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Correlation of Buffalo Voice Profile and Voice Handicap Index Scores in Pathological Voices

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Abstract

Voice is the primary means of one's expression. It serves a variety of communication purposes right from the beginning of life itself. Apart from being a means of communicating verbal messages, voice also serves as a powerful conveyor of personal identity, emotional state, education and social status (Greene and Mathieson, 1995). Just like a fingerprint, the human voice and speech pattern is amazingly distinctive (Boone, 1997).

The Buffalo Voice Profile (Wilson, 1987) is commonly used in rating voice problems and as a guideline for voice therapy. Scales of the Buffalo Voice Profile contains seven equal-appearing intervals with '1' meaning a slight deviation and '7' a severe deviation. This profile consists of 12 major aspects: laryngeal tone, laryngeal tension, vocal abuse, loudness, pitch, vocal inflections, pitch breaks, diplophonia, resonance, nasal emission, rate, and overall voice efficiency. The rater circles the appropriate term listed under each item.

The study aimed to correlate the effectiveness of examiner rating scale (Buffalo Voice Profile) and self-evaluation rating scale (Voice Handicap Index) in pathological voices. Thirty dysphonic persons between the ages 30 to 40 participated as subjects for the study. The subjects were divided into 11 males and 19 females. The selected subjects were native Malayalam speakers who were literate and could complete the Voice Handicap Index. All the subjects had obtained clinical diagnosis after evaluations were carried out by the ENT and Speech Pathologists. They were screened for any other speech, language, hearing, cognitive and neurological deficits.

The present study brought about a new result indicating that there was significant correlation of the functional, physical and emotional domains of VHI with the 'pitch breaks' parameter of BVP.

Findings of the study indicate that there is correlation between VHI domains and BVP parameters in pathological voices. So the impact of vocal pathology does impact physical, functional and emotional aspects of life. This will provide a better insight for vocal hygiene program and therapeutic management.

Key words: Buffalo Voice Profile, Voice Handicap Index Scores, Malayalam speakers

Introduction

Voice is the primary means of one's expression. It serves a variety of communication purposes right from the beginning of life itself. Apart from being a means of communicating verbal messages, voice also serves as a powerful conveyor of personal identity, emotional state, education and social status (Greene and Mathieson, 1995). Just like a fingerprint, the human voice and speech pattern is amazingly distinctive (Boone, 1997).

The degree to which a voice disorder impacts an individual's day to day activities may vary significantly depending on the severity of the voice disorder and the voice needs of the patient. Hence, understanding the significance of the symptom, the effects of the voice use and its effects on dysphonia which alter his or her physical, social and emotional well-being will help therapy.

Perceptual Evaluations of Pathological Voice

The perception of voice quality is the most important measure of outcome from any intervention aimed at improving voice quality (Kreiman, Gerratt, Kempstar, Erman & Berke 1993).

Perceptual evaluations of pathological voice which include clinician rating scales are the Grade, Roughness, Breathiness, Asthenia, Strain (Isshiki, Okamura, Tanabe & Morimoto, 1969) and Buffalo Voice Profile (Wilson, 1987). Individual's daily functions, occupations,

social interactions and psychological states (Quality of Life) can be assessed subjectively using the Voice Handicap Index (Jacobson, Johnson, Grywalski, Silbergleit using the Voice Handicap Index (Jacobson, Johnson, Grywalski, Silbergleit, Jacobson & Genninger, 1997) and the Voice Related Quality Of Life (Rosen & Murry, 2000).

The Buffalo Voice Profile (Wilson, 1987) is commonly used in rating voice problems and as a guideline for voice therapy. Scales of the Buffalo Voice Profile contains seven equal-appearing intervals with '1' meaning a slight deviation and '7' a severe deviation. This profile consists of 12 major aspects: laryngeal tone, laryngeal tension, vocal abuse, loudness, pitch, vocal inflections, pitch breaks, diplophonia, resonance, nasal emission, rate, and overall voice efficiency.

Voice Handicap Index (Jacobson, Johnson, Grywalski, Silbergleit, Jacobson & Genninger, (1997) has been developed to quantify the patient's perception of handicap due to voice problems. It consists of 30 questions under three domains: Functional, Emotional and Physical. The questionnaire is completed by the patient on a 5 –point rating scale to indicate his or her response.

Reliability and validity of perceptual rating scales have been studied extensively in western as well as in Indian scenario.

Correlation between Percetual and Acoustic Measures

Many studies have been done to find the correlation between the percetual and acoustic measures. Most of them revealed that there is a good correlation between acoustic parameters and perceptual measurements.

Bindhya (2007) and Shrivastav (2005) have documented the correlation of BVP and GRBAS in the Indian context.

Correlation of VHI verses V-RQOL rating scales have been conducted in Indian context across trained and untrained Bhajan singers. A high correlation between VHI and VRQOL has been indicated in the study (Shankar, 2009).

Correlation of Perceptual and Self-Rating Scales

Since perceptual evaluation is an integral part of voice assessment and rehabilitation, it becomes necessity to assess the correlation of the two commonly used client rating and patient self rating scales.

Profiling the parameter affected during perception of abnormal voice by the examiner along with the self rating scales by the subjects help the examiner to identify the cause of pathological voice and hence would be helpful in the determining appropriate treatment goals.

There are no published, Indian or International studies on correlation of perceptual and self-rating scales. Thus this study aims to correlate the effectiveness of examiner rating scale (Buffalo Voice Profile) and self evaluation rating scale (Voice Handicap Index) in pathological voices.

Review of Literature

Voice is the primary means of one's expression. It serves a variety of communication purposes right from the beginning of life itself. Apart from being a means of communicating verbal messages, voice also serves as a powerful conveyor of personal identity, emotional state, education and social status (Greene and Mathieson, 1995). Just like a fingerprint, the human voice and speech pattern is amazingly distinctive (Boone, 1997).

Voice as the Primary Instrument to Project Personality

Voice is the primary instrument through which most of the people project their personalities and influence their environment. The qualities of our voices are influenced by a number of factors such as physiological, psychological and functional.

From the physiological aspect, for instance, when the individual has a common cold, the quality of voice changes (Bunch, 1997). In certain cases voice becomes distorted due to emotional factors. Negative psychological states are usually reflected as tension in the physiological behaviour of the individual that distorts voice (Baker, 2002).

Voice Orders Severity and Perception of Voice Quality

The degree to which a voice disorder impacts an individual's day to day activities may vary significantly depending on the severity of the voice disorder and the voice needs of the patient. Hence, understanding the significance of the symptom, the effects of the voice use and its effects on dysphonia which alter his or her physical, social and emotional well-being, is very important for therapy purposes.

The perception of voice quality is the most important measure of outcome from any intervention aimed at improving voice quality. The patients and clinicians decide whether treatment has been successful, based largely on whether the voice sounds better. Unanimous judgments by group of listeners may provide one of the most convincing measures of the effectiveness of therapy. Despite this, perceptual measures of voice quality have not been highly regarded as research tools in this area. This is because of their potential problems with intra and inter- judge reliability and because there is no commonly accepted set of perceptual scales used by clinicians (Kreiman, Gerratt, Kempstar, Erman & Berke 1993).

Evaluations

Perceptual evaluations of pathological voice which include clinician rating scales are the Grade, Roughness, Breathiness, Asthenia, Strain (Isshiki, Okamura, Tanabe & Morimoto, 1969) and Buffalo Voice Profile (Wilson, 1987). Individual's daily functions, occupations, social interactions and psychological states (Quality of Life) can be assessed subjectively using the Voice Handicap Index (Jacobson, Johnson, Grywalski, Silbergleit, Jacobson & Genninger, 1997) and the Voice Related Quality Of Life (Rosen & Murry, 2000).

Measuring Perceived Voice Quality: Commonly Used Types

Perceived voice quality can be measured using a variety of tasks. There are different types of scales and measures for rating voice. In general, for a scale to be regarded as a valuable tool for clinical circumstances it should be robust, consistent and it has have high inter-judge agreement. The most commonly used types are:

Categorical Rating: It involves assigning speech or voice samples to discreet, unordered categories (e.g. breathy, rough)

Equal appearing Interval (EAI): Such scales require listeners to assign the numbers between 1 to n to a voice sample, where 'n' is the number of points in the scale. Points on EAI are assumed to be equidistant, so measurements are generally treated as interval level and parametric statistics applied.

Direct Magnitude Estimation (DME): Listeners assign the number to voice sample to indicate the extent to which a voice possesses a given characteristic. The range of possible numbers is generally not restricted.

Paired Comparison (PC): The listeners compare the two stimuli. They may judge the extent of difference on some dimension, similarity/ difference, relative roughness and so on.

Visual Analog Scale (VAS): These scales have undifferentiated lines, often 100mm long. Listeners rate voices on these scales by marking a mark on the line to indicate the extent to which a voice possesses a given characteristic.

The Voice Handicap Index and Buffalo Voice Profile are EAI (Equal Appearing Interval) Rating Scales. The EAI scales suggests that data obtained in experiments are made on an interval scale (i.e., each unit on the scale is perceptually equidistant from its neighbouring units.

Buffalo Voice Profile

The Buffalo Voice Profile (Wilson, 1987) is commonly used in rating voice problems and as a guideline for voice therapy. Scales of the Buffalo Voice Profile contains seven equal-appearing intervals with '1' meaning a slight deviation and '7' a severe deviation. This profile consists of 12 major aspects: laryngeal tone, laryngeal tension, vocal abuse, loudness, pitch, vocal inflections, pitch breaks, diplophonia, resonance, nasal emission, rate, and overall voice efficiency. The rater circles the appropriate term listed under each item. For example, pitch may be rated as normal it requires no further rating. If it's rated either high or low the rater must mark one of the numbers on the deviation scale for that item.

The BVP has been tested during its development and demonstrated internal consistency, test – retest reliability and validity.

Voice Handicap Index (VHI)

Voice Handicap Index (Jacobson, Johnson, Grywalski, Silbergleit, Jacobson & Genninger, (1997) has been developed to quantify the patient's perception of handicap due to voice problems. It consists of 30 questions under three domains: Functional, Emotional and Physical. The questionnaire is completed by the patient

VHI is an ordinal scale, which is scored from '0' indicating 'never' felt the problem to '4' where the patient 'always' felt the problem. Scores per subscale lay between 0 and 40, for VHI as a whole lay between 0 and 120. Higher the scores, severe will be the patient's perception of handicap due to voice problem. Generally a score of 10 points or less is considered being normal.

The VHI has been tested during its development and demonstrated internal consistency, test –retest reliability and validity.

Reliability and Validity of Perceptual Rating Scales

Reliability refers to the degree to which test scores are free from errors of measurements (American Psychological association, 1985) and construct of reliability then has to be defined as relatively free of random errors of measurement (Crocker & Algina, 1986) Random errors of measurement effect the score of a person because of purely chance happenings. These types of errors are not consistent and will smooth down over time if a test is repeated several times. Sources of such random errors may include "guessing, distraction in the testing situation, administration errors, content sampling, scoring errors, and fluctuations in the individual examinee's state" (Crocker & Algina, 1986).

Validity

Although reliability is an important attribute, the most critical property of any test is its validity. Validity refers to what the measurement actually measures and how useful the measurement is to researchers. Reliability is a condition for validity and it places an upper

limit on the validity of a test. Unreliable measures will allow tests to show little, if any, validity. Reliability is a necessary, but not a sufficient, prerequisite for the test to have validity (Crocker & Algina, 1986).

Study of Reliability and Validity of Perceptual Rating Scales

Reliability and validity of perceptual rating scales have been studied extensively in western as well as in Indian scenario.

Munoz, Mendoza, Fresneda, Carballo & Ramirez (2002) estimated the agreement and reliability of voice evaluation by a group of expert listeners using the central portion of a sustained vowel and a fragment of connected speech as voice samples. Ratings were made using Wilson's Buffalo III Voice Screening Profile. Analysis showed that intra individual listeners' agreement presented variability in the evaluation of both voice samples. Wilson's Buffalo III Voice Screening Profile presented good reliability values for both voice samples, with overall voice rating achieving higher values (.90) than any other voice-quality variable.

Bindya Baby (2007) found that the Buffalo Voice Profile and the GRBAS scales reliable to measure voice quality in Indian context. Overall grade was found to be reliable for the Buffalo Voice profile as compared to GRBAS and Voice Profile Analysis (Webb, Carding, Steen & Wilson; 2003).

Jacobson, et al. (1997) developed and validated Voice Handicap Index (VHI). An 85-item version of this instrument was administered to 65 consecutive patients seen in the Voice Clinic at Henry Ford Hospital. The data were subjected to measures of internal consistency reliability and the initial 85-item version was reduced to a 30-item final version. This final version was administered to 63 consecutive patients on two occasions in an attempt to assess test-retest stability, which proved to be strong.

Medha Hegde, Achala, Sapna Bhat (2008) aimed to recheck the validity of VHI developed for Indian context for control and dysphonic group. The mean scores obtained in the dysphonic group were higher than in the control group, hence VHI was found to be valid and reliable in Indian population.

Correlation across Perceptual and Acoustic Measures

Many studies have been done to find the correlation between the perceptual and acoustic measures. Most of them revealed that there is a good correlation between acoustic parameters and perceptual measurements. Objective analyses of voice disorders are essential in evaluation and treatment but the final arbiter of speech quality is its perception to the listener. Perceptual evaluation is especially valuable for assessing patients with voice problems. There are inherent limits despite the advances and the availability of acoustic analysis. Usually patients with dysphonia have aperiodi*c* speech signals, which significantly limit the analysis of acoustic parameters. Hence, in these populations, reliability of the examiner ratings becomes a central importance.

Tarika, Linda, James (2004) determined the correlation between the Grade, Roughness, Breathiness, Aesthenia, Strain (GRBAS) scale (a subjective measure of voice) and the Multi-Dimensional Voice Program (MDVP) scale (an objective measure of voice). Statistical analysis identified a significant correlation between the noise-related parameters of MDVP and the components of the GRBAS scale.

Correlation of Perceptual Rating Scales

Poretone, Hapner, McGor, Otto & Johns III (2006) investigated the correlation between the VHI and the V-RQOL, and to test conversion of scores between the two instruments. A retrospective medical chart review of 140 consecutive patients with a chief complaint related to their voice presenting for speech pathology voice evaluation following laryngology evaluation and diagnosis was adopted. Each patient who filled out the VHI and V-RQOL within a 2 week period with no intervening treatment included in the study. Calculated VHI score based on measurement V-RQOL score was compared to measure VHI score. There was no significant difference between the mean measured and mean calculated VHI scores. For individual scores, however regression analysis did reveal a significant difference between calculated and measured VHI. The VHI and V-RQOL are highly correlated; however, this study suggested that two instruments are not interchangeable for individuals.

Correlation of VHI verses V-RQOL rating scales have been conducted in Indian context across trained and untrained Bhajan singers. A high correlation between VHI and VRQOL has been indicated in the study (Shankar, 2009).

Clinician's and Patient's Perception of Voice Related Quality of Life

The relationship between the patient's perceptions of voice related quality of life using (V-RQOL) and the clinician's perception of voice severity using GRBAS scale have been assessed. Findings revealed that elderly women presented mild to moderate degree of alterations on the overall parameters of dysphonia, roughness, breathiness on the GRBAS scale and showed no negative impact on quality of life related to voice. (Murray, Medrado, Hogikyan & Aviv, 2004).

Bindhya (2007) and Shrivastav (2005) have documented the correlation of BVP and GRBAS in the Indian context.

Rosen, Murray, Zuin, Zullo & Sonabolian (2000) reported VHI as a useful instrument to monitor the treatment efficacy for voice disorders.

Courey (2000) did an outcome assessment following treatment of spasdomic dysphonia. VHI & 36-item Short Form (SF-36) surveys were administered on 38 patients before and after treatment. On the VHI, improvements in the patient's perception of their functional, physical, emotional voice handicap reached statistical significance. On the SF-36, patients had statistically significant improvements in mental health and equal functioning. Treatment of spasmodic dysphonic with botulinium toxin type A significantly lessened the patient's perception of dysphonic. In addition, treatment improved the patients social functioning and their perception of mental health. Thus, these outcome measures go well with the treatment.

Stress and Vocal Pathology

Arguments have been made that up to 80% of illness are stress related either directly or indirectly. According to the study done by Maria, Katherine, Jackie & Clark (2008) more

than 90% of the women having vocal pathologies reported moderate and higher levels of stress in their lives.

Validating VHI in Indian Languages

Sovani, Keer & Sanghi (2007) conducted a study attempting at validating the VHI in Indian languages. The VHI was translated to Hindi and Marathi languages. Backtranslation of these versions and test-retest reliability was done before administering them to one of two groups (Hindi and Marathi) of 30 typical individuals. Spearman's rank correlation coefficient and t-test were used. The mean VHI scores of the normative sample and pathological samples were significantly different. Test retest reliability was >0.9 for both Indian versions. There was a moderate correlation between VHI scores and client perceptions of severity. It was moderate for males, poor for females, and poorest for working women. The results suggest that Hindi and Marathi versions may regularly be used for assessment. Correlation analysis shows that persons with dysphonia give more priority to only one of the three aspects of the disorder (functional, physical, and emotional). Males view their problem more holistically while females tend to underestimate their problem, perhaps a salient characteristic of the Indian woman.

Need for the Present Study

Since perceptual evaluation is an integral part of voice assessment and rehabilitation, it becomes necessary to assess the correlation of the two commonly used client rating and patient self rating scales. Profiling the parameter affected during perception of abnormal voice by the examiner along with the self rating scales by the subjects help the examiner to identify the cause of pathological voice and hence would be helpful in the determining appropriate treatment goals. There is a scarcity in the area of research in India on the correlation of perceptual and self rating scales. As mentioned in the literature much of the studies were focused on perceptual and objective correlation testing.

Aim of the Study

The aim of the present study is to correlate the effectiveness of examiner rating scale and self evaluation rating in pathological voices.

Methodology

The study aimed to correlate the effectiveness of examiner rating scale (Buffalo Voice Profile) and self evaluation rating scale (Voice Handicap Index) in pathological voices.

Subjects

Thirty dysphonic persons between the ages 30 to 40 participated as subjects for the study. The subjects were divided into 11 males and 19 females. The selected subjects were native Malayalam speakers who were literate and could complete the Voice Handicap Index. All the subjects had obtained clinical diagnosis after evaluations were carried out by the ENT and Speech Pathologists. They were screened for any other speech, language, hearing, cognitive and neurological deficits. Informed consent was obtained from all the participants who were included in the study.

S. No.	Mean age range	Sex
1	36.5	Male
2	33.5	Female

Table 1: indicates the mean age of male and female subjects.

Eleven males and nineteen females participated in the study. The subjects were in the age range of 30-40 years. Males had a mean age range of 36.5 and females with a mean age range of 33.5.

S. No.	Diagnostic category	No. of Subjects		Percentage
		Males	Females	

1	Vocal nodules	3	12	50%
2	Right vocal fold palsy	2	2	13.3%
3	Hoarse voice	-	2	6.6%
4	Edema of vocal folds	1	1	6.6%
5	Chronic laryngitis	1	-	3.3%
6	Diplophonia	1	-	3.3%
7	Functional aphonia	1	-	3.3%
8	Glottal chink	1	-	3.3%
9	Sulcus vocalis	1	-	3.3%
10	Strained voice	-	1	3.3%
11	Vocal cyst	-	1	3.3%

Table 2: shows the number of subjects with the type of vocal pathology

Table 2 shows that the subjects who participated in the study had eleven different vocal pathologies. 50% of the dysphonics had vocal nodule, which consisted of twelve females and three males. Most of the female participants who were professional voice users (mostly primary school teachers) had vocal nodules. 13.3% had Right vocal fold palsy out of which two were males and two were females. 6.6% of the subjects had hoarse voice and Edema of vocal folds, two females presented with hoarse voice and one male and one female presented with edema of the vocal folds. 3.3% of the total dysphonics presented vocal pathologies like chronic laryngitis, diplophonia, functional aphonia, glottal chink, Sulcus vocalis, strained voice and Vocal cyst.

Materials

Voice Handicap Index

Voice Handicap Index (VHI) and Buffalo Voice Profile (BVP) were the materials used for the study.

VHI was proposed by Jacobson et al, in 1997. VHI provides a non standardized index of the subject's self rating degree of his/her voice related problems in three domains: emotional, functional and physical. The items were developed from patient's statements taken from case history or interview in which subjects have to rate the statements in three domains using five point rating scale from 0 (never) to 4 (always). Higher the score, greater the voice problem.

Buffalo Voice Profile

BVP was proposed by Wilson, in 1987. BVP rates the voice problems for diagnosis and as a guideline for voice therapy. Scales of the Buffalo Voice Profile contains seven equal-appearing intervals with '1' meaning a slight deviation and '7' a severe deviation. BVP profile consists of 12 parameters of voice such as: laryngeal tone, laryngeal tension, vocal abuse, loudness, pitch, vocal inflections, pitch breaks, diplophonia, resonance, nasal

emission, rate, and overall voice efficiency. The speech pathologist circles the appropriate term listed under each parameter and the same Procedure is used for all 12 parameter.

VHI and BVP rating scales were administered to the above mentioned population to identify the presence and severity of the voice problem.

Procedure

The VHI in Malayalam (Kuniyil, 2007) was provided to all the subjects to fill in by themselves. The Buffalo Voice Profile (BVP) was used to perceptually assess the pathological voices by three speech pathologists.

Data Collection

The voice samples of all the thirty subjects were analyzed using the PRAAT software version 5.2.44 (Boersma P, 2011).Samples for analysis included phonation of /a/, Malayalam reading passage and connected speech. A time of 30 – 35 minutes were spent for the sample collected for each subjects. Three speech pathologists perceptually assessed the pathological voices of the dysphonics. There were no significant differences in the perceptual analysis by the speech language pathologists for the above 3 samples. However analysis was carried out for the sample containing the longest duration.

Parameters of the Buffalo Voice Profile were subjected to comparison and correlation with the domains of Voice Handicap Index. Out of the twelve parameters of BVP, seven parameters were taken for comparison and correlation with the functional, physical and emotional domains of VHI. Parameters of BVP like Resonance, Nasal emission, Vocal abuse and overall vocal efficiency were not considered for comparison since none of the patients depicted a problem except for overall vocal efficiency which was perceived to be inadequate for all subjects with pathological voices.

Instructions

Instructions to the Subjects

Instructions given by the clinician in Malayalam to the subjects were as follows:

“nirdhe:shangal : swantham swarahe patiyum a: swaram avarude ji:vidhathil unda:kuna prashnathe patiyum vivarikhnathin a:LugaL upayo:gikuna prastha:vanakalaniva. I: anubhavam ningalude ji:vithathil ethrama:thram unden parish:dhikuka ”

0 = orikalumilla: 1 = mikava:rumilla: 2 = chillapo:l 3 = mikapo:Yum 4 = ella:ypo:Yum

(Instructions: These are statements that many people have used to describe their voices and their effects of their voices on their lives. Circle the response that indicates how frequently you have the same experience.

0 = never 1 = Almost never 2 = Sometimes 3 = Almost always 4 = Always)

Instructions Given in English to the 3 Speech Pathologists

Each speech pathologist was instructed as follows:

“You will be given 3 voice samples of each subject. / a: / vowel phonation, reading passage and connected speech. You will be required to perceptually analyze the voice and rate using the Buffalo Voice Profile.”

Statistical Analysis

Pearson’s co-efficient of correlation was carried out to assess the correlation of the parameters of VHI and BVP and paired t-test was used to find the significance of correlation between males and females. Results are discussed in the next section.

Results & Discussion

The study aimed to compare the effectiveness of examiner rating scale (Buffalo Voice Profile) and self evaluation rating (Voice Handicap Index) in pathological voices.

A total of 30 dysphonic subjects with a mean age range of years were included in the study. Voice Handicap Index and Buffalo Voice Profile rating scale were administered and attempted to get the frequency and severity of the voice problem. The means and standard deviations were obtained for the parameters of BVP and domains of VHI of the thirty subjects.

Paramete								

rs of BVP / Gender	Laryngeal tone	Laryngeal tension	Loudness	pitch	Vocal inflection	pitch	Diplophonia	Rate of speech
Males (11)	18.3	24.5	19.5	9	21	33	6	9
Females (19)	34	33.5	39	19.5	33.5	31	9	2.5
Total (30)	52.3	58	58.5	28.5	28.5	64	5	11.5

Table 3: shows the Mean scores of males and females for BVP

As shown in the table 3, females had higher mean values compared to males in all parameters except for pitch and rate of speech. This may be due to the number of females (19) who participated in the study were more than the men (11). Another reason could be that females in the study were professional voice users (mostly teachers) and depicted various perceptual voice pathologies.

	GROUP	N0.	Mean	Std. Deviation	Std. Error Mean
Functional	**Male**	11	27.45	9.004	2.715
	Female	19	22.53	7.640	1.753
Physical	**Male**	11	28.91	9.093	2.742
	Female	19	25.79	6.562	1.506
Emotional	**Male**	11	21.82	9.877	2.978

	Female	19	29.26	5.714	1.311

Table 4: shows the Mean and Standard Deviation scores of males and females for VHI.

In table 4, Males had a higher score on the physical and functional domain of VHI but females had a higher score on the emotional domain. This may be due to the effect of emotional factors related to vocal pathology.

Using Pearson's co-efficient correlation (2 tailed test), it was found that the domains of VHI did correlate with the parameters of BVP, however it was not statistically significant at 0.05 level.

Following are the tables of Pearson's correlation of domains of VHI and BVP.

VHI DOMAIN	BVP PARAMETER		COEFFICIENT CORELATION 'r'	p – value
FUNCTIONAL	LARYNGEAL TONE	BREATHY	0.453	0.139
		HARSH	-0.212	0.509
		HOARSE	-0.119	0.712
	LARYNGEAL TENSION	HYPER	0.209	0.268
		HYPO	0.110	0.569
	LOUDNESS	INCREASE LOUDNESS	0.158	0.405
		INCREASE SOFTNESS	0.172	0.364
	PITCH	HIGH	-0.174	0.357
		LOW	-0.016	0.931
	VOCAL INFLECTIONS	MONOTONOUS	0.302	0.104
		EXCESSIVE	0.002	0.993
	PITCH BREAKS		0.530(**)	0.003

	RATE OF SPEECH	FAST	0.153	0.430
		SLOW	0.96	0.662

(**) very highly significant at p > 0.01 level (2 tailed)

Table 5: shows the correlation of functional domain of VHI with parameters of BVP.

Table 5 shows correlation was present for most of the parameters of BVP with the functional domain of VHI; however there was significantly higher correlation for pitch breaks at 0.00 p values. This may be due to the presence of vocal pathology that indicated the perceptual presence of pitch breaks.

Figure 1

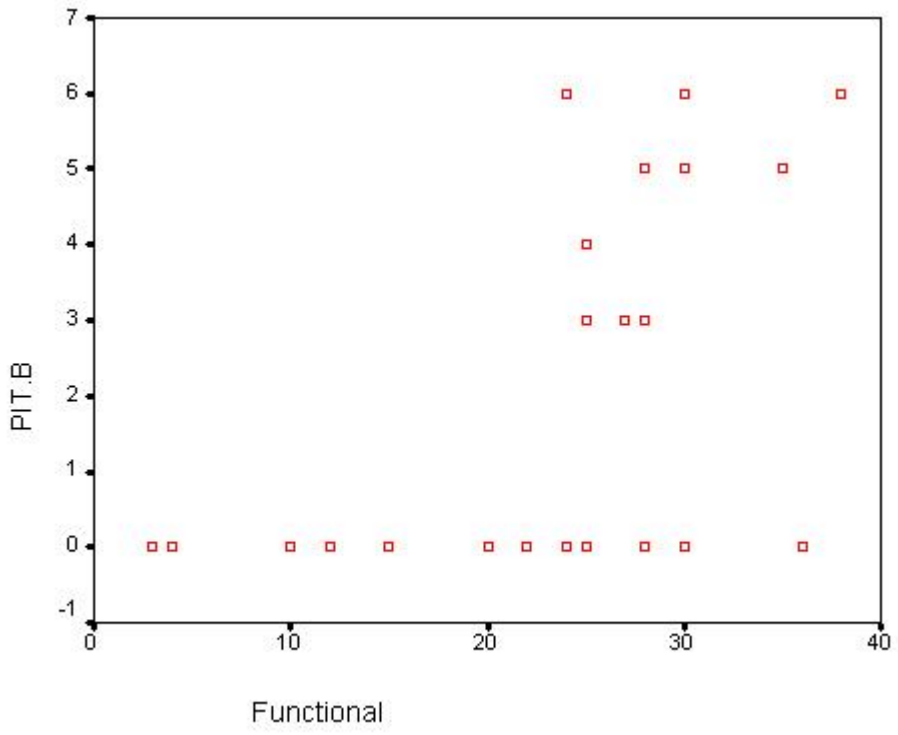

Figure 1: shows the scatter plot diagram for whole group (n = 30) between functional domains of on x - axis and pitch breaks on y – axis.

Figure 1 indicates there is very high correlation between functional domain of VHI and pitch breaks parameter of BVP. This may be due to laryngeal pathology or due to some loss of neural control of phonation.

VHI DOMAIN	BVP PARAMETER		COEFFICIENT CORELATION 'r'	p - value
PHYSICAL	LARYNGEAL TONE	BREATHY	0.250	0.458
		HARSH	-0.239	0.479
		HOARSE	0.080	0.814
	LARYNGEAL TENSION	HYPER	0.184	0.339
		HYPO	0.76	0.693
	LOUDNESS	INCREASE LOUDNESS	0.019	0.922
		INCREASE SOFTNESS	0.230	0.230
	PITCH	HIGH	-0.032	0.868
		LOW	-0.047	0.809
	VOCAL INFLECTIONS	MONOTONOUS	0.351	0.062
		EXCESSIVE	-0.065	0.736
	PITCH BREAKS		0.615(**)	0.000
	RATE OF SPEECH	FAST	0.073	0.713
		SLOW	0.210	0.285

(**) very highly significant at p > 0.01 level (2 tailed)

Table 6: shows the correlation of physical domain of VHI with parameters of BVP.

Table 6 shows correlation was present for most of the parameters of BVP with the physical domain of VHI; however there was significantly higher correlation for pitch breaks when compared with physical domain of VHI at 0.00 p values. This may be due to the presence of vocal pathology that indicated the perceptual presence of pitch breaks in the physical characteristics of pathological voice production.

Figure 2

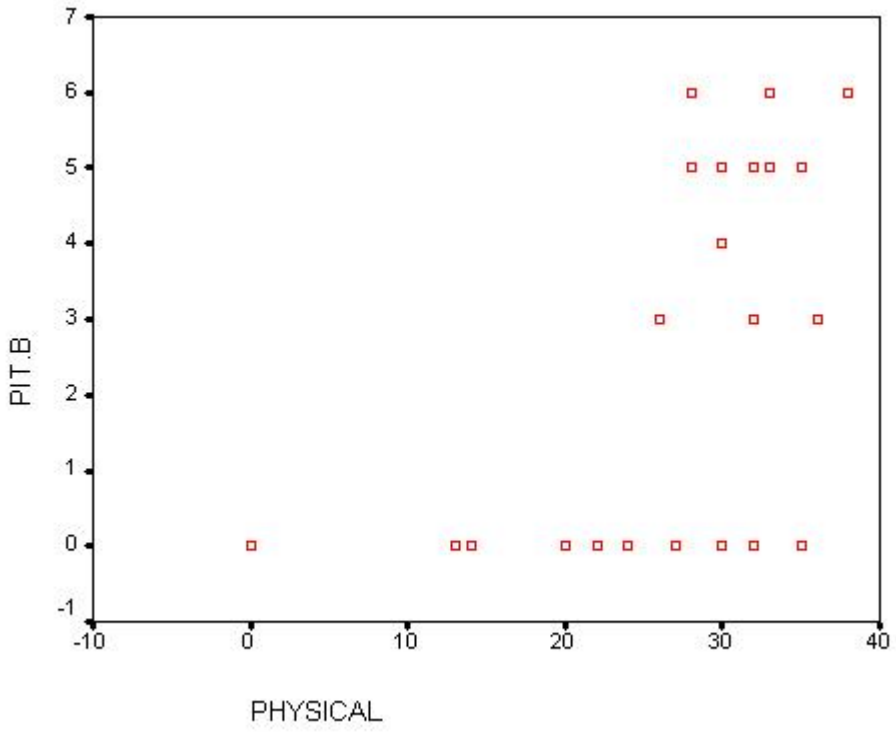

Figure 2: shows the scatter plot diagram for whole group (n = 30) between physical domains of on x - axis and pitch breaks on y – axis.

Figure 2 indicates there is very high correlation between physical domain of VHI and pitch breaks parameter of BVP. This may be due to laryngeal pathology or due to some loss of neural control of phonation co-occurring during functional use of voice.

VHI DOMAIN	BVP PARAMETER		COEFFICIENT CORELATION 'r'	p - value
	LARYNGEAL TONE	BREATHY	.485	.110
		HARSH	-.419	.175
		HOARSE	.186	.563
	LARYNGEAL TENSION	HYPER	0.066	0.728
		HYPO	0.211	0.264
	LOUDNESS	INCREASE LOUDNESS	0.299	0.109

EMOTIONAL		INCREASE SOFTNESS	0.120	0.529
	PITCH	HIGH	0.190	0.315
		LOW	-0.322	0.083
	VOCAL INFLECTIONS	MONOTONOUS	0.119	0.530
		EXCESSIVE	0.124	0.513
	PITCH BREAKS		0.184	0.332
	RATE OF SPEECH	FAST	-0.197	0.306
		SLOW	-0.016	0.935

Table 7: shows the correlation of emotional domain of VHI with parameters of BVP.

Table 7 shows that there is correlation between the emotional domain of VHI and the parameters of BVP but not statistically significant at 0.05 level.

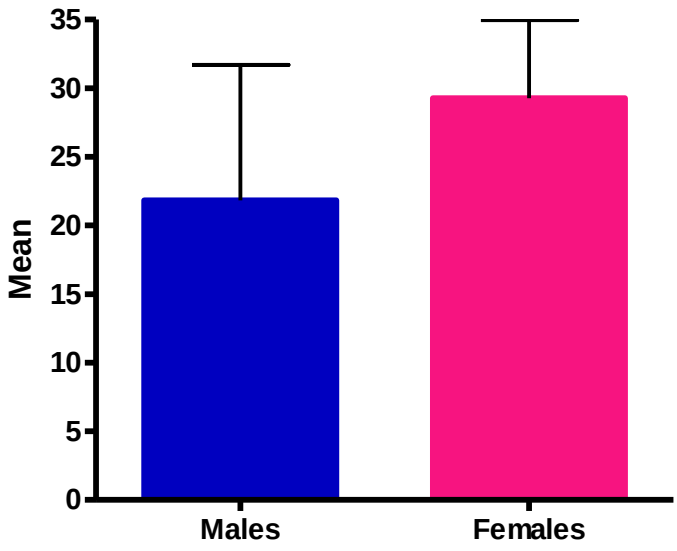

Figure 3: Indicating higher emotional correlation among the domains of VHI in females.

The error bar graph indicates that females have significantly higher correlation in the emotional domain compared to males. This may be due to the fact that females are

emotionally affected due to their pathological voice. This correlates with the study done by Maria, Katherine, Jackie & Clark (2008) which indicated that females with pathological voice indicated high amount of stress which relates to an emotional factor.

This was further supported by Sovani, Keer, Sanghi (2007) stating that males view their problem in more holistically while females tend to underestimate their problem, perhaps a salient characteristic of Indian women. This was correlating to the present study.

The result also indicates there is very high correlation between physical and emotional domains of VHI and pitch breaks parameter of BVP. This may be due to laryngeal pathology or due to some loss of neural control of phonation.

The present study brought about a new result indicating that there was significant correlation of the functional, physical and emotional domains of VHI with the 'pitch breaks' parameter of BVP.

Findings of the study indicate that there is correlation between VHI domains and BVP parameters in pathological voices. So the impact of vocal pathology does impact physical, functional and emotional aspects of life. This will provide a better insight for vocal hygiene program and therapeutic management.

Future Directions

The present study suggests that there is a need to explore wide range voice pathologies using a variety of clinician and self rating scales. The study can also use the objective measures along with the subjective rating scales this would help in providing a wider base in knowing the correlation and understanding the impact of voice on the quality of life.

Limitation of the Study

The present study includes only 30 dysphonics which consists of only 11 males and more number (19) of females. The number of females in the study might be a cause to

provide significant correlation in the emotional domain of VHI. Hence a larger population with equal number of participants in both genders can be taken.

Summary & Conclusion

Perceptual evaluations of voice are the "gold standard" measures of voice. It is essential that persons with voice disorders evaluate their quality of life, being it physical, emotional or functional. Uses of subjective and objective measures are essential in the evaluation of voice disorders. However, the objective measure never provides information of the intensity of the voice disorder on the well being of the person.

Comparisons of the same voice by listeners are subjective and related to perceptual evaluations (Bele, 2005). Various protocols have been referred in literature like the Grade, Roughness, Breathiness, Asthenia, Strain (Ishikki .et.al, 1969) scale and the Buffalo Voice Profile (Wilson, 1987). Subjective scales include Voice Handicap Index (Jacobson, Johnson, Grywalski, Silbergleit, Jacobson & Genninger, 1997) and the Voice Related Quality Of Life (Rosen & Murry, 2000) provide in understanding the subjects quality of life on the impact of the voice disorder.

Rating scales can be used to measure the impact of voice disorders on quality of life. These include the equal appearing interval (EAI), visual analog scales (VA) and direct magnitude estimation (DME).The commonly used categorical rating scales are the GRBAS and the Buffalo Voice Profile. The high variability in listener judgements both within and across listeners is a major limitation in using rating scales. According to European Laryngological Society, proper assessment of vice includes self evaluation of the subject's voice. It underlined the use of VHI as the instrument for the self- measurement of voice.

Though acoustic methods of voice analysis have been a primary tool of both clinicians and researchers for many years, these objective measures alone cannot assess the levels of handicap that a person experiences as a result of a voice disorder

Reliability and correlation studies of GRBAS and BVP have been documented by Bindya Baby (2007) and Srivastav (2005) in Indian context.

Perceptual evaluations as well as self assessment scales are necessary to evaluate the degree to which a disorder impacts an individual's day to day activities. The severity and degree of voice disorder perceptually assessed on a rating scale by the clinician needs to be correlated with the subjects self evaluation of voice. Hence, there is a necessity to assess the correlation of clinician perceptual scale with the subjects self rating scale. Thus, this study aimed to:

Find the correlation of BVP verses VHI in pathological voice disorders.

In the study 30 dysphonics were perceptually analyzed using the praat software. 19 females and 11 males participated in the study. All were native speakers of Malayalam and were literate and could complete the VHI questioners (Malayalam version). Five experienced speech language pathologists perceptually analyzed the voice samples and rated them using the BVP rating scale.

Seven parameters of BVP were subjected to Pearson's co-efficient correlation with the 3 domains of VHI. Parameters such as vocal abuse, vocal efficiency, and nasal resonance were not considered since it required the subject's response. T-test was also administered to find male and female difference across the 3 domains of VHI.

The study indicated good correlation between the parameters of BVP and VHI. There was significantly high correlation between pitch parameter of BVP with all the 3 domains of VHI (P=0.001) t test showed females with pathological voice had significant correlation of BVP with the emotional parameter of VHI than males. This may be due to the fact that females are more affected psychologically. The results correlate with the study by Maria et al. (2008) in which females with pathological voice had increased levels of stress.

Implications of the Study

Changes in voice due to organic, non-organic or paralysis do affect the quality of life in physical, functional and emotional domains of life. Profiling the parameters that affect voice would help in identifying the cause of the voice disorder which could help in providing appropriate treatment goals and an adequate vocal hygiene program.

The Future Directions of the Present Study

- That there is a need to implement a variety of clinician and self rating scales for various pathological voices in our clinical settings.
- The use of objective measures along with the subjective rating scales can be used to correlate the pathological voices.
- Knowing the correlation of the measures it would be helpful in providing a wider base in understanding the impact of voice on the quality of life.

Limitations to the Study

- The study included only 30 dysphonics which consists of only 11 males and 19 females. The more number of females in the study might be a cause to provide significant correlation in the emotional domain of VHI. Hence a larger population with equal number of participants in both genders can be taken.

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References

- American Psychological Association. (1985). Standards of Psychological and Educational Testing. Washington, D.C, American Educational Research Association, America.
- Baker, J. (2002). Psychogenic voice disorder and traumatic stress experience: a discussion paper with two case reports. *Journal of Voice, 17*, 308-318.
- Bindya, B. (2007). *Reliability measures of the Buffalo Voice Profile and GRBAS in the Indian context,* unpublished dissertation, Mangalore University, Mangalore.
- Bunch, M. (1997). *Dynamics of singing voice*. New York, Springer.
- Boone, D.R. (1991). *Is your voice telling you? How to find and use your natural voice* (2nd Ed.). San Diego, California: Singular Publishing group, Inc.

- Courey, M. S. (2000).*Outcomes assessment following treatment of spasmodic dysphonia with Botulinum toxin*. Annals of Otology, Rhinology, Laryngology, *109*, 810-828.
- Crocker, L., Algina, J., (1986). Introducation to classical and modern test theory. Orlando, F. L., Holt, Rinehart & Winston Inc., 106. Cited in Bele, I. V. (2005). Relaibility in perceptual analysis of voice quality. *Journal of Voice, 19* (4), 555-573.
- Greene, M. C. L. (1972). *The voice and its Disorders* (3rd ed.) New York: Pittman Publishing Corp.
- Greene, M.C.L., & Mathieson, L. (1995). *The Voice and its Disorders* (5th Ed.). Delhi: AITBS Publishers and Distributors.
- Jacobson, B.H., Johnson, A., Grywalski, C., Silbergleit, A., Jacobson, G & Genninger, M.S. (1997). The Voice Handicapp Index: Development and Validation. *American Journal of Speech Langauge Pathology*, 6, 66-70.
- Kreiman, J., Gerratt, B. R., Kempster, G. B., Erman, A., Berke, G. S. (1993). Perceptual evaluation of voice quality: Review, tutorial and a framework for future research. *Journal of Speech and Hearing Research*, 36, 21-40.
- Maria, D., Katherine,V. A., Jackie, G. S & Clark, A. R. (2008). The frequency of perceived stress, anxietyand depressionin patients with common pathologiesaffecting voice. *Journal of Voice, 22*(4), 472-488.
- Medha Hegde, Achala C. & Sapna Bhat . (2009). Voice Handicap Index – A Comparison of Clinician's Ratings and Self Ratings by Individuals with Dysphonia. *JAIISH*, 28, 2009.
- Munoz, J., Mendoza , E., Fresneda, M. D., Carballo, G., Ramirez, I. (2002). Perceptual analysis in different voice samples: agreement and reliability. *Percept motor skills.* 94 (3), 1187-95.
- Murray, T., Medrado, R., Hogikyan, N, D., & Aviv, J. E. (2004). The relationship between ratings of voice quality and quality of life measures. *Journal of Voice. 18*(2): 183-192.
- Portone, C. R., Hapner, E.R., McGreror, L., Otto, K., & Johns, M.M., (2007). Corelation of Voice Handicapp Index (VHI) and the Voice –Related Quality of Life Measure (V-RQOL). *Journal of Voice, 2*(6)723-727.

- Rosen, C.A., & Murry, T., Zullo, T., & Sonobolian, M. (2000). Voice Handicapp Index change following treatment of voice disorders. *Journal of Voice, 14*, 4, 619-623.
- Shankar, H. (2009). *VHI versus V-RQOL in trained and untrained bhajan singers*, unpublished dissertation, Mangalore University, Mangalore.
- Shrivastav, R. (2005). Multidimentional scaling of breathy voice quality: individual differences in perception. *Journal of Voice*, 20, 211-222.
- Sovani, P., Keer, V., & Sanghi, M. (2007). Correlation of voice handicap index scores with client perceptions of severity in male's v/s females with voice disorder. *JAIISH*, 26, 2007.
- Tarika, B., Linda, P., James, D. G. (2004). Perceptual evaluation of voice quality and its correlation with acoustic measurements. *Journal of Voice, 18(3), 299-304.*
- Webb, A. L., Carding, P.N., Deary, I.J., Mackenzie, K., Steen, N & Wilson, J. A. (2003). The reliability of three perceptual evaluation scales for dysphonia. *European Archives of Oto-Rhino-Laryngology*. *261*(8), 429-434.

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Appendix A

Malayalam Version of VHI Used in the Present Study

Swaravikal:ngasu:jakam

Voice Handicap Index

"nirdhe:shangal : swantham swarahe patiyum a: swaram avarude ji:vidhathil unda:kuna prashnathe patiyum vivarikhnathin a:LugaL upayo:gikuna prastha:vanakalaniva. I: anubhavam ningalude ji:vithathil ethrama:thram unden parish:dhikuka "

0 = orikalumilla: 1 = mikava:rumilla: 2 = chillapo:l 3 = mikapo:Yum 4 = ella:ypo:Yum

(Instructions: These are statements that many people have used to describe their voices and their effects of their voices on their lives. Circle the response that indicates how frequently you have the same experience.

0 = never 1 = Almost never 2 = Sometimes 3 = Almost always 4 = Always)

Bhha:gam - I

Part – I - F

1. Ente swaram ka:ranam enne keLkan a:likalk budhimuTa:N.
   My voice makes it difficult for people to hear me.

   0 1 2 3 4

2. shadbamuLa muriyil vech nja:n samsa:rikunath manasilla:kan a:LukaLk bhudhimuTa:n.
   People have difficulty understanding me in a noisy room.

   0 1 2 3 4

3. vi:D muyuvan ka:lkathakvidham viLicha:lum kudumba:ngaLK enne manasilla:ka:n budhimuTa:n.
   My family has difficulty hearing me when I call them throughout the house.

   0 1 2 3 4

4. a:grahikunathillum vaLare: kurachuma:thramethrame nja:n fo:n upayo:gika:ruLu.
   I use the phone less often than I would like to.

   0 1 2 3 4

5. ende swaram ka:ranam nja:n a:Lku:thil nin ozhinjumara:ra:n shramika:rund.
   I tend to avoid groups of people because of my voice.

   0 1 2 3 4

6. ende swaram ka:ranam nja:n suhurthukaLo:dum bhandukaLo:dum ayalka:rodum nja:n kurach ma:thrame samasa:rika:RuLu.
   I speak with friends, neighbours, or relatives less often because of my voice.

   0 1 2 3 4

7. muga:mugam samsa:rikumbol “avarthikuva:n” a:LukalL eno:d a:varthikuva:n” a:Luka Leno:d a:vashyapada:rund.
   People ask me to repeat oneself when speaking face- to- face.

0 1 2 3 4

8. swaravi:kalyam ende vekthiparavum sa:muhikavumaya ji:vithathe bha:dikunnu.
   My voice difficulties restrict personal and social life.
   0 1 2 3 4

9. ende swaram ka:ranam sambha:shanangaLil nin oyiva:kpedunathayi thon:na:rund.
   I feel left out of conversations because of my voice.
   0 1 2 3 4
10. ende swaravi:kalayam ka:raNam enik varuma:n nashtam unda:kunnu.
    My voice problem causes me to lose income.
    0 1 2 3 4

Bha:gam – II

Part II – P

1. samsa:rikumbo:l enik shwa:sam kiTa:tha:I tho:na:rund.
   I run out of air when I talk.
   0 1 2 3 4

2. oru divasathil thane: palapo:Ya:yi ende swarathil vithiya:sam anubhavapeda:rund.
   The sound of my voice varies throughout the day.
   0 1 2 3 4

3. a:Lukal cho:dika:rundu “entha:n ningalude swarathin prashnam”?
   People ask, “What is wrong with your voice”?
   01234

4. ende swaram vaLare paruparythathum vaRandathuma:n.
   My voice sounds creaky and dry.
   0 1 2 3 4

5. swaram puRapeduvikuva:n parama:vadi shakthi upayo:gike:ndatha:yi enik tho:na:rRund.

   I feel as though I have to strain to produce voice.

   0 1 2 3 4

6. enDe swarathinte spastatha pravachika:na:vathatha:n.

   The clarity of my voice is in predictable.

   0 1 2 3 4

7. enDe shabdam vyathyastama:kuva:n ve:NDi nja:n swaram matta:n shramika:rund.

   I try to change my voice to sound different.

   0 1 2 3 4

8. nja:n othiri praya:sapaTa:n samsa:rikunath.

   I use a great deal of effort to speak.

   0 1 2 3 4

9. vi:gune:rangalil enDe swaram ku:duthal mo:shama:yi tho:na:rund.

   My voice sounds worse in the evening.

   0 1 2 3 4

10. samsa:rathiniDayil enDe swaram ninupo:gunatha:yi thona:rund.

    My voice “gives out” in the middle of speaking.

    0 1 2 3 4

Bah:gam – III

Part – III – E

1. enDe swaram ka:ranam mattuLavaro:du samsa:rikhumbo:L enik sankarsham anubhavapeda:rund.

   I am tensed when talking to others because of my voice.

   0 1 2 3 4

2. enDe swaram a:LukaLk aswasthatha unda:ka:rund.

   People seem irritated with my voice.

   0 1 2 3 4

3. enDe swaravi:kalyam manasilla:ka:n maTulavarku kaYiYila enn thona:Rundu.

   I find other people do not understand my voice problem.

   0 1 2 3 4

4. enDe shabdavi:kalyam enne valla:the aLaTunu.

   My voice problem upsets me.

   0 1 2 3 4

5. swaravi:kalyam ka:ranam nja;n purathe:konum athikam po:ka:rilla.

   I am less outgoing because of my voice problem.

   0 1 2 3 4

6. enDe swaram oru vi:kalyamai: enik thona:rundu.

   My voice makes me feel handicapped.

   0 1 2 3 4

7. a:Lukal a:varthichu parayuva:n a:vashyapadumbo:L enik vishamam thona:rundu.

   I feel annoyed when people ask me to repeat.

   0 1 2 3 4

8. a:Lukal a:varthichu parayuva:n a:vashyapadumbo:L enik asahyatha: thona:rundu.

   I feel embrassed when people ask me to repeat.

   0 1 2 3 4

9. enDe swaram enne ayo:gyana:kunathayi tho:na:rund.

   My voice makes me feel incompetent.

   0 1 2 3 4

10. enDe swaravi:kalyam ennil laja: unda:kunnu.

    I am ashamed of my voice problem.

0 1 2 3 4

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Appendix B

Case Name

Age / Sex

Clinician

Date

BUFFALLO VOICE PROFILE

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1. LARYNGEAL TONE

i. Normal

ii. Breathy

iii. Harsh

iv. Hoarse

---

2. LARYNGEAL TENSION

i. Normal

ii. Hypertension

iii. Hypotension

---

3. VOCAL ABUSE

Present/Absent

---

4. LOUDNESS

Normal/Too Loud/Too Soft

---

5. PITCH

Normal/High/Low

---

6. VOCAL INFLECTIONS

Normal/Monotone/Excessive

---

7. PITCH BREAKS

None /Amount of pitch breaks

---

8. DIPLOPHONIA

Present/Absent

---

9. RESONANCE

Normal/Hypernasal /Hyponasal

---

10. NASAL EMISSION

Present/Absent

---

11. RATE OF SPEECH

Normal/Fast/Slow

---

12. OVERALL VOICE EFFICIENCY

Adequate/Inadequate

These parameters are assessed on 7-point scale. Speech sample should include connected speech, oral reading, individual phonemes and counting.

1-4 - Slight Variation, 4-7 - Moderate Variation, 7 - Severe Variation.

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