Voice disorders in teachers: self-report, auditory-perceptive assessment of voice and vocal fold assessment

Distúrbio de voz em professores: autorreferência, avaliação perceptiva da voz e das pregas vocais

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ABSTRACT

Purpose: To analyze the presence of voice disorders in teachers in agreement between self-report, auditory-perceptive assessment of voice quality and vocal fold assessment. **Methods:** The subjects of this cross-sectional study were 60 public elementary, middle and high-school teachers. After answering a self-awareness questionnaire (Voice Production Conditions of Teachers – CPV-P) used to characterize the sample and collect self-report data regarding voice disorders, the teachers were submitted to speech sample collection procedures and laryngoscopic examination. In order to classify the voices, three speech-language pathologist judges used the GRBASI scale, and an otorhynolaryngologist described the alterations seen in the vocal folds. Data were descriptively analyzed and then submitted to association tests. **Results:** In the questionnaire, 63.3% of the subjects reported having or having had a voice disorder, while 43.3% were diagnosed with a vocal quality deviation and 46.7% with vocal fold alteration. There was no association between self-report and voice quality assessment, or between self-report and vocal fold evaluation, with low levels of agreement between the three assessments. However, there was association between voice quality and vocal fold assessment, with intermediate level of agreement between them. **Conclusion:** There were more self-reported voice disorders than what was found in the auditory-perceptive and vocal fold assessments. The intermediate agreement between the two assessments predicts the need for the use of at least one of these techniques when performing screening procedures in teachers.

Keywords: Voice; Voice disorders; Faculty; Auditory perception; Laryngoscopy

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INTRODUCTION

Teachers are at high risk of developing occupational voice disorders, due to their exposure to several factors related to work organization and environment[1-3]. This fact may present important effects regarding work and economy in general[4].

Authors have affirmed[5] that vocal symptoms begin slowly and sporadically, and develop in time until they become permanent, with the onset of laryngeal disorders. Symptoms such as hoarseness, vocal strain and sore throat are signs of vocal abuse or intense vocal use in inappropriate conditions, and may contribute to the development of an occupational disorder.

In a research[6] that analyzed 500 studies about the teacher's voice, published in a 15-year period, the authors concluded that 415 (83%) made reference to evaluation procedures, of which more than half (52.3%) were from the teachers' perspective, followed by perceptive auditory analysis performed by speech-language pathologists (SLP) (15.2%). Among these studies, some[1,7,8] evidence prevalence indexes of vocal symptoms that were self-reported by teachers between 30% and 60%. It should be noted that the

research that had the lowest prevalence levels was conducted with teachers of deaf students, who, therefore, do not use their voices in the same way as teachers of hearing students[8]. In Brazilian studies that mentioned SLP evaluation[5,9,10], the number of teachers found to have voice disorders varied from 17.1 to 80%.

However, this variation is even larger when studies[10-12] used otorhynolaryngological evaluations, with percentages that range from 17.1% to 100% of occurrences. This variation, both in SLP and in otorhynolaryngological evaluations, may be explained mainly by the diversity in the methods used in the different studies.

Voice disorders have been responsible for leading several voice professional to situations of replacement or incapacity to perform their activities, which implies in financial and social costs. Furthermore, these professional, specifically the teacher, may be readapted to another function, which, aside from the mentioned consequences, may also cause personal, economic, professional and functional problems to the school.

It is important to compare self-perception, perceptual auditory assessment of voice and vocal fold evaluations in order to aid in the planning of specific screenings for teachers in schools so that different interests are met, including compliance with the laws regarding the vocal health of teachers, that are becoming increasingly frequent in Brazil[13].

In order to decide which screening procedures should be included in health promotion programs or prevention of certain ailments in workers, the cost/benefit relationship is always discussed. Thus, studies that may provide guidance on which procedure(s) present greater sensibility or specificity are always needed.

The purpose of the present study was to analyze the presence of voice disorders in teachers in agreement within self-report, perceptive-auditory and vocal fold evaluation.

METHODS

This is a cross-sectional, prospective, observational study, that was approved by the Research Ethics Committee of the Pontifícia Universidade Católica de São Paulo, under process number 0036/2006.

The city of Sorocaba (located in the State of São Paulo, at a distance of 96 km of the State Capital, São Paulo, approximately 600,000 inhabitants) issued an invitation for study development, as their aim was to begin a survey about the presence of voice disorders among the teachers in the city school system. Two elementary, middle and high schools were selected, and the criteria for selection were that these were large schools that worked during three periods during the day (morning, afternoon and night), and had elementary, middle and high school students. The schools were located in two different city regions, one in the city outskirts, and the other, downtown.

After the schools accepted to participate, all teachers (99) were invited to take part in the study. After study presentation, 39 teachers were excluded, due to the following reasons: did not agree to participate in all study phases, i.e., questionnaire completion and perceptual evaluation of voice and vocal folds (34), were readapted or on vacation (four); and had anatomical and functional alteration due to an accident (one). In all, 60 teachers distributed equally among both schools (31 and 29) took part in the study. All subjects signed a free consent term before the beginning of procedures.

Firstly, the participants completed the self-perception questionnaire named Voice Production Condition of Teachers – CPV-P[3]. All 79 questions of this instrument were documented, but, in this study, the data taken into account referred to the data concerning: social-demographics (age, gender, schooling, marital status, other occupation and number of work hours), past or present voice disorder, vocal symptoms (hoarseness, breaking voice, voice loss, shortage of breath, high-pitched voice, low-pitched voice, high-low pitch varying voice, weak voice); and laryngeal and pharyngeal sensations (globus, sore throat, secretion/phlegm in throat, dry throat, pain when speaking, pain when swallowing, phlegm and strained speech).

The answers to the vocal symptoms and laryngeal and pharyngeal sensations in this questionnaire are presented in a four-point Likert scale (never, rarely, sometimes, always). The teachers were considered as having a self-reported voice disorder when a minimum of two symptoms or sensations were reported present either “sometimes” or “always”.

Then, speech samples were collected in order to provide material for the perceptive-auditory assessment of voice, during the teachers’ scheduled work/meeting time (HTPC). The *corpus* was composed of a sustained vowel /a/, the same vowel in a scale, and semi-spontaneous speech samples. In order to collect these semi-spontaneous speech samples, the teachers were asked to present a lecture of a theme of his/her choice, and also answered three questions, used in a previous study[14]: “What factors do you think interfere in your voice? Why?”; “Do you think your work in school interferes in your voice? Why?”; and “Do you think that the school’s physical environment interferes in your voice? Why?”.

The recording was performed using a Plantronics® headset microphone type GameCom PRO1, placed at a distance of approximately 15cm from the lips, attached to an HP® Pavillion ZE 4920 CEL M330 1.4G notebook. All voices were recorded directly on a notebook using Sony® Sound Forge 7.0 software.

The samples were digitalized in audio format using the Sony® Sound Forge 7.0 software, and lasted 1’30”, so that they could be analyzed in a perceptive-auditory perspective. This material was presented to three Speech-Language Pathologist judges, who were experienced in using the GRBASI scale[15], that identifies the Grade of voice deviation and five independent aspects: roughness (R), breathiness (B), asteny (A), strain (S) and instability (I). All parameters were evaluated using the four-point scale, where 0 means normal or absent, 1 mild, 2 moderate and 3 extreme.

Even though the judges were experienced, they were submitted to an evaluation balancing procedure, where a few voices were presented for assessment. Then, each voice was evaluated by the judge individually and afterwards, the judges were asked to reach a consensus and classify each voice as

"deviated" when there was mild (grade 1), moderate (grade 2) or extreme (grade 3) grades of deviation and "normal" when the given grade was 0.

Vocal fold evaluation was performed by an otorhynolaryngologist, with 23 years' experience, and who used a flexible Machida® ENT-30P-III flexible nasolaryngoscope. The examination took place in school, during the HTPC time period. Once the device was inserted into one of the nostrils, the teacher was asked to sustain the vowels /a/, /ɛ/ and /i/; and then vowels /a/ or /ɛ/ in ascending *glissando*, depending on which vowel was easier for the subject; and, finally, they were asked to count from one to ten in their usual tone of voice.

After this procedure, the same professional analyzed each image and registered the findings on a specific protocol. The vocal folds were then considered "altered" in the presence of: supraglottic constriction (medial or anterior-posterior), mass lesions (nodules, polyps, Reinke's edema, thickening, edema and cyst), signs of gastroesophageal reflux and incomplete glottal closure (posterior triangular chinks were not considered abnormal as they are physiological). It should be noted that the description of incomplete glottal closures, in the absence of associated lesions, was contemplated in otorhynolaryngologic diagnosis.

The data referring to all procedures were entered twice in order to minimize the occurrence of errors. All variables were submitted to descriptive statistical analysis, and then the agreement among the three procedures (self-report, perceptive auditory assessment of voice and vocal fold evaluation) was analyzed using the Chi-square test and Kappa correlation coefficient. In these analyses, values higher than 0.75 were considered excellent agreement, below 0.40, low level of agreement, and values in between 0.40 and 0.75, intermediate levels of agreement[16]. All statistical analyses considered 5% ($p \leq 0.05$) as the level of significance.

RESULTS

The participating teachers were mainly of the female gender (66.7%), with mean age of 41 years (SD±9.81), married (61.7%), and with no other occupation (81.7%). Almost all subjects had college degrees (98.3%), and work over 20 hours per week (91.5%). In regards to the vocal aspects, of the 60 participating teachers, 38 (63.3%) reported having a voice disorder, past or present, and reported a minimum of two symptoms of laryngeal and pharyngeal sensations.

The most frequent vocal symptoms in the studied population were hoarseness (43.3%), low-pitched voice (30%) and weak voice (30%). The main sensations in throat mentioned by the teachers were phlegm (60%), dry throat (55%) and sore throat (43.3%) (Table 1).

The occurrence of voice disorder was confirmed by the SLP evaluation using the GRBASI scale in 26 (43.3%) teachers, of which 18 (30%) were mild, seven (11.1%) were moderate and one (1.7%) was extreme. Regarding the parameters evaluated by the scale, most cases presented roughness (40%) and breathiness (28.3%). None of the voices presented asteny (Table 2).

Regarding the otorhynolaryngologist's evaluation, 28 (46.7%) subjects had abnormal findings in their vocal folds, mainly hyperemia (ten – 35.7%), signs of gastroesophageal reflux – GER (eight – 28.6%), edema (five – 17.8%), and nodules (five – 17.8%) (Table 2).

The association and agreement among the three procedures (self-report, perceptive-auditory assessment of voice and vocal fold evaluation) was studied (Table 3). It may be observed that 44 (74%) of the teachers had compatible voice quality and vocal fold evaluations and, among the others, nine had abnormal findings in their vocal folds that were not compatible with degree of voice deviation. For other seven subjects, the opposite was true (Table 4). Finally, the sensitivity and specificity of the three procedures (self-report, perceptive-auditory assessment of voice and vocal fold evaluation) were analyzed (Table 5).

DISCUSSION

The subjects sample in this study is similar to other studies developed in this field: most are females, a factor that, in it-

Table 1. Number and percent of vocal symptoms and laryngeal and pharyngeal sensations reported by teachers (n=60)

Vocal symptoms			Laryngeal and pharyngeal sensations		
	Present n (%)	Absent n (%)		Present n (%)	Absent n (%)
Hoarseness	26 (43.3)	34 (56.7)	Sore throat	26 (43.3)	34 (56.7)
Voice loss	12 (20)	48 (80)	Secretion/phlegm in throat	24 (40)	36 (60)
Breaking voice	17 (28.3)	43 (71.7)	Dry throat	33 (55)	27 (45)
High-pitched voice	7 (11.7)	53 (88.3)	Pain when speaking	15 (25)	45 (75)
Shortage of breath (n=59)	12 (20.3)	47 (79.7)	Globus	14 (23.3)	46 (76.7)
Low-pitched voice	18 (30)	42 (70)	Pain when swallowing	17(28.3)	43(71.7)
High/low-pitch varying voice	6 (10)	54 (90)	Phlegm	36 (60)	24 (40)
Weak voice (n=59)	18 (30)	41 (70)	Strained speech	35 (58.3)	25 (41.7)

Table 2. Numeric and percent distribution of teachers, according to the frequency of voice disorder detected by auditory-perceptive assessment of voice and vocal fold evaluation (n=60)

Variable	Category	Present		Absent	
		n	%	n	%
Perceptive evaluation of voice (GRBASI)	Grade of deviation	26	43.3	34	56.7
	Roughness	24	40.0	2	60.0
	Breathiness	17	28.3	9	71.7
	Strain	13	21.7	13	78.3
	Instability	2	3.3	24	96.7
VF evaluation	Altered vocal folds	28	46.7	32	53.3
	Hyperemia	10	35.7	18	64.3
	Signs of reflux	8	28.6	20	71.4
	Edema	5	17.8	23	82.2
	Nodules	5	17.8	23	82.2

Note: VF = vocal folds

Table 3. Numeric and percent distribution of teachers, according to alterations in auditory-perceptive evaluation, vocal fold evaluation, and self-reported voice disorder (n=60)

Variable		Self-reported voice disorder						
		Absent		Present		Total		Kappa (p-value)
		n	%	n	%	n	%	
Perceptual alteration of voice	Absent	13	59.1	21	55.3	34	56.7	0.034 (0.773)
	Present	9	40.9	17	44.7	26	43.3	
VF alteration	Absent	15	68.2	17	44.7	32	53.3	0.214 (0.079)
	Present	7	31.8	21	55.3	28	46.7	

Kappa agreement test and Chi-square association test ($p \leq 0.05$)
Note: VF = vocal fold

Table 4. Numerical and percent distribution, according to variables related to voice and vocal fold alterations (n=60)

Perceptive voice alteration	VF Alteration				Total	
	Present		Absent			
	n	%	n	%	n	%
Present	19	67.9	7	21.9	26	43.3
Absent	9	32.1	25	78.1	34	56.7
Total	28	100.0	32	100.0	60	100.0
Statistics	Kappa=0.462; p<0.0001*					

* Significant values ($p \leq 0.05$) – Kappa agreement test and Chi-square test
Note: VF = vocal fold

Table 5. Percent distribution of sensitivity and specificity related to self-reported voice disorder and perceptive-auditory voice assessment, in relation to vocal fold evaluation (n=60)

Variable	VF Evaluation	
	Sensitivity (%)	Specificity (%)
Self-reported voice disorder	75.0	46.9
Perceptual evaluation of voice	67.9	78.1

Note: VF = vocal fold

self, may account for a greater number of voice disorders[5,12]; with mean age close to the end of the period of maximum vocal efficiency[17]; who have teaching as their only occupation; and work for more than 20 hours per week[7]. The high percentage of teachers with college education is also similar to other studies[1], and is related to the demands of the Law for Educational Standards of Brazil (LDB).

Self-reported voice disorders occurred in numbers similar to those reported by a national study[2] and international studies[17,18]. The percentage in the present study is higher when

compared to some studies[7,8,12,19,20], and lower when compared to others[8,10,11,21]. These discrepancies may be related, among other aspects, to organization and environmental factors that vary according to the reality of the places where studies were conducted, or even to differences in the methodology of each study[18]. This factor confirms the multi-factor nature of voice disorders[22].

The occurrence of vocal symptoms may also difference according to reports of percentage, according to the analyzed study. The most commonly reported symptom by the subjects in this study (hoarseness) is associated to the presence of dysphonia and considered as an indicative of a voice disorder[23]. It should also be noted that even though most studies relate this symptom to intensive speech contexts, it may also occur due to inappropriate hydration, jaw-opening limitations (overloads laryngeal structures during voice production), number of hours of sleep or lack of rest, according to a national study[24].

As far as the most commonly reported laryngeal and pharyngeal sensations (phlegm, dry throat and sore throat), these may also vary, in reports and percentage, according to the studied group of teachers[5]. It may be considered that the fact that the teachers speaks in an inadequate work environment and organization conditions may generate an overload in the organs for phonation. This situation, when added to poor hydration, leads to a discomfort understood as dry throat, which may develop into a painful or sore throat.

In this study, the number of teachers with voice disorders confirmed by perceptive-auditory voice evaluation (43.3%) was similar to a finding in an international study[21], inferior to those in some national researches[5,12] and higher than those in others[10,19]. In spite of these differences, it has been stated by an international study[25], that the prevalence of voice disorders in teachers is usually estimated close to 50%. This is an alarming percentage, since many teachers tend to reduce their activities due to their voice conditions[19].

Once again, this diversity in values seems to indicate that the use of different investigation methods may yield varied results, which makes the measurement of the impact of the presence of voice disorders in the health of teachers in Brazil more difficult. This fact was also discussed in an American study[22], that detailed a survey of studies that aimed to establish the occurrence of voice disorders among teachers. These studies showed a variation from 21% to 80% of pre-school, elementary, middle and high school teachers with voice disorders. However, the comparison of the findings was not effective, because, according to the authors, different criteria were used to determine the presence of voice disorder. Therefore, it may be said that in order to conduct epidemiological studies, there needs to be a uniformity of procedures in order to determine the occurrence of this disorder.

It should be noted that, in the present study, when the teachers' voices were considered abnormal, they were classified into mild or moderate grades, with predominant parameters being breathiness and roughness, present in voices with functional dysphonia[26]. Breathiness, found in the perceptive-auditory assessment of the teachers voices, indicates incomplete glottal closure, that may be detected in several laryngeal conditions, such as nodules, polyps and *sulcus vocalis*, present in the vocal fold evaluations performed in this study, as well as in others[27].

Particularly in this study, the occurrence of subjects with diagnosed lesions in the vocal folds coincided with a national study[15], and was higher than in some studies[10,20] and lower than in others[5,11,20]. The higher values found in some studies may be justified by the methods used in most of them, since in order to deal with aspects related to place and time for examination, as well as with the cost of procedure, the population submitted to laryngeal examination was always smaller when compared to the initial population. In some of these studies[10,11,20], before proceeding with the exam, the researchers selected the teachers through a questionnaire and/or an SLP assessment, so that only those subjects who had a voice complaint and/or abnormal SLP evaluation results were submitted to ENT evaluation.

There was no observed association or agreement between self-reported voice disorders (in greater number) and perceptive-auditory evaluation, nor between self-report and perceptive vocal fold evaluation, which confirms findings from another national study[10]. Therefore, the premise that the teacher has difficulties in perceiving their health-disease process[28] may be refused, since they reported voice disorders more often when compared to professional evaluations. It must be noted that actions that promote vocal well-being that spread guidance to voice professional aiming at immediate treatment at the onset of vocal symptoms should be enforced, as a way to prevent future ailments.

The agreement between the assessment performed by professional (74%) is high, with intermediate level of Kappa agreement, which coincides with the results of another national study[29]. Therefore, one of the two procedures (perceptive-auditory assessment of voice or vocal fold evaluation) should take place alongside symptom survey in voice disorder prevention programs, so that there may be a better understanding of the needs that must be met for each population.

If the cost-benefit balance is at stake when making a decision about screening procedures for these programs, the conduction of perceptive-auditory evaluations of voice may be considered, as it enables the planning of programs for the promotion of vocal well-being and prevention of voice disorders in a faster, less invasive (considering the comfort of the subjects) and cheaper way. This fact is reinforced by the result of the calculations of the sensitivity and specificity of self-report of voice disorders in relationship with vocal fold evaluation, since the questionnaire is a sensitive method to detect voice disorders. The SLP evaluation using the GRBASI scale proved to be a specific method, which was also found by another study[30].

It was observed in this study that in addition to abnormal findings in the glottal font (larynx) detected by the use of the GRBASI scale, several teachers had other problems in oral communication (articulation, resonance, breathing, among others). The use of protocols that also consider filter aspects is suggested for future studies, so that there may be a combined analysis of the aspects of phonation (larynx) and articulation (supralaryngeal).

CONCLUSION

This study confirms greater self-report of voice disorder by the participating teachers than was found by perceptive--auditory and vocal fold evaluation, probably due to the presence of symptoms that have not yet constituted a voice or laryngeal disorder. The intermediate agreement between both evaluations predicts the need to conduct at least one of these procedures in order to better identify the specific needs during screening and in the implementation of programs aiming the promotion of vocal well-being or the prevention of voice disorders in teachers.

RESUMO

Objetivo: Analisar a presença do distúrbio de voz em professores na concordância entre autorreferência, avaliação perceptiva da voz e das pregas vocais. **Métodos:** Deste estudo transversal, participaram 60 professores de duas escolas públicas de ensino fundamental e médio. Após responderem questionário de autopercepção (Condição de Produção Vocal do Professor – CPV-P) para caracterização da amostra e levantamento de dados sobre autorreferência ao distúrbio de voz, foram submetidos à coleta de amostra de fala e exame nasofibrolaringoscópico. Para classificar as vozes, três juízes fonoaudiólogos utilizaram à escala GR-BASI e, para pregas vocais (PPVV), um otorrinolaringologista descreveu as alterações encontradas. Os dados foram analisados descritivamente, e a seguir submetidos a testes de associação. **Resultados:** No questionário, 63,3% dos participantes referiram ter ou ter tido distúrbio de voz. Do total, 43,3% foram diagnosticados com alteração em voz e 46,7%, em prega vocal. Não houve associação entre autorreferência e avaliação da voz, nem entre autorreferência e avaliação de PPVV, com registro de concordância baixa entre as três avaliações. Porém, houve associação entre a avaliação da voz e de PPVV, com concordância intermediária entre elas. **Conclusão:** Há maior autorreferência a distúrbio de voz do que o constatado pela avaliação perceptiva da voz e das pregas vocais. A concordância intermediária entre as duas avaliações prediz a necessidade da realização de pelo menos uma delas por ocasião da triagem em professores.

Descritores: Voz; Distúrbios da voz; Docentes; Percepção auditiva; Laringoscopia

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