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Brief Communication

Comunicação Breve

Vocal dose in teachers: correlation with dysphonia

Dose vocal em professores: correlação com a presença de disfonia

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Keywords

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ABSTRACT

Teachers are professionals with high prevalence of dysphonia, whose main risk factors are the large work hours in classrooms with the presence of background noise. The purpose of the study was to calculate the phonation time and the cycle dose of teachers with dysphonia and teachers without voice disorders during the class. There were two groups analyzed: five teachers with functional dysphonia were the first group and five teachers without voice disorders were the second group. For the data was used the VoxLog® dosimeter and the parameters were: intensity; fundamental frequency; phonation time and cycle dose. The statistical analysis used ANOVA, Student's T-test, and Kruskal–Wallis test. Dysphonic teachers showed major values of phonation time and cycle dose compared with teachers without voice disorders. The dysphonia is related to extended period of speech time and greater exposure of the tissue of the vocal fold to phonotrauma.

Descritores

Voz
Disfonia
Fonoaudiologia
Distúrbios da Voz
Acústica da Fala
Docentes

RESUMO

Professores são profissionais com alta prevalência de disfonia, para a qual os principais fatores de risco são as longas jornadas de trabalho em salas de aula com presença de ruído ambiental. O objetivo da pesquisa foi calcular o tempo de fonação e a dose cíclica de professoras com disfonia e de professoras sem alteração de voz durante a atividade letiva. Para o estudo, dois grupos foram analisados: cinco professoras com disfonia funcional constituíram o grupo de professores disfônicos, e cinco professoras sem alteração de voz constituíram o segundo grupo. Para a coleta dos dados foi utilizado o dosímetro marca VoxLog® e os parâmetros analisados foram: intensidade; frequência fundamental; tempo de fonação e dose cíclica. Na análise estatística foram utilizados os testes Anova, T de Student e Kruskal-Wallis. Observou-se que professores disfônicos apresentaram um maior tempo de fonação e de dose cíclica quando comparados com professores sem alteração vocal. A disfonia associa-se com um tempo maior de fonação e uma exposição maior do tecido da prega vocal a fonotraumas.

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INTRODUCTION

Teachers are included in a professional category that presents high prevalence of dysphonia, and the literature describes the long working hours in inappropriate classrooms, with the presence of background noise and chalk dust as the main risk factors[1,2].

The metrics of the vocal dose among teachers were analyzed in researches aimed at understanding the use of the voice in such professional category[3,4]. Authors concluded that teachers have twice the phonation time when compared with non-occupational voice users[3] and that the presence of dysphonia complaints increases teachers' vocal dose[4].

The dosimeter is a portable device that measures data related to the use of the voice, storing them for a certain period[5,6]. The collection time of phonation data may vary, reaching up to 24 hours, and the data are collected by means of an accelerometer, which measures the vibration of the skin, and a microphone. The collected acoustic data are also dependent on the equipment, but usually measure fundamental frequency (F0), vocal intensity, and vocal dose[7].

Vocal dose can be defined as the amount of exposure of the tissue of the vocal folds (VF) to vibration over time[8]. There are several types of vocal dose described in the literature and the most common are the following: 1. Time Dose: quantifies the total vibration time of the VF during speech and is measured in seconds; 2. Cycle Dose: quantifies the number of oscillations of the VF in time and is measured in number of cycles; 3. Distance Dose: quantifies the total distance that the VF travel in an oscillatory trajectory, depending on the phonation time, F0, and intensity and is measured in meters[5]. This research aimed at calculating the phonation time and cycle dose of teachers with and without dysphonia during teaching activity.

METHODS

This is an observational analytical pilot study approved by the Research Ethics Committee of Universidade Federal de Minas Gerais (COEP 0531/2011).

We selected two groups for the research: group of dysphonic teachers (G1) consisting of five women complaining of vocal alteration, diagnosed with functional dysphonia and the presence of median-posterior triangular glottic chink in the ENT examination, and aged 35 to 50 years ($\overline{X}$= 45.2 years); and group of teachers without vocal complaints (G2), consisting of five women without complaints related to voice and voice alteration, analyzed by speech evaluation, and aged between 35 and 50 years ($\overline{X}$ = 43.8 years).

There was no age difference between the groups (p = 0.50). All were teachers of a public school and taught in elementary school. Exclusion criteria for both groups included those who had undergone prior speech therapy; who smoked; who had neurological, hearing, or pulmonary disorder complaints; and who were pregnant during the period of data collection.

Samples were collected at the school where the teachers were working, in the early morning, during the first teaching activity for a continuous period of 40 minutes.

To collect the data, we used the dosimeter developed by the University of Linkopings, Sweden, VoxLog® brand of Sonvox, model 3.1, consisting of a microphone, an accelerometer, and a portable unit that stored the vocal data. The accelerometer was placed in the neck near the thyroid cartilage and fixed by an adhesive tape. The collected data were analyzed on a computer using specific software of the equipment consisting of the following parameters:

- Intensity: It was captured by microphone and measured in decibels (dB) (SPL).
- Fundamental frequency (F0): It was captured by the accelerometer and estimated by Fast Fourier Transform[6].
- Phonation time: It is the percentage of recording time in which VF vibrated, measured in percentage[9]. It was captured by the accelerometer.
- Cycle dose: It is defined as the total number of complete oscillatory cycles performed by the VF in a given time interval. It was captured by the accelerometer and obtained by the following equation[6]:

$$Cd = \int_{0}^{tp} K_v \, F_0 \; dt \; kcycles \qquad (1)$$

where kv is 1 for the presence of voice and 0 (zero) for the absence of voice, and F0 is the fundamental frequency in hertz (Hz). As the number of cycles is very high, this parameter is adapted to measure the dose in units of one thousand cycles.

Statistical analysis was performed by the Shapiro–Wilk test, which was used to verify the normality of the sample. To compare the vocal parameters between the groups, ANOVA and t-test were used for variables with normal distribution and the Kruskal–Wallis test was applied for nonparametric variables (vocal intensity and age).

RESULTS

The phonation time and cycle dose were higher in the group of dysphonic teachers (G1) (Table 1).

Table 1. Analysis of the vocal parameters in the two studied groups

Parameters	G1				G2				p Value
	Average	SD	Min	Max	Average	SD	Min	Max	
Fundamental frequency	288.6	17.7	267.2	307.4	304.9	47.5	260.5	382.3	0.12
Vocal intensity	92.2	1.8	90.2	94.7	92.6	3.3	87.2	95.5	0.23
Phonation time	30.7	7.6	20.2	40.7	23.9	6.9	17.7	34.6	0.00*
Cycle dose	238.1	76.9	148.2	341.8	188.8	87.7	116.4	333.5	0.02*

G1 - Group of dysphonic teachers; G2 - Group of teachers without alterations in voice; SD - standard deviation
*Statistically significant

DISCUSSION

The F0 and intensity were similar in both groups. Research shows that the F0 and intensity among teachers do not differ, even in the presence of dysphonia[4]; however, with the continuous use of the voice over time, there is an increase in F0 and intensity[4,10]. This study examined the F0 and intensity for a period of 40 minutes, which suggests that the increase in these parameters is dependent on a more prolonged time of use, which is consistent with the literature[11]. Dysphonic teachers had higher phonation time values and cycle dose, suggesting a greater exposure of the tissue of the VF to consecutive trauma[8]. These results are confirmed by the literature[4] and suggest that the presence of dysphonia may generate more use of voice in dysphonic teachers because of the need to repeat voice emissions, as the presence of dysphonia tends to decrease speech intelligibility of students[12], intensified by the fact that the noise in classrooms also decrease the understanding of the spoken message by the students[13].

This study is a pioneer in the evaluation of vocal dose of teachers in Brazil. Although the sample is small, the findings confirm the results in the literature, which indicate the great vocal dose of teachers[3], intensified by the presence of dysphonia[4]. Further studies with a larger sample and controlling ergonomic work situations are important to understand the effect of cultural interference and work organization in the use of the voice in Brazilian teachers.

CONCLUSION

Teachers with dysphonia have a longer phonation time and higher cycle dose compared with teachers without voice problems. Dysphonia is associated with a longer phonation time and greater exposure of the tissue of the VF to phonotrauma.

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Author contributions

The authors designed and planned the project. EFPP and ATVR collected and analyzed the data; ACCG and JNS organized the text and critically reviewed the manuscript content; MCM and EBLC gave support and final approval to the article to be submitted.