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Original Article

An Evaluation of Dysphonia among Teachers

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Abstract

Background: In pursuit of excellence in their profession, school teachers often ignore the most valuable tool in their possession - their voice. Teaching requires a high vocal demand, and consequently, teachers present a high risk of developing voice disorders during the course of their career. The prevalence of current voice disorders is significantly higher in teachers (11%) when compared to non-teachers (6.2%), as is the prevalence of voice disorders during teachers higher in teachers (11%) when covs. 28.8% non-teachers).

Aim of the Study: To evaluate teachers with dysphonia using voice analysis, objective analysis, acoustic analysis, and aerodynamic analysis.

Materials and Methods: A prospective study on 80 teachers was conducted by dividing them into two groups 40 teachers each. Group I (GI) included teachers with permanent or frequent voice complaints (>2 months). Group II (GII) teachers included teachers without voice complaints (<2 months). Voice analysis in all the teachers was conducted in the form of self-perception study (voice handicap index [VHI]), and perceptual study (grade, roughness, breathiness, asthenia, and strain [GRBAS]). The objective analysis was performed with stroboscopic evaluation of voice, acoustic analysis, aerodynamic analysis, and the dysphonia severity index. The acoustic analysis was performed using the Vaghmi software; included the fundamental frequency, lowest intensity, jitter, and shimmer. The aerodynamic analysis included the maximum phonation time (MPT) and S/Z ratio. The perceptual analysis, acoustic analysis, and aerodynamic analysis were conducted by a well-trained speech-language pathologist. The dysphonia severity index, which is designed to establish an objective and quantitative correlate of the perceived voice quality, was also calculated.

Observations and Results: The age groups were between 26 and 70 years. The mean age in the GI was 39.98 years, and in the GII was 42.3 years. The mean work experience of the teachers in the study group was 11.08 years, and in the control group was 14.175 years. Among the symptoms with which teachers in the study group presented, the most common symptom was hoarseness (60%). The VHI was perceived as normal by 67.5% of teachers in GI and normal in all subjects of GII group. Vocal nodules were present in 9 (22.5%) teachers belonging to GI group and in 1 teacher from GII group. GRBAS was mildly deviated in 30% of teachers in the study group, and in 35% of teachers in the control group.

Conclusions: Statistically significant differences were noted in the VHI and in the stroboscopic parameters such as glottis closure, vocal fold edge, and mucosal wave pattern. Significant differences were also seen with respect to the fundamental frequency, jitter, shimmer, MPT, and in the dysphonia severity index. The main differences between the two groups in our study were seen with respect to the frequency and number of reporting symptoms, the VHI, stroboscopic analysis, acoustic analysis, aerodynamic analysis, and in the dysphonia severity index.

Key words: Dysphonia severity index, Stroboscopy, Voice, Voice disorders, Voice handicap index

INTRODUCTION

The human voice is a dynamic instrument. In the words of Richard Strauss, "the human voice is the most beautiful instrument of all, but it is the most difficult to play." Its ability to articulate, communicate ideas, create beautiful melodies, and translate human emotions into sounds is unmatched in the animal kingdom. The sound of each person's voice is unique due to the actual shape and size of the vocal cords as well as the size and shape of the rest of that person's body, especially the chest and vocal tract. Dysphonia is defined as any impairment of the voice or difficulty in speaking.[1] Dysphonia has either organic or functional causes and develops due to impairment in any one of the vocal organs. The prevalence of current voice disorders is significantly higher in teachers (11%) when

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compared to non-teachers (6.2%), as is the prevalence of voice disorders during teachers' lifetime (i.e., 57.7% teachers vs. 28.8% non-teachers). Smith *et al.*[2] reported that over 38% of teachers studied complained that teaching had an adverse effect on their voice, and 39% of those teachers had to reduce teaching activities as a result.[3] In a study conducted in India, 49% of teachers reported to have voice problems.[4] Teachers are at an increased risk of developing dysphonia due to a multitude of factors. Very few studies have been conducted to evaluate dysphonia in teachers in India. In a landmark study by Roy *et al.*,[5] to examine the frequency and adverse effects of voice disorders on teachers and in the general population; they observed that teachers were significantly more likely to have multiple voice symptoms and missed more work days than general populations. Dejonckere *et al.*[6] proposed a basic protocol for the functional assessment of voice pathology; it included perceptual analysis, videolaryngostroboscopy, acoustic analysis, aerodynamics, and subjective rating by the patient. This study is an attempt on our behalf to highlight the various factors that could contribute to dysphonia among teachers and to assess the voice characteristics of school teachers.

Period of the Study

The study period was from October 2015 to September 2017

Institute of Period

The study was conducted at Kannur Medical College, Anjarakandy, Kannur, Kerala, India.

Subjects of Study

The study was conducted on school teachers in the Dakshina Kannada district of Karnataka.

Aim of the Study

To evaluate teachers with dysphonia using voice analysis, objective analysis, acoustic analysis, and aerodynamic analysis.

MATERIALS AND METHODS

This prospective study was conducted at Kasturba Medical College Hospital after attaining clearance by the Institutional Ethics Committee board.

Inclusion Criteria

1. School teachers aged above 18 years; who had declared to be active in their profession during the study period were included.
2. Teachers with frequent voice complaints for more than 2 months were included in Group I (GI).
3. Teachers with <2 months of voice complaints were included in Group I (GII).
4. Teachers with chronic voice disorders were included in GI.

Exclusion Criteria

1. Teachers with recent upper respiratory tract infections, laryngeal malignancy, laryngotracheal trauma, and history of laryngeal or thyroid surgery, neurological, and neuromuscular diseases were excluded.
2. Teachers not willing to participate in the study were excluded. Teachers with debilitating illnesses were excluded.

A detailed pro forma was filled for each subject with regard to their vocal symptoms, working conditions, associated symptoms, and diseases, as well as the clinical examination findings and voice analysis. The study comprised a total of 80 teachers who were divided into two groups: The study group, Group I (n = 40) included teachers with permanent or frequent voice complaints (frequency more than twice per month) such as hoarseness, vocal fatigue, dry throat, vocal strain, and repeated throat clearing. The control group, Group II (n = 40), included teachers without vocal complaints (frequency less than once per month). Details were sought from each teacher with regard to their vocal symptoms, working conditions, and associated symptoms and diseases, following which they underwent a voice analysis. Voice analysis was conducted in the form of self-perception study (voice handicap index [VHI]), and perceptual study (grade, roughness, breathiness, asthenia, and strain [GRBAS]). The objective analysis included the stroboscopic evaluation of voice, acoustic analysis, aerodynamic analysis and the Dysphonia Severity Index. The acoustic analysis, which was calculated using the Vaghmi software, included the fundamental frequency, lowest intensity, jitter, and shimmer. The aerodynamic analysis included the maximum phonation time (MPT) and S/Z ratio. The perceptual analysis, acoustic analysis, and aerodynamic analysis were conducted by a well-trained speech-language pathologist. The Dysphonia Severity Index, which is designed to establish an objective and quantitative correlate of the perceived voice quality, was also calculated. It is constructed as [MPT × 0.13] + [Fo-High × 0.0053] − [I-Low × 0.26] − [Jitter (%) × 1.18] + 12.4. The DSI for perceptually normal voices is +5 and for severely dysphonic voices is −5.[3] A statistical package SPSS version 17 was used to do the data analysis. The qualitative data were analyzed using the Chi-square test, and quantitative data were analyzed using the students unpaired t-test. Comparisons among the two groups were done using the Fischer's exact t-test. Correlations were measured using the Pearson's correlation coefficient. A probability value of <0.05 was considered significant.

OBSERVATIONS AND RESULTS

The study comprised 80 teachers who were divided into two groups based on their clinical symptoms. The study group (GI) consisted of 40 teachers with permanent or frequent symptoms, and the control group (GII) consisted of 40 teachers without vocal symptoms.

Age

They belonged to an age group varying between 26 years and 70 years. The mean age in the study group was 39.98 years, and in the control group was 42.3 years. There was no statistically significant difference in the age group [Table 1].

Gender

Majority of the teachers were female. Only three male subjects were present in the study, one in the study group, and two in the control group [Figure 1].

Level of Teaching

Primary school teachers were the most common subjects in our study, being equally present in both groups (40%). High school teachers, secondary school teachers, and pre-primary school teachers were less common [Table 2].

Teaching Characteristics

All the teachers had been actively practicing their profession during the period of this study. The mean work experience of the teachers in the study group was 11.08 years, and in the control group was 14.175 years. The teachers in the study group taught their respective subjects for a mean duration of 31.625 h per week, whereas the teachers in the control group taught for a mean duration of 29.775 h per week. Majority of teachers in both the groups taught for more than 30 h per week. There was no statistically significant difference between the number of years they had been teaching, or between the numbers of working hours per week [Table 3].

All the teachers were employed in schools with closed classrooms. All of them used blackboards as a means of visual aid. None of the teachers reported any history of allergy to chalk dust. There was an average of 36.35 students in a classroom being taught by teachers in the study group, and 34.65 students per classroom being taught by teachers in the control group. Voice amplification facilities, such as microphones were not available for any of the teachers. None of the teachers were involved in any vocally demanding activities outside the classroom. None of them had to miss their jobs due to their voice problems. The teachers had an average of two children at home. On comparing the level of hydration being maintained, the teachers in the study group had an average of 10.5 glasses of water per day, whereas the teachers in the control group had 9.9 glasses of water per day. This was not statistically significant.

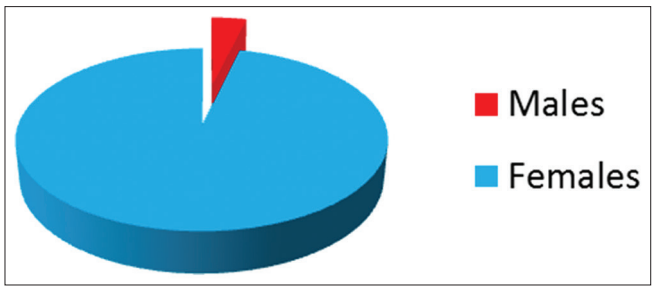

Figure 1: Gender distribution

Table 1: Age distribution in both groups

Age	Group		Total (%)	
	Study group (%)	Controls (%)		
30 and below	5 (12.5)	3 (7.5)	8 (10.0)	Not significant
31–40	17 (42.5)	16 (40.0)	33 (41.3)	
41–50	14 (35.0)	16 (40.0)	30 (37.5)	
Above 50	4 (10.0)	5 (12.5)	9 (11.3)	
Total	40 (100.0)	10 (100.0)	80 (100.0)	

Not significant

Table 2: Distribution of teachers by level of teaching

Level of teaching	Group		Total (%)	
	Study group (%)	Controls (%)		
Grade				Not significant
Pre primary	6 (15.0)	5 (12.0)	11 (13.8)	
Primary	16 (40.0)	16 (40.0)	32 (40.0)	
Secondary	10 (25.0)	9 (22.5)	19 (23.8)	
High	8 (20.0)	10 (25.0)	18 (22.5)	
Total	40 (100.0)	40 (100.0)	80 (100.0)	

Table 3: Teaching characteristics

Working conditions	*N* (%)		*P* value
	GI	GII	
Experience (years)			
<10	19 (47.5)	12 (30)	0.108
10–15	8 (20)	12 (30)	0.301
15–20	8 (20)	10 (25)	0.592
>20	5 (12.5)	6 (15)	0.745
Working hours per week (h)			
20–25	9 (22.5)	10 (25)	0.792
25–30	4 (10)	8 (20)	0.210
>30	27 (67.5)	22 (55)	0.251
Number of students			
<30	3 (7.5)	1 (2.5)	0.304
30–35	7 (17.5)	8 (20)	0.774
35–40	17 (42.5)	24 (60)	0.117
>40	13 (32.5)	7 (17.5)	0.121

Symptoms

Among the symptoms with which teachers in the study group presented, the most common symptom was hoarseness (60%). Other symptoms included increased vocal strain (52.5%), dryness of throat (20%), change in pitch (30%), frequent throat clearing (37.5%), vocal fatigue (12.5%), and weakness of voice (10%). 35% of the teachers in the study group had only one symptom. 27.5% of the teachers had 2 symptoms, and 37.5% of them had three or more symptoms. In the control group hoarseness was present in only 15 % of the teachers. Other symptoms included strain (10%), dry throat (5%), change in pitch (5%), and weakness of voice (5%). 72.5% of these teachers did not have any symptoms, and only 5% of the teachers had more than three symptoms [Table 4].

The comparative analysis of symptoms of both the groups is shown in Figure 2.

Symptoms of laryngopharyngeal reflux disease were present in 50 % of the teachers in the study group, whereas it was present in only 25% of the teachers in the control group. This difference was statistically significant.

VHI: The functional, emotional and physical aspects of the voice disorder, as detected by the VHI were analyzed. It quantifies the voice disorder by categorizing the voice handicap as normal (<33), mild (>33), moderate (>44), or severe (>61). On evaluating the VHI, it was perceived as normal by 67.5% of teachers in the study group. It was perceived as mild and moderate by 15% each. One teacher (2.5%) perceived her VHI to be severe. All the teachers in the control group perceived their VHI to be normal [Tables 5 and 6].

Stroboscopy

On stroboscopic evaluation, vocal nodules were the most common structural lesion involving the larynx. It was present in 9 (22.5%) teachers belonging to the study group and in one teacher from the control group. Other structural abnormalities included the presence of vocal polyps in 3 (7.5%) teachers from the study group, congestion of the vocal cords, and thickening of the vocal cords [Figures 3-5 and Table 7].

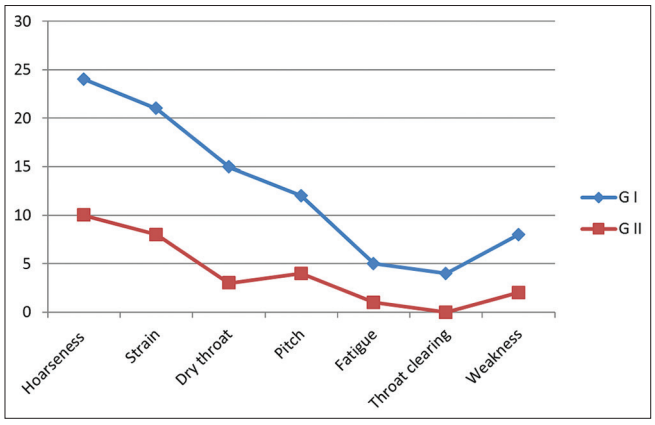

Figure 2: Comparison of frequency of symptoms in both groups

The glottic closure was found to be normal in 60% of teachers in the study group, and in 92.5% of teachers in the control group. It was mildly deviated in 40% of teachers in the study group, and in 7.5% of teachers in the control group. These results were very highly significant. The periodicity of the vocal cords was found to be normal in 97.5% of teachers in the study group, and in all the teachers in the control group. It was mildly deviated in 1 (2.5%) of the teachers in the study group. The symmetry of movement of the vocal cords was found to be normal in 95% of teachers in the study group, and in all the teachers in the control group. It was mildly deviated in 5% of teachers in the study group. The amplitude of the vocal cords was normal in all the teachers in the study group, and in 97.5% of teachers in the control group. It was mildly deviated in 1 (2.5%) of the teachers in the control group. The mucosal wave pattern was normal in 67.5% of teachers in the study group, and in 87.5% of teachers in the control group. It was mildly deviated in 20% of teachers in the study group, and in 12.5% of teachers in the control group. The mucosal wave pattern showed moderate deviation in 12.5% of the teachers in the study group. These differences were statistically significant. The vocal fold edges were normal in 70% of the teachers in the study group, and in 95% of teachers in the control group. It was mildly deviated in 15% of teachers in the study group and in 2.5% of the teachers in the control group. It was moderately deviated in 15%

Table 4: Frequency of symptoms in both groups

Symptoms	*N* (%)		*P* value
	GI	GII	
Hoarseness	24 (60)	6 (15)	0.0015
Strain	21 (52.5)	4 (10)	0.0024
Dry throat	15 (37.5)	2 (5)	0.0013
Pitch	12 (30)	2 (5)	0.025
Fatigue	5 (12.5)	0 (0)	0.089
Throat clearing	4 (10)	0 (0)	0.040
Weakness	8 (20)	2 (5)	0.042

Significant difference in hoarseness, strain, dryness of throat, change in pitch, throat clearing, and weakness was observed ($P < 0.05$). GI: Group I, GII: Group II

Table 5: Comparison of VHI scores

	N (%)					Significant
	Normal	Mild	Moderate	Severe	Total	
GI	27 (67.5)	6 (15)	6 (15)	1 (2.5)	40 (100)	
GII	40 (100)	0 (0)	0 (0)	0 (0)	40 (100)	

GI: Group I, GII: Group II, VHI: Voice handicap index

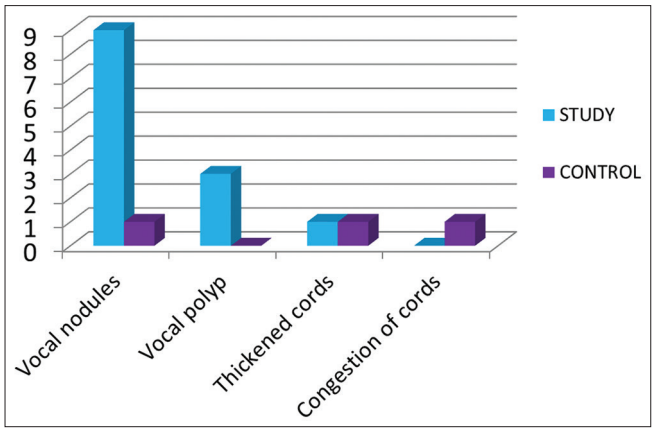

Figure 3: Frequency of vocal cord lesions

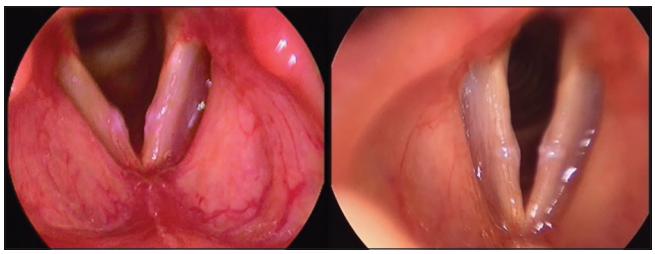

Figure 4: Vocal nodules

Figure 5: Vocal cord edema

of teachers in the study group, and in 2.5% of teachers in the control group. These results were statistically significant [Table 8].

GRBAS

The GRBAS were evaluated and revealed the following results. The grade was found to be normal in 57.5% of teachers in the study group, and in 50% of teachers in the control group. It was mildly deviated in 30% of teachers in the study group, and in 35% of teachers in the control group. The grade showed moderate deviation in 12.5% of teachers in the study group, and in 15% of teachers in the control group. The roughness of voice was perceived to be normal in 87.5% of teachers in the study group, and in 77.5% of teachers in the control group. It was mildly deviated in 12.5% of teachers in the study group, and 22.5% of teachers in the control group. Breathiness of voice was normal in 60% of teachers in the study group and in 45% of teachers in the control group. It was mildly deviated in

Table 6: Voice handicap index

Effects	*N* (%)		*P* value
	GI	GII	
Functional			
Difficulty being understood	27 (67.5)	10 (25)	0.000
Reduction in phone calls	24 (60)	8 (20)	0.000
Avoid people because of voice	23 (57.5)	7 (17.5)	0.000
Reduction in social activities	19 (47.5)	9 (22.5)	0.019
Loss of income because of voice	6 (15)	0 (0)	0.010
Difficulty being understood in a noisy room	12 (30)	2 (5)	0.0032
Family has difficulty hearing me at home	6 (15)	0 (0)	0.010
Speak with friends less often	4 (10)	0 (0)	0.040
People ask to repeat myself	15 (37.5)	2 (5)	0.0003
Left out of conversations	9 (22.5)	1 (2.5)	0.006
Emotional			
Tense on talking	22 (55)	8 (20)	0.001
Being upset	28 (70)	7 (17.75)	0.000
Voice makes me feel handicapped	21 (52.5)	4 (10)	0.000
Being ashamed	13 (32.5)	3 (7.5)	0.005
People are irritated with my voice	9 (22.5)	2 (5)	0.023
People do not understand the problem	18 (45)	7 (17.5)	0.007
Less outgoing	8 (20)	0 (0)	0.002
Speech makes me handicapped	6 (15)	0 (0)	0.010
Feels incompetent	6 (15)	0 (0)	0.010
Annoyed when asked to repeat	8 (20)	2 (5)	0.042
Physical			
Run out of air on talking	21 (52.5)	6 (15)	0.0003
Voice varies throughout the day	30 (75)	8 (20)	0.000
People enquire about the voice	28 (70)	2 (5)	0.000
Voice sounds creaky and dry	24 (60)	0 (0)	0.000
Have to strain to produce voice	27 (67.5)	9 (22.5)	0.000
Clarity of voice is unpredictable	24 (60)	10 (25)	0.001
Try to change my voice	10 (25)	3 (7.5)	0.033
Great effort to speak	13 (32.5)	5 (12.5)	0.032
Voice worse in evenings	27 (67.5)	11 (27.5)	0.0003
Voice gives out during speech	11 (27.5)	3 (7.5)	0.018

GI: Group I, GII: Group II. Significant difference in all parameters

Table 7: Lesions of vocal cord on stroboscopy

Lesions on vocal cord	GI	GII	*P* value
	N (%)	*N* (%)	
Nodules	9 (22.5)	1 (2.5)	0.006
Polyp	3 (7.5)	0 (0)	0.079
Thickening	1 (2.5)	1 (2.5)	1
Congestion	0 (0)	1 (2.5)	0.314
Normal	27 (67.5)	37 (92.5)	0.005
Total	40 (100)	40 (100)	

GI: Group I, GII: Group II. Significant difference in normal findings and in the presence of vocal nodules

32.5% of teachers in the study group and 40% of teachers in the control group. It was moderately deviated in 7.5% of teachers in the study group and 15% of teachers in the control group. The asthenia of voice was perceived to be normal in 95% of teachers in the study group and in 97.5% of teachers in the control group. It was mildly deviated in 5% of teachers in the study group and 2.5% of teachers in the control group. Vocal strain was normal in 80% of teachers in the study group and 87.5% of teachers in the control group. It was mildly deviated in 15% of teachers in the study group and in 12.5% of teachers in the control group. It was moderately deviated in 5 % of teachers in the study group [Table 9].

Acoustic Analysis

Acoustic analysis included the fundamental frequency, lowest intensity, jitter, and shimmer.

Fundamental frequency

The mean fundamental frequency was only 177.33 in the study group, whereas it was 193.296 in the control group. This difference was very highly significant [Table 10].

Intensity

The mean lowest intensity was 81.275 in the study group and 81.225 in the control group. There was no statistical significance.

Jitter

The mean jitter was 3.049 in the study group and 2.112 in the control group. This difference was statistically significant.

Shimmer

The mean shimmer was 3.123 in the study group and 2.844 in the control group. This difference was not statistically significant.

Aerodynamic Analysis

MPT

The MPT was found to be only 11.7 s in the study group and 12.950 s in the control group. This was highly significant [Table 11].

S/Z ratio

The S/Z Ratio was 0.972 in both the groups.

Dysphonia Severity Index

The Dysphonia Severity Index was severely affected in both the groups.

The normal values may range between −5 and +5. A more negative value of DSI indicates a poorer quality of voice. It was −8.836 in the study group and -8.316 in the control group. The difference was statistically significant [Figure 6].

Table 8: Variations on stroboscopy

Lesions on vocal cord	Normal	Mild	Moderate	Severe	Total
	N (%)	*N* (%)	*N* (%)	*N* (%)	*N* (%)
GI					
Closure	24 (60)	16 (40)	0 (0)	0 (0)	40 (100)
Amplitude	40 (100)	0 (0)	0 (0)	0 (0)	40 (100)
Periodicity	39 (97.5)	1 (2.5)	0 (0)	0 (0)	40 (100)
Symmetry	38 (95)	2 (5)	0 (0)	0 (0)	40 (100)
Wave	27 (67.5)	8 (20)	5 (12.5)	0 (0)	40 (100)
Edge	28 (70)	6 (15)	6 (15)	0 (0)	40 (100)
GII					
Closure	37 (92.5)	3 (7.5)	0 (0)	0 (0)	40 (100)
Amplitude	39 (97.5)	1 (2.5	0 (0)	0 (0)	40 (100)
Periodicity	40 (100)	0 (0)	0 (0)	0 (0)	40 (100)
Symmetry	40 (100)	0 (0)	0 (0)	0 (0)	40 (100)
Wave	36 (90)	4 (10)	0 (0)	0 (0)	40 (100)
Edge	38 (95)	1 (2.5)	1 (2.5)	0 (0)	40 (100)

GI: Group I, GII: Group II. Significant difference in glottis closure, mucosal wave pattern, and vocal fold edge

Table 9: Deviations in GRBAS score

Alterations	Normal	Mild	Moderate	Severe	Total
	N (%)	*N* (%)	*N* (%)	*N* (%)	*N* (%)
GI					
G	23 (57.5)	12 (30)	5 (12.5)	0 (0)	40 (100)
R	35 (87.5)	5 (12.5)	0 (0)	0 (0)	40 (100)
B	24 (60)	13 (32.5)	3 (7.5)	0 (0)	40 (100)
A	38 (95)	2 (5)	0 (0)	0 (0)	40 (100)
S	32 (80)	6 (15)	2 (5)	0 (0)	40 (100)
GII					
G	20 (50)	14 (35)	6 (15)	0 (0)	40 (100)
R	31 (77.5)	9 (22.5)	0 (0)	0 (0)	40 (100)
B	18 (45)	16 (40)	6 (15)	0 (0)	40 (100)
A	39 (97.5)	1 (2.5)	0 (0)	0 (0)	40 (100)
S	35 (87.5)	5 (12.5)	0 (0)	0 (0)	40 (100)

GI: Group I, GII: Group II, GRBAS: Grade, roughness, breathiness, asthenia, and strain. No significant difference between any of the parameters

Table 10: Acoustic analysis

Acoustic analysis	GI	GII	*P* value
Fo	177.334	193.272	0.000
Io	81.275	81.175	0.278
Jitter	3.049	2.092	0.000
Shimmer	3.123	2.845	0.034

GI: Group I, GII: Group II. Significant difference in Fo, Jitter, and Shimmer

Table 11: Aerodynamic analysis

Aerodynamic analysis	GI	GII	*P* value
MPT	11.700	12.950	0.009
S/Z ratio	0.972	0.972	0.314

Significant difference in MPT. MPT: Maximum phonation time

On correlating the various working conditions of all 80 teachers in our study with the quantitative parameters of voice analysis, there was found to be no significant associations. We did not find any significant association between the total number of years in the profession and

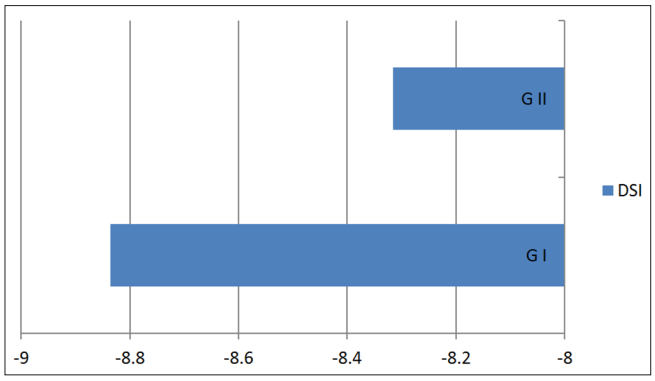

Figure 6: Dysphonia severity index values

dysphonia. Although the teachers worked for prolonged hours, and for a large number of students, we did not find any significant correlation between these factors and the risk of developing dysphonia.

DISCUSSION

The age of the 80 school teachers we analyzed was comparable between the two groups, but the teachers in the study group tended to be of a younger age. This could be due to the fact that teachers in India have no vocal training before getting into a profession with a high vocal demand. A study conducted in Taiwan also reported the absence of any significance between age group and dysphonia.[7] Roy *et al.*[5] and Smith *et al.*[2] found a higher prevalence of voice disorders in teachers more than 50 years of age which was attributed to the cumulative effect on voice as the personages. Hormonal changes with aging and menopause may also affect the quality of voice.[8] Almost all of our subjects were females, which signify the high proportion of females among the teaching profession in Indian schools. Females are more prone to dysphonia due to the reduced length of the vocal cords which may hinder phonic adaptations for heavy voice use. They also produce voice at a higher fundamental frequency. Consequently, there is less tissue mass to dampen a larger number of vibrations.[9] Hyaluronic acid, which increases water flow to the lamina propria of the vocal folds resulting in a shock absorbing action during voice emission, is also less in females.[10] Majority of our subjects were primary school teachers. Primary school teachers usually report excessive noise in their classrooms, and they tend to raise their voice so as to be heard above the background noise. As they usually teach all the subjects by themselves, they do not receive appropriate breaks in between their classes. Our findings were similar to the findings by Angelillo *et al.*[11] who, on studying the relationship between the level of teaching and dysphonia, reported that if the students were younger, the prevalence of voice disorders increased in teachers. However, in a study conducted in Brazil, it was suggested there is an increased risk of developing dysphonia if the teachers had worked for more than 15 years, and for more than 22 h per week.[12] Crowded classrooms and excessive noise as measured by Sound Level Meter were also identified as definite risk factors in the development of dysphonia.[13] There was a significant difference in the reporting of voice symptoms among the two groups. Even though teachers in both the groups had similar working conditions, the study group had a significantly higher number of symptoms. The most common symptom was hoarseness (60%). As in our study, hoarseness was found to be the predominant symptom in studies conducted by Roy *et al.*,[2] Smith *et al.*,[3] and Sapir *et al.*[14] Hoarseness, vocal strain and dryness of throat were the major self-perceived symptoms of voice disorder for the teachers in our study. A large proportion of teachers in the study group also had multiple symptoms (65% > 1, 37.5% > 3). This shows that teachers who develop voice problems usually report multiple voice symptoms. However, it should be kept in mind that the number of symptoms reported by teachers in our study cannot be compared to other studies, due to the different number of total symptoms considered by different authors,[15] for example, the number of total symptoms considered in our study was seven, while the corresponding number in Roy *et al.*'s[2] study was 14. On evaluating the working condition at the schools, we found that teachers had to work continuously for prolonged hours. Teachers in both the groups had been in their profession for many years and worked between 20 and 46 h per week. Majority of the teachers worked for more than 30 h per week. No significant difference was found in the number of years in the profession and the number of working hours per week between the two groups. Nor were there any differences in the grades taught and the number of students per classroom. The number of students per classroom was high. Majority of the classrooms had more than 30 students, resulting in a high student-teacher ratio. We found no correlation between the working conditions as listed above, with either the objective or subjective parameters evaluated in this study. Laryngopharyngeal reflux disease is a well-recognized risk factor in the development of dysphonia, wherein the mucosa is exposed to constant acid reflux which can cause laryngeal lesions.[9] Although we did not objectively evaluate for laryngopharyngeal reflux disease, patients did complain of associated symptoms such as throat clearing, hoarseness, chronic cough, and sore throat. This could indicate the underlying presence of reflux disease. We discovered a significantly higher prevalence of these symptoms among teachers in the study group (50%) when compared to the control group (25%). The VHI is regarded as the "gold standard" for measuring the subjective burden due to dysphonia.[16] It reflects a patient's judgment about the impact of his voice disorder

on daily life. It is also used as a tool for outcome measurements.[16] Moreover, it enables us to form an impression about how concerned the individual is regarding their voice problem. The VHI was deviated in 13 (32.5%) of the teachers in the study group, and it was normal for all the teachers in the control group. Teachers with voice disorders experienced reduced communicative ability, reduced social activities, decreased the number of phone calls they made, and felt that their emotional state was affected. They were easily upset as a result of their voice problem. These results were consistent with previously undertaken studies.[17,18] On evaluating the GRBAS score, the grade, roughness and breathiness were affected in both the groups. Interestingly, the control group of teachers who had perceived their own voice to be normal, and who had few voice symptoms had higher GRBAS scores. 60% of the teachers in the control group had deviations in the GRBAS score, whereas only 47.5% of the teachers in the study group had such deviations. Similar findings were reported by other studies as well.[19,20] We further attempted to analyze as to why the control group was affected more with a poorer quality of voice on perceptual analysis. This could be due to the fact that if the changes in the voice are gradual, occurring over a long period of time, many of the teachers may consider it to be a normal process and do not perceive it as a problem. Furthermore, many teachers consider dysphonia and voice-related problems to be an occupational hazard that they have to bear within their profession. During the course of their careers these teachers could develop compensatory strategies or techniques to minimize the difficulty in voice production which may have an effect on their perception of voice quality. However, our findings were inconsistent with Meulenbroek and de Jong,[21] who reported the GRBAS score to be more affected in teachers with vocal complaints than with the control group. Stroboscopic exam is a valuable part of the evaluation of people with dysphonia. It offers more information about the presence or absence of motor/coordination abnormalities in the vocal folds, so that potential problems during phonation can be identified.[22] The mucosal wave pattern can be altered due to a variety of lesions such as vocal nodules, polyps, Reinke's edema, sulcus vocalis, and vocal cysts. These variations in stroboscopy probably occur due to the negative vocal adaptations that happen following prolonged vocal stress.[3] On stroboscopic evaluation, vocal nodules were the most common pathological lesion, being present in 12.5% of the teachers. It indicates poor phonatory standards, and excessive use of voice by teachers. In a study conducted on 1046 teachers with and without symptoms, the most common organic lesion they encountered was vocal nodules.[23] Stroboscopic evaluation revealed abnormalities of the vocal folds in 47.5% of the teachers in the study group, and in 12.5% of the teachers in the control group. Teachers in the study group showed significant alterations in the vocal fold edge, limited mucosal wave of the vocal folds, and incomplete glottic closure. The abnormalities in glottis closure can cause air loss, thereby resulting in a change of voice and reduced vocal capabilities.[3] Acoustic measures allow for objective quantification of voice quality. Acoustic analysis was done utilizing the Vaghmi software. The various parameters evaluated included the fundamental frequency, the lowest intensity, jitter, and shimmer.

Fundamental Frequency

The fundamental frequency range best discriminates between teachers with effective and ineffective voice. The fundamental frequency also helps in distinguishing between individuals with varying degrees of vocal fatigue.[12] In our study, the fundamental frequency was significantly reduced in the study group. Increased vocal effort by the teachers could probably result in increased muscle tone and reduced phonatory control.[24]

Intensity

The intensity levels were normal in both the groups in our study. However, the intensity may be reduced due to inadequate closure of the vocal cords.[25]

Jitter and Shimmer

The jitter and shimmer values are not very reliable as their values vary considerably between different studies.[26] On aerodynamic analysis, the MPT was significantly reduced in the study group. MPT may be reduced due to a decrease in the vital capacity or larynx dysfunction.[27] In our study, the Dysphonia Severity Index was negative in both the groups, which indicates the poor quality of voice in both the groups. However, it was more negative in the study group with a statistically significant difference when compared to the study group. The deviation noted in the DSI could be due to the decrease in the fundamental frequency and MPT. In the literature, the DSI is regarded to be unisex because the gender-related parameters of highest frequency (higher in female voices) and MPT (longer in male voices) of pathological as well as of healthy voices appear to be compensated in the DSI formula.[28,29]

SUMMARY

Statistically significant differences were noted in the VHI and in the stroboscopic parameters such as glottis closure, vocal fold edge, and mucosal wave pattern. Significant differences were also seen with respect to the fundamental frequency, jitter, shimmer, MPT, and in the Dysphonia Severity Index. The main differences between the two groups in our study were seen with respect to the frequency and number of reporting symptoms, the VHI, stroboscopic

analysis, acoustic analysis, aerodynamic analysis, and in the Dysphonia Severity Index. The Dysphonia Severity Index also showed their voice to be severely affected. These results highlight the fact that many teachers in our country do have significant voice problems, even if they do not perceive any voice disorder themselves. Objective evaluation of voice must be considered in any teacher, however, insignificant their voice problem may seem.

CONCLUSIONS

The teaching population in India works for prolonged hours in acoustically poor environments and are highly susceptible to voice problems. Many teachers do have significant voice problems, even if they do not perceive any voice disorder themselves. Objective evaluation of voice must be considered in any teacher; however, insignificant their voice problem may seem. In India, dysphonia is not considered as an occupational hazard, and there is a deficiency in knowledge regarding voice problems. A preventive strategy should be in place to reduce dysphonia among teachers. Education on vocal hygiene should be started before the beginning of the teaching career. Further, large-scale multi-parametric studies should be undertaken to understand the extent and causes of dysphonia among teachers in India.

REFERENCES

1. McGlashan J. Disorders of the voice. In: Scott-Brown's Otorhinolaryngology, Head and Neck Surgery. 7th ed. Gleeson M, Browning GG, Burton MJ, Clarke R, John H, Jones NS, editors. London: Hodder Arnold; 2008. p. 2192-210.
2. Smith E, Gray SD, Dove H, Kirchner L, Heras H. Frequency and effects of teachers' voice problems. J Voice 1997;11:81-7.
3. Boominathan P, Samuel J, Arunachalam R, Nagarajan R, Mahalingam S. Multi parametric voice assessment: Sri ramachandra university protocol. Indian J Otolaryngol Head Neck Surg 2014;66:246-51.
4. Maertens K, de Jong FI. The voice handicap index as a tool for assessment of the biopsychosocial impact of voice problems. B-ENT 2007;3:61-6.
5. Jacobson BH, Johnson A, Grywalski C, Silbergleit A, Jacobson G, Benninger MS, *et al*. The Voice Handicap Index (VHI)-development and validation. Am J Speech Lang Pathol 1997;6:66-70.
6. Roy N, Merrill RM, Thibeault S, Parsa RA, Gray SD, Smith EM, *et al.* Prevalence of voice disorders in teachers and the general population. J Speech Lang Hear Res 2004;47:281-93.
7. Dejonckere PH, Bradley P, Clemente P, Cornut G, Crevier-Buchman L, Friedrich G, *et al.* A basic protocol for functional assessment of voice pathology, especially for investigating the efficacy of (phonosurgical) treatments and evaluating new assessment techniques. Guideline elaborated by the committee on phoniatrics of the european laryngological society (ELS). Eur Arch Otorhinolaryngol 2001;258:77-82.
8. Chen SH, Chiang SC, Chung YM, Hsiao LC, Hsiao TY. Risk factors and effects of voice problems for teachers. J Voice 2010;24:183-90.
9. Garrigues V, Gisbert L, Bastida G, Ortiz V, Bau I, Nos P, *et al.* Manifestations of gastroesophageal reflux and response to omeprazole therapy in patients with chronic posterior laryngitis: An evaluation based on clinical practice. Dig Dis Sci 2003;48:2117-23.
10. Sliwinska-Kowalska M, Niebudek-Bogusz E, Fiszer M, Los-Spychalska T, Kotylo P, Sznurowska-Przygocka B, *et al.* The prevalence and risk factors for occupational voice disorders in teachers. Folia Phoniatr Logop 2006;58:85-101.
11. Hummel C, Scharf M, Schuetzenberger A, Graessel E, Rosanowski F. Objective voice parameters and self-perceived handicap in dysphonia. Folia Phoniatr Logop 2010;62:303-7.
12. Angelillo M, DiMaaio G, Costa G, Angellilo N, Barillari V. Prevalence of occupational voice disorders in teachers. J Prev Med Hyg 2009;50:26-32.
13. Ohlsson AC, Andersson EM, S€odersten M, Simberg S, Barregard L. Prevalence of voice symptom and risk factors in teacher students. J Voice 2012;26:629-34.
14. Morton V, Watson DR. The teaching voice: Problems and perceptions. Logoped Phoniatr Vocol 1998;23:133-9.
15. Sapir S, Keidar A, Mathers-Schmidt B. Vocal attrition in teachers: Survey findings. Eur J Disord Commun 1993;28:177-85.
16. Kooijman PG, de Jong FI, Thomas G, Huinck W, Donders R, Graamans K, *et al.* Risk factors for voice problems in teachers. Folia Phoniatr Logop 2006;58:159-74.
17. Tavares EL, Martins RH. Vocal evaluation in teachers with or without symptoms. J Voice 2007;21:407-14.
18. Smith E, Kirchner HL, Taylor M, Hoffman H, Lemke JH. Voice problems among teachers: Differences by gender and teaching characteristics. J Voice 1998;12:328-34.
19. Russell A, Oates J, Greenwood KM. Prevalence of voice problems in teachers. J Voice 1998;12:467-79.
20. Cantor Cutiva LC, Vogel I, Burdorf A. Voice disorders in teachers and their associations with work-related factors: A systematic review. J Commun Disord 2013;46:143-55.
21. Kooijman PG, de Jong FI, Oudes MJ, Huinck W, van Acht H, Graamans K, *et al.* Muscular tension and body posture in relation to voice handicap and voice quality in teachers with persistent voice complaints. Folia Phoniatr Logop 2005;57:134-47.
22. Meulenbroek LF, de Jong FI. Voice quality in relation to voice complaints and vocal fold condition during the screening of female student teachers. J Voice 2011;25:462-6.
23. Aghadoost O, Amiri-Shavaki Y, Moradi N, Jalai S. A comparison of dysphonia severity index in female teachers with and without voice complaints in elementary schools of Tehran, Iran. Nurs Midwifery Stud 2013;1:133-8.
24. Hakkesteegt MM, Brocaar MP, Wieringa MH, Feenstra L. The relationship between perceptual evaluation and objective multiparametric evaluation of dysphonia severity. J Voice 2008;22:138-45.
25. Van Lierde KM, Claeys S, Dhaeseleer E, Deley S, Derde K, Herregods I, *et al.* The vocal quality in female student teachers during the 3 years of study. J Voice 2010;24:599-605.
26. Urrutikoetxea A, Ispizua A, Matellanes F. Vocal pathology in techers: A video-laryngo-stroboscopic study in 1046 teachers. Rev Laryngol Otol Rhinol 1995;116:255-62.
27. de Ceballos AG, Carvalho FM, de Araújo TM, Dos Reis EJ. Auditory vocal analysis and factors associated with voice disorders among teachers. Rev Bras Epidemiol 2011;14:285-95.
28. Munier C, Kinsella R. The prevalence and impact of voice problems in primary school teachers. Occup Med (Lond) 2008;58:74-6.
29. Kosztyła-Hojna B, Rogowski M. Usefulness of video-laryngo-stroboscopy in the diagnosis of laryngeal pathology. Pol Merkur Lekarski 2003;14:413-6.

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