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Differential diagnosis of adductor spasmodic dysphonia and muscle tension dysphonia using acoustic parameters

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ABSTRACT

Objective: The study aimed at differentiating Adductor Spasmodic Dysphonia (ADSD) from Muscle Tension Dysphonia (MTD) using acoustic measurements . **Method:** Perceptual as well as acoustic analysis of the voice was done on 12 patients of Adductor Spasmodic dysphonics and Muscle tension dysphonics each. The age of these patients ranged between 30 to 64 years . **Results:** Adductor spasmodic dysphonics statistically differed from muscle tension dysphonia in the acoustic parameters of voice break, harmonic to noise ratio, and jitter. The parameters which showed maximum significance of differences were voice break which was presented only by the adductor spasmodic dysphonics and harmonic to noise ratio which was affected in muscle tension dysphonia. **Conclusion:** Voice breaks were found to be more sensitive in discriminating adductor spasmodic dysphonia from muscle tension dysphonia in the present study. Percentage of voice break correlated with perceptual assessment of severity.

Key words- Adductor Spasmodic Dysphonia, Muscle Tension Dysphonia, Acoustic Parameters

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Spasmodic dysphonia (SD) is a voice disorder characterized by involuntary disruption of voice, the signs of which are seen during voluntary speech and are asymptomatic during coughing, crying, laughing, and yawning. There are two main types of SD, adductor spasmodic dysphonia (ADSD) and abductor spasmodic dysphonia (ABSD) [1].

ADSD is more common compared to ABSD and is characterized by hyper adduction of the vocal cords producing effortful, strained-strangled voice quality. ABSD is characterized by breathy, abrupt breaks and prolonged abduction during voiceless consonants [1]

There has been considerable debate regarding the psychogenic versus neurogenic etiology for spasmodic dysphonia [1].

Muscle tension dysphonia may be confused with Adductor spasmodic dysphonia because of the similarity in symptoms. Muscle tension dysphonia is a hyperfunctional voice disorder characterized by a generalized increase in muscle tension in the larynx and paralaryngeal areas associated with vocal abuse in the absence of any organic pathology [2]. The voice in this disorder is breathy, strained and harsh and associated with vocal fatigue [3]. Laryngoscopic findings include ventricular fold activation, narrowing of the pharyngeal structures and antero-posterior squeezing of the muscles that surround the vocal folds [4] or even complete obstruction of true vocal folds [5].

There are not many studies on the differential diagnosis of ADSD from Muscle tension dysphonia using acoustic analysis. Few studies have compared ADSD with MTD like fiberoptic laryngoscopy, phonatory airflow measurement, spectrography, phonatory break analysis [6-12].

Aim

The aim of our study was to find the acoustic parameter which differentiates adductor spasmodic dysphonia from muscle tension dysphonia and also to correlate the severity of dysphonia evaluated perceptually with the acoustic parameters.

Method

The study was done on 12 patients diagnosed as spasmodic dysphonia (5 females and 7 males) and twelve patients with Muscle tension dysphonia (8 females and 4 males). The age of the patients ranged between 30 to 64 years. The diagnosis was done after comprehensive voice

evaluation by an otorhinolaryngologist and voice pathologist including stroboscopy, acoustic analysis and perceptual analysis.

Using PRAAT software (version 5.1.04) mean and standard deviation of acoustic parameters – jitter, shimmer, phonatory break and Harmonic to noise ratio were found.

1. Jitter is the average cycle to cycle variation in frequency.

2. Shimmer or amplitude perturbation (local) is the average cycle to cycle variation in amplitude.

3. Phonatory (voice) break is defined acoustically as an absence of voicing, for at least 50 milliseconds within a word or a sustained vowel.

4. HNR (Harmonic to noise ratio) is the amount of additive noise in the voice signal.

Severity rating through perceptual analysis

Two speech pathologists were asked to informally rate the severity of ADSD on a five point ordinal scale (0 indicated absence of dysphonia; 1, mild dysphonia; 2, moderate dysphonia; 3, severe dysphonia; and 4, profound dysphonia) by perceptually listening to the recorded speech samples using PRAAT (version 5.1.04). Evaluators listened to stimulus using Sennheiser HD 595 headphone.

The intra-judge reliability and inter-judge agreement was found out. Intra-judge reliability was evaluated by randomly replaying speech samples two times to the same judge. Inter-judge reliability was evaluated by comparing the rating obtained from both.

The Statistical analysis was done using The Statistical Product and Service Solution Ver. 15.0 (SPSS Inc., Chicago, IL,USA; 2006).An independent samples t- test was performed to compare the mean difference between the ADSD group and MTD group. Correlation between the perceptual analysis of the severity of dysphonia with the acoustic parameters was also done.

RESULTS

Acoustic Analysis

Table.1. Showing the results of paired individual –t test to find the difference between spasmodic dysphonia and muscle tension dysphonia for the different acoustic parameters

Parameters	Spasmodic Dysphonia		Muscle Tension Dysphonia		p value
	Mean	SD	Mean	SD	
Jitter	2.081	1.12	1.217	0.11	0.011
Shimmer	6.46	5.29	4.16	0.695	0.067
Phonatory break	10.28	5.18	0	0	0.001
HNR	20.09	2.671	9.385	4.56	0.001

Table 2. Correlation of the acoustic parameters with severity judgement

	Spasmodic dysphonia	Muscle tension dysphonia
Jitter	0.2943811	0.33
Shimmer	0.59654685	0.51
Voice breaks	0.95	0.0
HNR	-0.68	-0.91

DISCUSSION

Our study showed that adductor spasmodic dysphonics differed from muscle tension dysphonia for the acoustic parameters of voice break, harmonic to noise ratio and jitter. The parameters which showed maximum significance of differences were voice break and harmonic to noise ratio. Patients with muscle tension dysphonia did not reveal any voice breaks in their voice analysis, whereas it was typically present in the voice of spasmodic dysphonics. Harmonic to noise ratio was significantly reduced in muscle tension dysphonia compared to spasmodic dysphonics. The acoustic parameter of shimmer (cycle to cycle variation in amplitude) was found to be more similar in adductor spasmodic dysphonia as well as muscle tension dysphonia.

Correlation of the severity of dysphonia evaluated perceptually with the acoustic parameters showed a strong positive correlation for voice breaks (0.95), and a moderate negative correlation for harmonic to noise ratio (-0.68) which indicated that as the number of voice breaks increased, the severity of adductor spasmodic dysphonia also increased and as the values of harmonics to noise ratio decreased the severity of adductor spasmodic dysphonia increased. The MTD group showed a strong negative correlation with harmonics to noise ratio (-0.91) .The intra-judge reliability was 96% and inter-judge agreement was 92%, indicating high correlation between the ratings.

Even though adductor spasmodic dysphonics differed from muscle tension dysphonics statistically for the acoustic parameters of voice break, harmonic to noise ratio and jitter, voice break was the only parameter which was completely absent in MTD and present in ADSD; the percentage of which varied depending on the severity of the problem assessed perceptually. Hence the parameter of voice breaks may be considered as more sensitive in discriminating adductor spasmodic dysphonia with muscle tension dysphonia in clinical practice. These findings are in support to the study of Sapienza, Walton and Murry (2000) [9] which says that patients with ASD had high % of phonatory breaks whereas it was absent in MTD.

Despite the fact that differential diagnosis of the two conditions is challenging, it is essential for the selection of management strategy. While manual tension reduction techniques such as circumlaryngeal massage is found to be effective for MTD [13- 16], the treatment for adductor spasmodic dysphonia is the injection of minute quantities of botulinum toxin into laryngeal muscles as the primary treatment modality [16] or a type 2 thyroplasty techniques proposed by Isshiki etal [17, 18] .

CONCLUSION

Since the line of management for Adductor Spasmodic Dysphonia differ from Muscle Tension Dysphonia, differential diagnosis of the two conditions is essential. Voice break is found to be more sensitive in discriminating adductor spasmodic dysphonia from muscle tension dysphonia according to the present study. Percentage of voice break correlated with severity perception among adductor spasmodic dysphonics.

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