Conclusion: Presenters wish to stimulate discussion and promote action on these questions: How far has the field of Spasmodic Dysphonia diagnosis and treatment progressed in the past 30 years? What can be done to improve the consumer's decision-making process? How can clinicians best communicate options to the patient and to one another? What role can the Voice Foundation play?

Mary Brady, MS, Resource Development Consultant, ID3, Independent consumer advocate, NSDA member

Erik Laurence, BSEE, MBA, CMO, SD blogger, NSDA member

# The Effect of the Lee Silverman Voice Treatment (LSVT LOUD) on Facial Expressivity in Parkinson's Disease (PD): Outcomes and Predictors

Objective: Individuals with PD demonstrate facial expressivity impairments which negatively impact social interactions and interpersonal relationships (e.g., Brozgold et al., 1998). Preliminary research showed that LSVT (Ramig et al., 2011) increases facial expressivity in PD (Spielman et al., 2003). Using additional procedures, we examined the effects of LSVT on social engagement (SE) and facial mobility (FM) in PD. In addition, we examined whether demographic (gender, age, and education) and clinical factors (global cognitive status, depressive symptoms, illness duration, disease stage, and side of initial motor symptoms) could predict the likelihood of improvement from LSVT.

Methods/Design: Participants included 37 individuals with idiopathic PD: 20 participants (75% male; M age=67.0 yrs.) in the LSVT LOUD group and 21 control participants (70% male; M age=64.7 yrs.) receiving no treatment. Facial expression was elicited through a spontaneous emotional expression task from the New York Emotion Battery (Borod et al., 1992) involving 4 videotaped monologues (happiness, sadness, anger, and neutral) at baseline and post treatment. Facial expressions were rated for SE and FM by 24 naïve raters on 7-point Likert scales.

Results: Group (2) x Time (2) x Monologue Type (4) ANCOVAs (controlling for depression scores) were conducted for the two facial variables. There was a significant 3-way interaction ($p=.021$) for SE, with the LSVT group changing over time as a function of monologue valence. There were effects of Monologue for SE ($p=.009$) and FM (approaching a trend), with higher scores for happiness and anger relative to sadness and neutral. Multiple regression analyses for the 8 demographic/clinical factors were not significant for either face variable.

Conclusion: LSVT had an effect on ratings of social engagement but not on facial mobility. The fact that regression analyses did not yield significant effects suggests that LSVT was not affected by individual differences in this data set.

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## A Study of Vocal Exercises and their Effect on the Hypothyroid Vocalist

By using vocal warm ups to strengthen the vocal structure, it is hoped that positive results in vocal quality, after twelve weeks of lessons and regular practice, will be evident. Through experimentation, the goal was to find out if vocal warm ups affect the vocalist with hypothyroidism positively, negatively, or not at all. A second objective was decided upon to find out first if there is noticeable vocal quality improvement using warm ups as opposed to none at all, and second, whether a systemized order of warm ups benefits more than a random order of warm ups. A similar study of systemized warm ups was conducted and published by Thomas Blaylock, which is used as a reference for this investigation. At the end of the three-month teaching period, an impartial group of voice teachers evaluated audio samples collected from each subject during the first and twelfth lessons. To avoid any bias, samples were arranged separately via survey monkey website so participants focused on the improvement in vocal quality. Hypothyroidism, a dysfunction of the thyroid gland, which controls and regulates many aspects of our body, is one of those medical issues that can drastically change an individual's vocal life. Singers who have hypothyroidism often experience symptoms that conflict with healthy voice production such as changes in vocal fold histology, laryngopharyngeal reflux, fatigue and so on. Literature acknowledges the importance of thyroid hormone changes to the singer's voice, but does consider the subject too large to cover sufficiently. The purpose of this project is to research how hypothyroidism affects the singer's voice and what vocal pedagogy methods can be taken to develop a healthy vocal instrument. This investigative study also opened an inquisition into the pharmaceutical side of hypothyroidism; is there a difference between generic and branded synthroid medication and what are the benefits and draw backs of each?

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**VP-P2**

## The Effect of Menstrual Cycle on Singing Voice: A Systematic Review

Objective: Singers have an artistic control over their voice production and expect that's its perceived well by the listeners. Research has reported of differences in a women's voice across the different stages of menstrual cycle. A review of the studies carried out in singers on the influence of menstruation on the singing voice will enable a better understanding of these voice changes.

Methods/Design: A systematic literature search was carried out on PubMed, Scopus, Web of Science and Cochrane databases. The keywords 'singing voice', 'menstruation' and 'menstrual cycle' were searched in different combinations. Those articles that discussed the effect of menstruation on the singing voice were only included for the final review.

Results: Five published articles in English language were identified and considered for the review. Hormonal variations occur to a great extent during the menstrual cycle and these variations can have an influence on the voice of singers. There are limited studies that have been carried out exploring the relationship between menstrual cycles and singing voice. One study has compared the combined effect of vocal abuse and menstruation in singers and reported that this population is more susceptible to developing vocal nodules and hyper alteration of vocal folds. Another study on Western classical singers has reported of perceptual effects on the voice of singers. Further, reported that greater effort is required to produce voice and its sounds less aurally and artistically rewarding. The studies have reported that the voice changes are primarily due to water retention, edema of interstitial tissue and venous dilation. A great variability was found between the studies in terms of type of singers, study methods and outcome measures tested.

Conclusion: Even though the studies point out to changes in singing voice associated with menstrual cycle, there is a need for more studies among different types of singers and outcome measures.

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**VP-P5**

**The Use of Mobile Device Applications in Assisting Students in Meeting Goals in the Voice Studio**

Objective: To see if the use of cell phone apps, which are used by most college students on a daily basis could be used in helping them further technical and music goals in their weekly applied vocal sessions. The hypothesis was that they would find these programs extremely useful, would augment instruction, and assist them in monitoring their progress and goals.

Method: Seventeen applied voice students in my studio were given a gift card to purchase applications for their mobile device and given specific instructions in the types of applications they were to buy and use. Students were told to purchase one app that would assist them with warming up, one app that would help them journal their practice time during the week, and any other musical app that they thought might assist them in their vocal or musical studies.

Results: Students purchased a variety of apps in the categories delineated. Of the three categories from which students were required to purchase, they found the warm-up apps to be the most successful with the ratings averaging a 8.62 when asked to rate effectiveness and helpfulness on ten point scale in meeting vocal goals in the studio. The journaling apps were less successful with an average rating of 5.71 and the miscellaneous apps received negligible ratings.

Conclusion: Students did find that using targeted musical applications on their mobile devices helped them be more prepared and assisted them toward their vocal goals in certain areas.

Chris Turner, DMA, Assistant Professor of Voice,, Stephen F. Austin State University

## Five Yoga Postures and Breathing Exercises for Reducing Music Performance Anxiety

Objective: Participants learn five basic yoga postures and two breathing exercises that can assist them in reducing Music Performance Anxiety (MPA), and enhancing pre-performance emotional states. MPA can prevent high-level singers from performing at their best. Without tools to help combat this fear, careers can be negatively affected or cut short. Some performers turn to alcohol or beta-blockers to help control the symptoms. These options, while perhaps helpful in the short-term, do not provide singers with strategies to address the underlying anxiety and the body's physiological responses to fear; the breath is intrinsically linked to emotions, and thus especially in singers, is impacted when fear dominates. This workshop follows up the authors' recent study, which examined the use of five specified yoga postures and two breathing techniques in terms of their efficacy in controlling heart rate and reducing MPA in Master and Artist Diploma level singers at the University of Cincinnati, College-Conservatory of Music.

Methods/Design: This hands-on workshop will provide each participant with instruction on how to safely move through each of the five postures and breathing exercises, making necessary adjustments for comfort and ease. The postures used are: mountain pose, or *tadasana*, forward fold, or *uttanasana*, child's pose, or *balasana*, spine twist, or *ardha matsyendrasana*, and cat/cow, or *marjaisana/bitilasana*. The two breathing exercises taught are *ujjayi* breathing, or ocean breath, and *nadi shodhana*, or alternate-nostril breathing. These basic exercises can be done in the space of an office, dressing room, or backstage, making them highly useful for the professional singer.

Results and Conclusions: Participants leave the workshop with valuable tools for reducing MPA, diminishing pre-performance heart rates, and improving overall emotional pre-performance states. Teachers of singing can use these methods in their studios as well. A handout will be given with pictures and descriptions of the exercises.

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# How to Vocalize for Contemporary Singing Genres

Introduction: Few scientific studies have been done on the efficacy of vocal exercises for professional singers. Those published have only discussed listener perception or teacher's directives, changes in vibrato rate, or respiratory training. None have definitively tested the best vocal exercises for singers. It is time that voice scientists and the voice teaching profession begin to discuss effective training exercises for singers in this century. Voice teachers have effectively taught professional singers through the centuries using exercises sung on vowels as warm ups and technique builders in an improvised way. For example, the exercises of Garcia taught pitch onset, breath management, resonance, range extension and agility. Those systematic vocal techniques worked best to sing the music of composers of 19th century works because they used melodies and rhythms based on ornamentations written into the music itself. However, those exercises were typically composed only in major scales, and with simple rhythms using common meters. But, what about new music of the 21st century including art song, opera, musical theater, pop, and rock genres?

Objective: Twenty-first century singing genres require exercises based on the music of today with a use of all scale types including minor scales or modes, with unusual intervallic leaps, and with tricky rhythms, as well as multi-metric patterns.

Methods/Design: The author will demonstrate published exercises of legendary vocal pedagogues such as Garcia, Miller and Brown, and contrast with those of Popeil and Kayes and some of her own. Audience members will interact by singing the exercises prepared by the author to determine if 21st century musical motives are positive variations on the older standard scales or arpeggios.

Results and Conclusions: The author's exercises will open auditor's thoughts to the development of exercises appropriate to the task of training modern singers and begin a debate about what voice scientists might wish to study next to fill a gap in the literature.

Katherine Eberle Fink, DMA, Professor, University of Iowa School of Music

**W3**

## Dancing with Voice: Integrating Techniques across Performance Disciplines

This workshop makes practical connections across performance disciplines in the areas of voice, dance, movement and acting. Putting it all together, participants will explore the physicality of language, both spoken and sung, in a movement-based context.

The presenter draws on both clinical and practice-based research in the UK, Australia and the US to clarify the technical requirements and physical relationships of sounding and moving simultaneously. Texts from musical theatre will facilitate “doing it all” without sacrificing anything and while remaining healthy!

Joan Melton, PhD, ADVS, Emeritus Professor, CA State University Fullerton, Program Director, One Voice Centre for Integrative Studies,Associate Artist, New York Classical Theatre

## The Female Middle Singing Voice Explored with Non-invasive Feedback from Audio and Egg Signals

Using recorded non-invasive signals of VoceVista (spectrum analysis and EGG), objective characteristics of the female middle register are described in some detail as they occur in classical singing, "mix," and belting. These characteristics include two major points of transition at the borders of the middle register: 1) from the lower ("chest") register, and 2) the move to the upper extension at secondo passaggio(ca. F5-G5); as well as varied resonance adjustments of the first and second formants at these transitions.

The workshop will first present recorded files that can be considered model approaches to the critical transitions that define the middle register. Subsequent exploration of the transitions with acoustic and EGG feedback from live voices should then help reveal the complexity of the factors that the singing teacher needs to consider with respect to both voice type and individual variation.

Note: Since displayed feedback from non-invasive signals will play an essential role in guiding and evaluating the efforts of the singer subjects, an exception to the rule against use of audiovisual aids is requested, as has sometimes been granted in past symposia.

Donald Gray Miller, Ph.D., M.M., B.A., Researcher, Groningen Voice Research, Stavangerweg 21-2, 9723JC, Groningen, Netherlands

**Creative Precision: Lessac and the Art of Articulation: Using the Rhythmic Musicality of Consonants to Effectively and Enjoyably Express Yourself**

In this experiential workshop, participants will improve their consonant articulation and increase their expressiveness using the musical metaphors of the Lessac System. We will explore how the rhythmic and vibratory sensations of consonants develop the musicality and kinesthetic sensitivity that are the basis of expressive and intelligible articulation. While learning to "play" English consonants like instruments, participants will use their musicality, creativity, and improved kinesthetic awareness to use language effectively. By employing consonants' inherent resonant and rhythmic qualities, participants will then explore the expressive possibilities of consonants in everyday usage and text work. This workshop will be particularly useful for performers, therapists, and educators who are looking for ways to successfully improve intelligibility with enjoyment, creativity, and expressiveness.

Diane Gaary, MFA, Associate Professor, Temple University, Philadelphia, PA, Arcadia University, Glenside, PA, Westminster Choir College, Princeton, NJ

## A Painless Approach to Treatment of Primary Muscle Tension Aphonia

The term “primary muscle tension dysphonia/aphonia" is currently used to refer to patients presenting with absent voice or severely limited ability to voice, without an underlying vocal fold pathology sufficient to explain the severity of the dysphonia/aphonia. Patients with these symptoms have been diagnosed historically with “hysterical aphonia” or “functional aphonia.” There are multiple methods for re-engaging the voice of a patient with primary MTD/A described in the literature dating as far back as the early 1900s. Speech-language pathologists generally have had good success in treating primary MTD/A with a multitude of different treatment approaches. News stories in the recent past have increased public awareness of speech-language pathologist's involvement in returning patients’ lost voices, and patients who are savvy health consumers will expect quick results.

The aim of this workshop is to increase clinician confidence in the ability to quickly bring back the voice of a patient with primary MTD/A. We will begin with hands-on exploration of the breathing and muscular tension patterns exhibited in various presentations of primary MTD/A to gain a sense of how the aberrant voices are produced. We will then practice multiple techniques to eliminate hyperfunction and restore voicing, specifically variations on traditional circumlaryngeal massage designed to reduce discomfort. Vegetative tasks, sounds produced with a semioccluded vocal tract, and other phonation elicitation techniques will also be practiced. Finally, we will work through a mock initial therapy session in fast-forward, practicing each step from return of normal phonation at the sound level through conversational speech.

Carissa Maira, MS, CCC-SLP, Emory Voice Center, 550 Peachtree St. NE, Atlanta, GA 30308

# Turn of Direction: Anticipatory Placement Sensations as a Means to Introduce Second Formant Interaction Strategies in Classical Western Tenor Voice Training

Kenneth Bozeman[i] and Donald Miller[ii] have both presented and authored clear, science based pedagogic principles of classical western male voice acoustics. Training the tenor high voice still can be a challenge for many teachers rooted in kinesthetic feedback sensations and traditional pedagogy. Tenors in training tend to lack a kinesthetic awareness of the feeling of a strong standing wave of resonance above the first formant until they have experienced it. Seeking to further Bozeman's and Miller's work, this session will suggest tonal "placement" strategies based on second formant speech locales to establish $F_2$ interactions with higher harmonics ($3f_o$ or $4f_o$). While acknowledging that each singer's kinesthesia is unique, these directional suggestions will provide a practical starting point of resonance when training a tenor who has developed the requisite laryngeal stability to begin to explore the "turn" of the voice.

The goal of the workshop is to give attendees a science based, practical tool to introduce the difference of acoustic sensation inside the mouth as a connection to a higher harmonic is established. The workshop will introduce this concept to a young tenor who is unfamiliar with the presenter. Both the singer and workshop attendees will be given a one page handout that charts the F2 placement sensations I will describe in the session.

Nicholas Perna, DMA, Assistant Professor of Voice Pedagogy, Mississippi College

[i] Bozeman, Kenneth. Practical Vocal Acoustics. Hillsdale, NY: Pendragon Press: 2013.
[ii] Miller, Donald. Resonance in Singing. Princeton, NJ: Inside View Press. 2008.

## Adapting Yogic Breath-Work for Voice Therapy and Singing Voice Rehabilitation

Voice clients often present with sub-optimal respiration patterns that negatively impact phonation in their speech and/or singing.

Adapted breath-work (*prãnãyãma*) can be used to increase awareness and control of respiratory movement patterning, which can facilitate increased control of tidal volume and inhalatory and exhalatory flow rates. It is also a potent tool for managing negative stress response, i.e., balancing sympathetic/parasympathetic nervous system activation.

This workshop will provide a brief overview of the yogic breath-work, then instruct participants in examples of adapted yoga breath-work for use in voice therapy and singing voice rehabilitation.

Kenneth Tom, Ph.D., CCC-SLP, Associate Professor, California State University Fullerton, Department of Human Communication Studies, 800 N. State College Boulevard, Fullerton CA 92831

## Teaching Strategies for Functional Musical Theatre Group Voice Classes

Some academic voice programs may require entering students to participate in a group voice class before enrolling in one-on-one voice lessons. Additionally, some private voice teachers may decide to supplement private voice lessons with group voice classes.

Group voice classes offer students the opportunity to learn basic vocal technique together and can be a more efficient use of teacher time and university financial resources. Group voice classes can also offer challenges including how to (a) manage effectively both individual and group singing, (b) address basic vocal technique in a way that prepares students for different teaching methods following the class, (c) encourage individual repertoire building with a large number of students, (d) teach concurrently students of different levels and voice types, and (e) maintain a supportive and focused environment to foster optimal student learning.

This session will focus on teaching strategies for functional musical theatre group voice classes; however, its principles can be applied to group teaching of any singing style. This presentation includes student participants as we explore and demonstrate practical and functional strategies for teaching musical theatre group voice classes in academic and private settings.

Amelia Rollings, PhD, MM, Assistant Professor of Musical Theatre Voice, Department of Theatre & Dance, Western Kentucky University

**W10**

# Habilitating the Injured Singer: A Systematic Approach

Abstract:
The proposed session will be a live demonstration with injured singers focusing on the fundamentals from a Singing Voice Specialist's perspective. Our profession has designated the title of SVS to those voice teachers with specialized training in anatomy, physiology, acoustics and that work in affiliation with a voice team to habilitate injured singers. However, all voice teachers may benefit from observing an SVS's systematic approach to working with singers with injuries or pathologies such as nodules, cysts, paresis, muscle tension dysphonia (MTD), etc.

The objective is to guide teachers in designing a protocol for habilitation of the singing voice. They will gain knowledge in triaging technical issues contributing to the presented pathology or injury, and designing a systemic approach through the five systems of the voice: respiration, phonation, registration, articulation and resonation. It is imperative that singing teachers understand how a voice disorder impacts vocal function in order to create an effective habilitative plan.

Narrative:

At the 51st Annual NATS convention I was afforded the opportunity to present on a panel entitled "It Takes a Team: Managing Voice Disorders." This session focused on the team aspect of working with injured singers, and the scope of practice for the primary team members. As the Singing Voice Specialist (SVS) representative, my two primary objectives were to address the triage component of listening to the speaking and singing voice, and to explain how to create a team relationship with the laryngologist and SLP. As a follow-up, I presented a session at the 2014 NATS National Conference entitled, "A Practical Guide for Working with Voice Disorders." In this session, I laid the foundation for educating oneself to become qualified to work with voice disorders. Furthermore, using nodules as an example, I provided a practical guide for the proper protocol through PowerPoint. The proposed presentation will instead utilize a live demonstration to further demonstrate my habilitation process with injured singers.

The discussion of who should work with voice disorders remains a controversial topic within the voice community. From my standpoint, it is crucial that we continue to educate the NATS members as to the direction of the SVS training. There remain ongoing conversations about SVS certification and discussions around the variety of voice team models that exist. The reality is that we must further arm non-SVS voice teachers with critical information should they end up habilitating injured singers for reasons such as: 1.) necessity—due to logistics of their location, or 2.) lack of an awareness about the skill set required to work with injured singers. With a membership of over 7,000 NATS members, the fact remains that voice teachers are on the front line of vocal health and we need to ensure that injured singers are receiving optimal care.

Learning the fundamentals of working with injured singers would be of use to every NATS teacher. Establishing a systematic approach to diagnosing voice issues through the five systems of the voice is necessary. A clearly devised approach to vocalizes and repertoire aimed at habilitating the voice will guide voice teachers in a structured manner.

During previous conferences, workshops and conventions, NATS has invited otolaryngologist and speech language pathologists to inform voice teachers about injured singers by showing graphic pictures of nodules, polyps, cysts, hemorrhages and other pathologies. However, the question remains: how do we use this information to help students suffering from injuries?

Having worked with voice disorders for many years in affiliation with several voice teams, I have cultivated tremendous relationships with laryngologists and speech language pathologists. I am consulted by voice teachers who are not SVS's on how to proceed with singers who have common voice concerns. Specialists often ask me for referrals to voice teachers in other parts of my state. Through thirty years of teaching classical and CCM at the private and university levels, and now working as an SVS for over a decade, I am qualified to provide this guidance to my colleagues. I firmly believe that there are still some specific fundamentals related to habilitating injured voices that would be enormously useful to share to even those teachers who remain current in the areas of voice science and pedagogy.

Kari Ragan, DMA, SVS, Artist in Residence, Voice Faculty, University of Washington, Seattle, WA

## Life's a Pitch: A Method to Teach Correct Pitch Matching to the Pitch Challenged

I have been teaching singing technique for almost twenty years, the last nine of them at Circle in the Square Theatre School in Manhattan. I have taught numerous students who loved to sing, or in the case of Circle in the Square, were required to sing, but who were unable to match pitches correctly. Out of necessity, I developed a method to help these students, some of who had been told they were tone deaf, to match pitch. In all this time, I have yet to find someone who could not learn to match pitch reasonably well and accomplish their desire to sing a song.

In this course, I will show, hands on, how to help these students. I will show teachers how to help the pitch challenged find their way from general pitch areas to more specific musical pitches and then lay out the principles behind my methodology. I will take two or three students who have trouble matching pitch and/or have been told that they are tone deaf and work with them using these methods. If history repeats itself, then it will take between thirty seconds to thirty minutes for initial pitch matching to occur.

I hope these methods will give teachers practical tools to tutor the pitch challenged as a tutor would give remedial help to someone who finds math a difficult subject. Imagine walking through life having been told that you "just can't add." It is a tragic situation when a human being goes through life disenfranchised from his or her voice. I hope this will empower teachers who feel at a loss to help these potential singers and will in turn lead to thousands more human beings who will be able to reclaim their basic human birthright of singing.

Beth Falcone, MM, BA, Singing Technique Teacher, Circle in the Square Theatre School, 1600 Broadway, New York, NY 10019

**W12**

## Vocal Health and Technique for the Young Singer/Actor Engaged in Musical Theatre, CCM and Classical Music

How do you keep an over achieving high school singer's voice healthy? In one day, the student may sing in the choir, an A Cappella group, the fall or spring musical, and at night perhaps a coffee house featuring the latest pop songs to raise money for the school play!

This interactive workshop will help participants identify and correct vocal challenges in young singers. Teachers will learn how to set the foundation of solid technique for developing singers preparing for careers in singing and acting. Presented by a vocal teacher who specializes in working with 15-22 year old students and a clinical vocologist/voice therapist, who works with singers and actors as patients, this workshop will walk you through the ins and outs of training the young voice while also addressing the more technical side of vocal rehab and how to spot medical vocal issues.

Part 1 of the workshop will provide a "checklist" for assessing young voices, explain the challenges of working with this constituency of students, and share ideas that have been successfully employed when caring for the student who has become a patient of a laryngologist. This workshop will also explain differences in vocal and medical jargon, so teachers will be better equipped to serve as "interpreters" across disciplines, and to set goals and restrictions when students have had medical vocal issues.

Part 2 of the workshop will be an interactive demonstration where the presenters will work with 2-3 singers between the ages of 15-19 to apply the collaborative strategies introduced in Part 1.

A vocal assessment checklist and useful warm ups will be handed out.

Chandler Thompson, DMA, MS, CCC-SLP, Coordinator of Clinical Services, Professional Voice Specialist, Brigham and Women's Hospital/Division of Otolaryngology

Noel Smith, BFA Voice Performance, Boston Conservatory, Musical Theatre/CCM Specialist, Walnut Hill School for the Arts, NATS Massachusetts Regional Governor, NATS Boston Program Director

**W13**

## Legit Singing in Musical Theatre

It is essential in today's musical theatre market for a singer to be able to sing in many styles including legit as in the recent Broadway legit musicals, such as Dr. Zhivago and *Gentlemen's Guide to Love and Murder*. This workshop will examine specific techniques and exercises for developing the musical theatre legit voice in a "hands on" experience. Because of the demands for singers to sing legit songs in shows or for auditions, there is a need for the flexibility of the larynx making different interior shapes to allow changes in the resonance to serve the song style as well as the character. Through experimentation and exercises, this workshop is designed to enhance skills of musical theatre singers and help classical singers cross over. The workshop uses a hands-on and skill-building delivery style, interacting with participants and working with music theatre and classical singers on their audition songs to examine specific ways to present their song in the correct musical theatre legit style. Participants of this Legit Singing in Musical Theatre workshop will leave with tools to use in the classroom, studio setting, auditions and professional stage. This workshop will interact with participants and work with music theatre singers to explore the legit style in music theatre.

Edrie Means Weekly, MM, BME, 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

**W14**

## 45 Uses of the Straw in Celebration of the 45th Annual Symposium

Semi-occluded vocal tract exercises using a straw have been shown to be beneficial to singers and speakers. Join NATS Executive Director and voice professor Allen Henderson in this workshop to better understand the process and benefits of these exercises for you and your students as well as many other uses of straws in the voice studio. In celebration of the 45th Annual Symposium, this fast paced workshop will provide 45 uses of the straw and participants will leave with a complete list of exercises and uses for their personal use and for sharing with their students.

OBJECTIVE: to provide well organized training for teachers in using straw phonation exercises as well as a repertoire of effective exercises using straw in the studio.

Allen Henderson, DMA, MM, BM, Executive Director, National Association of Teachers of Singing, Professor of Music, Georgia Southern University

## Teaching Endoscopy: Pool Noodles and Cadavers

Endoscopy is in the SLP's scope of practice, but is often constrained by state laws and institutional best practices. In many facilities, it is expected that a physician will be nearby while a speech-language pathologist passes the scope independently; in others, it is expected that a crash cart will be available if the SLP "calls a code." I developed a training protocol in endoscopy for graduate students, teaching it as half of an elective course (1.5 credits), that does not rely on live subjects for scoping. Students develop skills in setting up and breaking down the endoscope, and passing the endoscope on a series of inanimate objects that become progressively more difficult to scope. This is followed by passing the endoscope on a cadaver. The class was also invited to a nearby laryngologist's office to pass the scope on each other. The classroom instruction focused on the use of endoscopy for evaluating resonance, voice and swallowing.

This course by no means substitutes for a two-day continuing education course in scoping. However, it does allow our students to be more sophisticated about scoping when placed in hospital externships and it exposes them to a part of the field they might not otherwise get to experience. Students ($N = 13$) completed a survey before and after the endoscopy course. Questions related to their confidence and competence in handling the endoscope. Paired data from ten Likert scale questions were evaluated with Wilcoxon signed ranks statistic, and all ten showed a significant difference (all $p < .03$). Qualitative data from open-ended questions will also be presented.

For programs with or without a cadaver lab available, our curriculum offers an affordable option compared to purchasing a simulator mannequin. Students are interested in learning these skills in graduate school and benefitted greatly from building skills incrementally.

Future plans include incorporating the endoscope in additional courses, such as speech and hearing science and voice disorders. Participants will be invited to examine the teaching materials created for this course and to brainstorm other ways to teach endoscopy away from the hospital.
Participants will have an opportunity to introduce the scope to inanimate objects, manipulate the scope, and practice reporting out.

Shari Salzhauer Berkowitz, PhD, CCC-SLP, Assistant Professor, Mercy College, 555 Broadway, Dobbs Ferry, NY 10522

# Fixing Common Technical Faults in Injured Singers

Objective:
In addition to symptoms and problems caused by a vocal injury or voice disorder that an injured singer must contend with, it is very common for that singer to also have existing faults in singing technique that may have preceded the vocal injury/disorder or may be adaptive behaviors as the singer attempts to compensate for difficulties associated with his/her voice injury/disorder. Often, by retraining the problematic technical faults for the singer, the Singing Voice Specialist can facilitate improvement or resolution of problem symptoms by implementing a range of exercises and suggestions to correct the technical faults. For example, a female pop singer with a vocal fold scar may benefit from learning about retraining the head-chest shift in vocal registers.

Methods/Design:
This workshop will demonstrate several options, a "bag of tricks", for ways to fix a list of technical faults. These interventions/exercises will be demonstrated by the workshop leader, working with volunteers from the audience. Workshop attendees will be able to try some of the treatment suggestions "hands-on" with fellow attendees. A handout list of technical singing faults will offer 4-5 interventions for each fault. We will conclude with a question/answer time for individuals to ask about specific problems they want addressed.

Results:
Workshop attendees will add to their repertoire of treatment interventions and suggestions, will have the opportunity to try out some of them with fellow attendees, and may ask specific questions about technical problems confronting injured singers.

Conclusions:
While the Singing Voice Specialist and other vocal and speech professionals offer training and retraining for the specific symptoms of a given voice disorder, it is advantageous to also address other possible technical faults that trouble injured singers.

Deanna McBroom, MM, Professor of Voice, Director of the Voice Program, Singing Voice Specialist, College of Charleston, Medical University of South Carolina

# Emotional Voices, Conscious Ears: The Role of Empathetic Listening While Working With Professional Voice Users

Objectives:

1. Define Empathetic Listening skills that support communication with professional voice users.
2. Review data that supports the value of Empathetic Listening and provide strategies for implementation within private voice sessions.
3. Discover how to properly utilize Empathetic Listening within a session to advance reception of information and expedite the voice training process.

Sessions with professional voice users can be full of varied emotions. Clinicians must acknowledge the client's emotions while continuing to provide services within a training session. The precisely placed box of tissues in any studio or office is often the clinician's acknowledgement of the range of emotions that can accompany voice training, whether the voice is healthy or pathologic. If not properly addressed, the emotional responses from clients can derail a session or cause the client to become non-receptive.

Clinicians have trained their ears to distinguish changes in a voice, but can we better understand what's being said? One strategy, Empathetic Listening, is a way to acknowledge the client's feelings while still allowing the training session to progress.

Methods:
Through an interactive presentation and small group role play, the process of developing and implementing Empathetic Listening skills will be introduced. Following a short presentation, attendees will divide into small, cooperative groups. Small groups of 3 to 4 will receive a script of several scenarios. Each person will role play as the clinician, client, and observer while employing the new Empathetic Listening model.

Results and Conclusions:
This method will demonstrate the value of Empathetic Listening and provide clinicians with strategies for use in their own work immediately, making stronger communicators in both the clinic and private voice studio settings.

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## Manual Circumlaryngeal Techniques for the Speech-Language Pathologist in the Treatment of Muscle Tension Dysphonia

Muscle tension dysphonia represents approximately 10% of patients seen in multidisciplinary voice disorders clinics. Moreover, muscle tension dysphonia may contribute considerably to the nature and severity of dysphonia in patients with other structural or neurological voice disorders. Manual circumlaryngeal techniques are a direct and effective treatment approach to significantly improve voice symptoms in this population. Substantial treatment effects have been documented in a single treatment session. The purpose of this workshop is to demonstrate and practice manual circumlaryngeal techniques in the treatment of muscle tension dysphonia by the speech-language pathologist. Hands-on training will include the following:

1) Palpation of the laryngeal region to identify sites of muscular tautness
2) Extralaryngeal massage, including the suprahyoid region, thyrohyoid space, and lateral margins of the thyroid cartilage
3) Laryngeal reposturing maneuvers, including anterior-posterior compression, downward laryngeal traction, and impeding laryngeal elevation
4) The use of negative practice in the application of manual circumlaryngeal techniques
5) The combination of laryngeal reposturing and voice production to stimulate immediate voice change
6) The implementation of self-massage and digital cues to generalize and maintain voice improvement

At the conclusion of this workshop, attendees will be able to palpate the extralaryngeal region, perform stimulability testing to determine which techniques might be most effective, distinguish laryngeal massage from laryngeal reposturing, and perform basic laryngeal massage and laryngeal reposturing manual circumlaryngeal techniques. Handouts will be provided.

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**W20**

## The Voice Body Connection: A Breath-Centered Approach to Vocal Anatomy

Objective:
Voice professionals regularly speak about breathing, as it is the bridge between voice and body. Instructions may be uttered such as: “Breathe with your diaphragm” or “Expand your ribcage/belly/back.” Yet clients and patients receiving these instructions often do not have the anatomical basis to understand them. When seeking resources to develop their anatomical knowledge, they may be more likely to encounter training methodologies that address the voice through imagery and sensory ideas. There are many patients, clients, students and performers who wish to develop a better physiological understanding of their breathing and their voice, and they desire clear, simple, scientific information about the vocal apparatus and how it works. The Voice Body Connection workshop is designed to address this need, using a breath-centered approach to vocal anatomy. Drawing upon yoga and other somatic practices, the workshop will introduce techniques to help clients understand the physical actions of breathing for voice and speech. The workshop is designed to provide voice professionals with tools for giving a simple, accessible explanation of the breath to their clients using physical exercises, props, imagery, and metaphors firmly based in sound anatomical principles.

Methods: The workshop will be experiential. Participants will follow along with the exercises and may interact with each other in pairs in a mock client/voice professional relationship. Handouts will be provided.

Elissa Weinzimmer, MFA, BA, Certified Teacher of Fitzmaurice Voicework®, Founder, Voice Body Connection, Voice and Movement Master Teacher, Anthony Meindl’s Actors Workshop, 39 W. 32nd St. Suite 601, New York, NY 10001, Voice Production and Speech Faculty, American Musical and Dramatic Academy (AMDA), Voice and Movement Instructor, New York Film Academy, Managing Director, Vibrant Voice Technique

**W21**

## Learning Style Preferences and the Voice Studio

Background: David Kolb (author of the Learning Style Inventory) suggested that teachers consider students' learning style preferences when presenting new information. Since learning to sing is a highly individual process, it behooves us as voice pedagogues to know our own learning style preferences and to discern those of our students. Voice teachers often introduce technical concepts in ways that reflect their own learning style preferences, rather than those that would best serve their students. By using the Learning Style Inventory, teachers can design pedagogical approaches that meet the needs of student singers, helping them progress more quickly and effectively.

Objective: The objective of this session is to introduce voice teachers and other educators to the concept of learning style preferences (whether following this particular system or another) and explain how they can be used in the voice studio. Additionally, the workshop leaders will engage the *active participation* of the workshop attendees to demonstrate how to teach technical concepts (such as singer's breathing and/or phonation) to the four different learning preference/processing types.

Methodology: The Learning Style Inventory will be used to introduce workshop participants to the four learning styles, and help them understand ways they can adapt their own teaching methods to better serve the student singer. The workshop leaders will demonstrate strategies for teaching the four styles *using class participants.* Attendees will have the opportunity to participate in mock-lessons using techniques that primarily serve each specific learning style. Handouts explaining the 4 learning styles will be distributed.

Results: It is expected that participants will gain an understanding that they, and their students, have specific learning style preferences that inform their teaching and the reception of that teaching by their singers. They will leave the workshop with specific strategies to help them teach singing concepts and techniques using different approaches, guided by the learning style preference of the student singer.

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Betsy Kowal, MM, BM, Graduate Assistant, Westminster Choir College of Rider University, 101 Walnut Lane, Princeton, NJ 08540

**W22**

**The Role of Inhalation Phonation in the treatment of Muscle Tension Dysphonia (MTD) in Singers**

Inhalation phonation therapy is a well-documented approach of voice therapy specifically targeting muscular release of supraglottic structures, gentle stretching of the cricothryroid muscle, and promoting entrainment of the vocal fold edges. This therapy method has traditionally been used in treating aphonia, vocal fold scar and ventricular phonation in the speaking voice. There is a significant application of inhalation phonation techniques in optimizing function in the injured or muscularly imbalanced singing voice.

This workshop will demonstrate and instruct participants in the method and role of inhalation phonation techniques in the rehabilitation and habilitation of the singing voice. Biomechanical and physiologic rationale will be discussed.

Kate A. Emerich, MS, BM, CCC-SLP, Singing Voice Specialist, Voice Pathologist, Owner, Vocal Essentials, LLC

Ona Reed, BM, Vocal Instructor

# The Dante Pavone Breathing Exercises

Developed by the internationally renowned singing instructor Dante Pavone, the Pavone Breathing Exercises are based on the Italian appoggio technique and are designed to establish abdominal and lower back breathing, an advanced level of expiratory breath control, and an optimal raised rib posture for singing. The protocol consists of three breathing exercises which are practiced in a particular sequence over a specific period of time. The exercise protocol, when performed as directed, provides for easy generalization of posture and breath control techniques to stage and studio and is appropriate for all styles of singing from rock to classical.

The Pavone Breathing Exercises workshop will include the following; a brief discussion and explanation of the physiological rationales for the breathing exercises, explanation and demonstration of the breathing exercises with a workshop volunteer, and attendee instruction and participation in the performance of the breathing exercises. Everyone will be encouraged to participate!

Karen Ann Kochis-Jennings, Ph.D., CCC-SLP, Assistant Professor, Communication Disorders and Sciences, California State University, 18111 Nordhoff Street, Northridge, California 91330

**W24**

## Audiobook Narration: An Actor's Craft

This workshop provides an overview of the audiobook business from the actor's point of view: the industry, the way it works, and a hands-on look into the process of training and preparation.

In this mini training session, we will discuss and explore the elements necessary to bring audio books to life. A few actors will bring in a page or two from a book. As they read, I will direct and work with them. We will work on the elements important to audio narration as an actor: timing; rhythm; style; how to make each character an individual; portraying different ages and genders, etc. What are the things the Audiobook Narrator needs to keep in mind? What are the pitfalls?

Johnny Heller c/o Abrams Artists, 275 7th Ave # 26, New York, NY 10001

## Silent Practice: Differentiate the Vocal Tract and Boost Resonance Through Voiceless Fricatives

Many of the parts in the larynx and vocal tract exist in a black hole of sensitivity - we know these pieces exist, we've seen pictures of them, however when singing we often have no idea how they behave, yet as singers we are expected to develop a mastery of their movements. Though teaching efforts are made to help a student become more intimate with the internal life of their instrument, often phonation itself presents an obstacle from attending to the functions of parts that inform artistry.

Imagine being able to prepare your - or a student's - voice to sing freely and easily without engaging it first. No trills, yawn-sighs, or vocalizes. Add to that the potential to somatically experience how breath and the vocal tract interact dynamically, the many ways we create and control pitch, how overtones can be enhanced, all while merely exploring voiceless fricatives and as simple as do-re-mi. This interactive presentation will unpack many processes that occur while singing, though often outside of conscious awareness.

Using an innovative method of exploration currently called 'Windhaling,' learn how to differentiate the lips, areas of the tongue, velum, pharynx, larynx position and parts within the larynx, while also gaining clarity on connections to respiration and its relation to pitch and glottal resistance, pitch creation and acoustics, and also feel an incredible boost of resonance when you turn your voice on and phonate. Though firmly rooted in voice science, this presentation will focus on 'how to do' as well as 'how to teach' and include live demonstrations with attendees and a student unknown to the presenter.

Jeremy Ryan Mossman, MM, BM, Director of Musical Theatre Voice, Western Michigan University

## Musical Theater Singing for the Next Generation: Training the Future Stars

With musical theater singing gaining popularity, youth programs that advertise training in this style of performance are flourishing. Many address vocal concerns and the young singing voice. In contrast, though, many focus solely on the music and acting aspect of the genre, leaving the vocal technique for a later date. As the field continues to grow and change, the vocal demands are increasing for our young singers. However, a successful synthesis for teaching vocal technique in musical theatre, especially for young people, as well as a general consensus of age-appropriate sounds, is lacking.

Therefore, in this workshop, we will take a practical approach towards working with young singers to address several issues including an approach to the young voice and acceptable sounds and repertoire. We will suggest a series of warm ups which are age appropriate for the young voice (ages 7-17), based on our own current practice and research. We will mention differences between the age ranges of 7-12 (young voice), 12-14 (changing voice), and the high school student (14-18). We will demonstrate head voice, mixed voice, chest and belt (when and if) with our singers. Finally, we will include repertoire suggestions and other factors for a well- rounded studio such as practice strategies and motivation.

Our goals for this session will be 1) understanding of vocal parameters when working with the young voice in the music theatre repertoire 2) practice exercises (vocalizes) to build upon (and why they work) 3) Listening cues for teachers and practitioners 4) repertoire suggestions 5) other studio practice suggestions.

Jeanne Goffi-Fynn, EdD, MM, Director – Doctoral Cohort Program, Lecturer in Music, Columbia University, Teachers College, Music and Music Education, 525 West 120th Street, New York, NY

Karen Hall, EdD, Associate Editor, Journal of Singing, Interim Chair, Fine Arts Department & Interim Director, Music Department, Northern New Mexico College

Christiane Roll, Ed.DCT., Assistant Professor of Musical Theatre, Florida Southern College, 111 Lake Hollingsworth, Lakeland, FL 33801

**W30**

## Reinforcement of the Singing Voice

Singing voice has to be strong, harmonious and flexible. There are different phoniatrical techniques to endure the singing mechanism improving laryngeal function. Using movements during the singing voice exercises, the singer can reach more flexibility and give more dynamism. The diaphragmatic, costal and back support are important for voice production. In this workshop we analyze different body movements during the vocal exercises.

Two routines are presented and performed:

1.Arms, back movements routine with a light foam tube as a reference point for the body posture. The shoulders have to be in a relaxed position. The body moves to the sides and lean up and down during the vocal production. There are three different exercises with arms and thorax movements. One of them is mainly for the endurance. The other two are designed to give a better balance between breathing, support, glottal attack and resonance,volume and pitch management; consciousness of oral and nasal resonance and voice projection.

2.Strength through therapeutical band.
The elastic band give us the possibility of balance the extra and intralaryngeal forces during the performances of singing voice exercises. Singing voice exercises used in this workshop are humming, nasal resonance with ng, flexibility in two octaves in triads , crescendo and diminuendo. These techniques and routines offer a more dynamic way of practicing voice exercises trying to make an adequate balance of the body.

R. Eugenia Chavez Calderon, MD, Director of Centro de Foniatría y Audiología, Mexico City, Minerva 104-501 Col.Florida, Mexico 01030 D.F

# Vocal Pacing for Recovery and Wellness: Strategic Planning for Rehearsal, Performance and the Practice Room

Vocal pacing refers to achieving balance in amount, type and intensity of voice use. Most singers—particularly those recovering from a voice injury or disorder— will benefit from being intentional and deliberate in how they allocate their voice use. An important element in optimizing vocal pacing is planning voice use.

Planning voice use has numerous advantages for singers, allowing them to adjust their voice use in anticipation of fluctuating demands. By planning voice use in advance, singers can conserve voice in preparation for times when demands will ramp up, as during an extended performance engagement. While planning voice use is an important factor in the vocal health and wellness of any singer, this practice becomes even more critical for singers with a voice injury. With appropriate planning, singers can often continue practicing and performing during the recovery period. A strategic approach to allocating voice use may be applied to rehearsals, performances and the practice room, and is also helpful in making decisions about taking on performance engagements and prioritizing vocal activities.

Workshop Format

The workshop will feature a number of strategies for guiding singers to optimize planning voice use. Principles of planning voice use will be illustrated through live demonstration of interactive planning sessions with singers and through case examples.

Learning Objectives

Workshop participants will learn how to:

- Design and personalize visual organization schemes (charts, graphs, etc.) for planning voice use
- Apply visual organization schemes in guiding singers to optimize vocal pacing
- Guide singers in using vocal planning to establish vocal priorities and make decisions about voice use
- Develop and implement a variety of strategies for systematic allocation of voice use during practice time

And will:

- Understand the benefits of modifying intensity of voice use in various singing situations
- Understand benefits of “mental practice” to promote musical and motor learning

Leda Scearce, MM, MS, CCC-SLP, Singing Voice Specialist and Director of Performing Voice Programs and Development, Duke Voice Care Center, 3480 Wake Forest Road, Raleigh, NC, 27609

**W32**

## Treating Hyperfunctional Voices with Yoga Principles

Over the past decade, principles of yoga have become widely infused into contemporary voice therapy and the teaching of singing. Yoga techniques direct attention toward whole body relaxation, body alignment, and breath coordination during various singing and speaking tasks. Yoga is not only a sequence of postures and movements but also has it's foundations in relaxing the body and calming the mind to help balance one's life, both physically and emotionally. In this workshop, exercises will target postural optimization, easy onset of voice production, breath coordination, and release of maladaptive tension through integration of physiological principles of voice production with basic tenets of yoga practice. This session will focus on incorporating the principles of yoga in voice therapy with persons diagnosed with a hyperfunctional voice difficulty. Specific attention will be on whole body relaxation, body alignment, and breath coordination in various singing and speaking tasks. This program is useful with both professional voice users and the everyday voice user. Ways to maximize patient compliance will be discussed. After completing this workshop participants will have knowledge of basic yoga principles and how to apply them when caring for patients and students with hyperfunctional voice production.

Workshop Outline:
Discussion regarding identifying appropriate patient and student populations.
Part 1: Centering, conscious relaxation, and breath coordination.
Part 2: Light stretches, postural alignment, laryngeal reposturing, and easy onset.
Part 3: Balance and endurance, finding vibrancy, range extension, and carryover to patient specific material.
Part 4: Cool down and progressive relaxation

Adam T. Lloyd, MM, MA, CCC-SLP, Speech-Language Pathologist, Singing Health Specialist, Department of Otolaryngology, University of Miami, Miller School of Medicine, 1120 NW 14th Street, 727, Miami, FL 33126

## Transitioning from Speaking to Singing Voice Rehabilitation in Untrained Singers

OBJECTIVE: Untrained singers often present to the Otolaryngology clinic with complaints of vocal strain, vocal fatigue, reduced range, difficulty with register transition, and odynophonia. They may or may not complain of changes in the speaking voice as well, however; a thorough voice assessment including videostroboscopy often reveals the diagnosis of muscle tension dysphonia attributed to both hypo- and hyperadduction of the vocal folds. Resonant Voice Therapy in conjunction with Semi-Occluded Vocal Tract exercises are some of the effective voice therapy techniques that promote a balanced vocal production with oral tone focus in speaking voice. A dilemma is presented when the untrained singer self-reports improved vocal function in speaking voice but denies improvement with singing voice as they revert back to the use of supraglottic muscle tension during singing and does not independently incorporate resonant voice into singing. The objective for this workshop is to discuss the challenges faced by untrained singers in closing the gap between speaking and singing voice rehabilitation.

METHOD: Introductory remarks will be followed by hands-on experience and subsequent rationale. This participatory workshop draws on Resonant Voice Therapy, exercise physiology, motor learning, as well as combination of vocal pedagogy and voice-pathology/rehabilitation. The maintenance of orofacial vibratory tactile sensation via the motor learning principles will be strongly emphasized at all levels of singing voice rehabilitation.

RESULTS: Long-term retention of ease and clarity in vocal production that is achieved in Resonant “speaking” Voice Therapy can be effectively incorporated into singing voice rehabilitation.

CONCLUSIONS: This workshop involves concepts in voice rehabilitation, Resonant Voice Therapy, exercise physiology, and motor learning in bridging the gap between speaking and singing voice rehabilitation in untrained singers.

Christina H. Kang, MM, MS, Speech-Language Pathologist/Singing Voice Specialist, Mayo Clinic Arizona, Department of Otorhinolaryngology-Head and Neck Surgery

**W34**

## Doing the Wrong Things the Right Way

Actors in live theatre, film and television are frequently asked to use their voices in ways that are potentially harmful to the vocal mechanism. This participatory workshop will cover warming up, speaking loudly, shouting, screaming, sobbing, laughing, grunting, groaning, choking and other challenging vocal behaviors before closing with exercises for warming down the voice. Participants are asked to bring drinking water with them and to save questions for the end of the session.

Bonnie N. Raphael, Ph.D. Professor of Voice and of Dramatic Art, Head of the Professional Actor Training Program: University of North Carolina, Chapel Hill, Vocal Coach: PlayMakers Repertory Company and American Repertory Theatre, Harvard University

**W35**

## The Confusion about Belting: A Workshop with Answers

The topic of belting has been a hot one in vocal pedagogy for more than 40 years. Classical singers are often confused by what it is and is not, but can be called upon to teach it nevertheless, even if they do not make that sound themselves. Many people think of belting as shouting, yelling, or singing in the nose. It is none of those. With rock music having a growing influence on all Contemporary Commercial Music styles, it is important that everyone including laryngologists, voice scientists and speech language pathologists dealing with singers understand what belting is and is not and can appreciate its varied (not uniform) characteristics. It is absolutely never necessary to contract, retract, constrict, or squeeze any muscles in the throat or neck deliberately, nor it is recommended to position the larynx on purpose in order to sing a belt (or any other) sound. In fact, such behavior would be detrimental to both musical quality and vocal health. While it is true that the vocal tract and vocal fold behaviors are different in belting than they would be in a classical or a "mix" vocal quality, getting those behaviors to arise is about understanding vocal function exercises and the results they produce indirectly (in anyone) when done correctly. Belting can be taught, but it takes skill to do it well. It is a powerful and energized musical expression that can be learned by anyone who works with a seasoned, experienced teacher who can also sing the repertoire that asks for this vocal quality and knows how and why it is different from classical singing or other non-belt CCM styles.

Note: This workshop would work best if belters (any level) are available as demonstration students, however, it is possible to work with anyone who wishes from the audience who is willing to volunteer.

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