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Original articles

Effects of the exercise of the semi-occluded vocal tract with a commercial straw in the teachers' voice

Efeitos do exercício do trato vocal semiocluído em canudo comercial na voz do professor

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ABSTRACT

Objective: to verify the effects of the phonation exercise in a commercial straw on the voice of teachers.

Methods: a blind intervention study with a single group of teachers. The participants were asked to perform the phonation exercise in a straw immersed in a bottle with water at the beginning of the work shift, for four consecutive weeks. The parameter "overall severity" of the Consensus Auditory-Perceptual Evaluation of Voice (CAPE-V) for the perceptual-auditory evaluation, the Screening Index for Voice Disorder (SIVD) and the self-reported vocal effects were used in the comparison between the pre- and post-intervention moments.

Results: the mean age of the teachers was 45.28 (± 8.48) years, ranging from 30 to 58 years old. The majority of the teachers were females (79.3%). The frequency of self-reported vocal changes was 58.6%. There was a decrease in the mean CAPE-V and SIVD scores in the comparison before and after the intervention with a statistical significance ($p < 0.05$). In the post-intervention, the most frequent self-reported effects occurred were "voice improvement" and "less fatigue" (both with 37.9%).

Conclusion: exercise with a commercial straw promoted improvement in the teachers' voices and self-reported beneficial effects and can be used as a protective measure.

Keywords: Teachers; Voice; Voice Training; Workers' Health; Speech, Language and Hearing Sciences

RESUMO

Objetivo: verificar os efeitos do exercício de fonação em canudo comercial na voz de professores.

Métodos: estudo de intervenção, com grupo único de professores, cego ao avaliador. Os participantes foram solicitados a executar o exercício de fonação em canudo imerso a uma garrafa com água no início do turno de trabalho, por quatro semanas consecutivas. Utilizou-se o parâmetro "grau global de severidade" do protocolo Consenso da avaliação perceptivoauditiva da voz (CAPE-V) para a avaliação perceptivoauditiva, o protocolo de autoavaliação índice de triagem de distúrbios de voz (ITDV) e os efeitos vocais autorreferidos na comparação entre os momentos pré e pós-intervenção.

Resultados: a média de idade dos professores foi de 45,28 (± 8,48) anos, variando entre 30 e 58 anos, sendo composta, na sua maioria, pelo sexo feminino (79,3%). A frequência de alteração vocal autorreferida foi 58,6%. Houve decréscimo na média dos escores do CAPE-V e do ITDV na comparação antes e após a intervenção com significância estatística ($p<0,05$). Na pós-intervenção os efeitos autorreferidos ocorridos mais frequentes foram "melhora na voz", "menor cansaço" (ambos com 37,9%).

Conclusão: o exercício com canudo comercial promoveu melhora na voz dos professores e efeitos benéficos autorreferidos e pode ser utilizado como medida protetora.

Descritores: Docentes; Voz; Treinamento da Voz; Saúde do Trabalhador; Fonoaudiologia

INTRODUCTION

The teacher is the professional who is most ill with voice problems and at the same time is the occupational group that is the focus of most research on this subject. They are highlighted because they present a high risk of developing occupational voice disorders due to exposure to factors that are related to the environment and work organization[1]. When compared to other professions, there is a high occurrence of vocal alterations in teachers associated to factors such as high noise in classrooms and habitual use of loud voice[2].

Even with a high frequency of vocal alterations, teachers continue to use their voice with considerable demand, showing that they are exposed to occupational hazards, and besides that, the use of protective techniques to avoid the appearance of alterations is infrequent[3].

In the literature there is a record of the development of vocal alteration due to occupational use, relating it to the recurrent excessive use of voice[2]. As teachers use it intensely they are predisposed to cause a process of excessive friction by the repetitive movement of the vocal folds, generating a phonotrauma that can lead to lesions in the tissues that make the composition of the anatomical structure[4-7].

A cross-sectional survey of 126 high school teachers from a state school in Macéio, Alagoas, showed that 87.3% of the teachers self-referred to vocal alteration at some point in their teaching work[8]. This study analyzed publications on teacher's voice over a period of 15 years (between 1994 and 2008) and pointed to prevalences of self-reported vocal problems from 30% to 60%[9].

Few intervention studies are carried out to verify the effects of certain techniques on teachers' voices, one of them performed a randomized clinical trial aiming to verify the effects of two techniques on voices of college professors. The most referred vocal symptoms were dry throat sensation and hoarseness before (66.6%, 40.4%, respectively) and after vocal interventions (30.9%, 14.2%, respectively), showing a reduction in the prevalence of vocal symptoms after performing the techniques[10].

A descriptive study aimed at describing the results obtained by a teacher's vocal health prevention program demonstrated a significant decrease in vocal symptoms reported by teachers who participated effectively in the program, particularly in the advanced groups, with vocal exercises[10].

In the literature, there is a series of available vocal exercises to be used with voice professionals and speech therapies[11]. Among them, we can mention phonation exercise performed in commercial straw immersed in water which is a variation of the semi-occluded vocal tract exercise (SOVTE).

The adjustments of these exercises are varied, the partial occlusion of the lip causes a sensation of slight resistance to the passage of sound, allowing the control and performance of the technique without overloading the glottis. In this occlusion of the vocal tract (which is responsible for the articular configurations employed and the resonance properties, as well as the acoustic characteristics of the produced sound) there is a change in the internal pressure in relation to the atmospheric one, altering the glottic configuration and vocal tract, producing better vocal quality. The increase in intraoral pressure generates retroflex resonance which results in adduction and abduction forces on the vocal folds, decreasing the tension and trauma in the collision of the vocal folds[12,13].

Considering the above, the aim of the present study is to verify the effects of the phonation exercise with commercial straw as a protective strategy of the voice. These effects were investigated through protocols of perceptual-auditory evaluation of vocal quality and self-evaluation of teachers from a public school.

METHODS

This study was registered at Platforma Brasil under CAAE (Ethics certificate) no. 19722913.4.0000.0053 and approved by the Research Ethics Committee of the State University of Feira de Santana (UEFS), under the no 423.012 /13.

A pre and post-test study was conducted with a single group of teachers, blinded to the evaluator. 29 teachers from a public school in Salvador, Bahia, participated in the study from July to October 2015. Of the 71 teachers from the school 11 were not found, 10 did not accept to participate in the research, 8 gave up and 6 did not meet the inclusion criteria prior to recording. In all, 36 teachers were eligible to remain in the research, but there were further losses throughout the intervention, 6 teachers dropped out and 1 could not do the post-intervention recording because of sore throat (Figure 1).

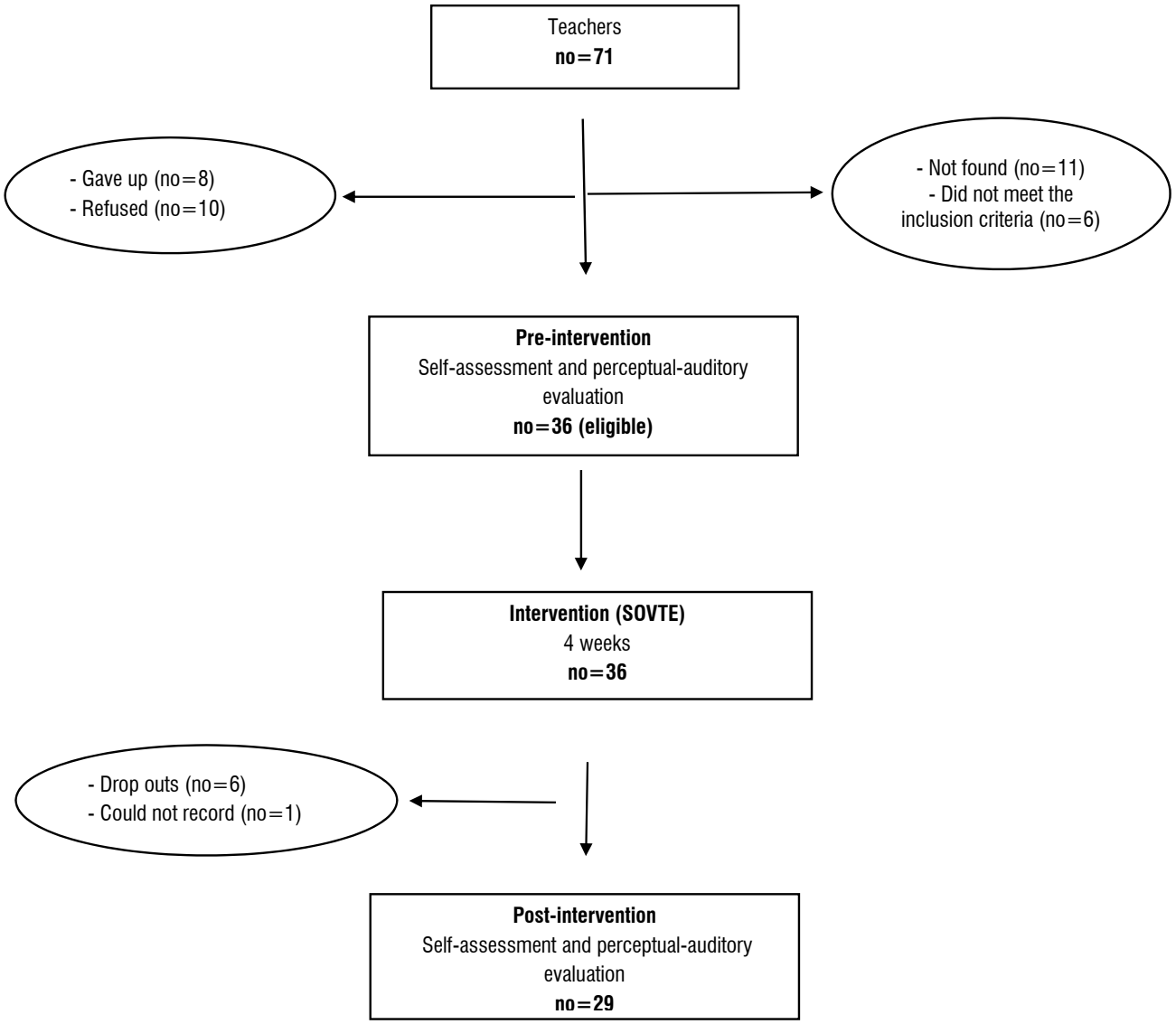

Figure 1. Reasearch flowchart. Salvador, Bahia, 2015

The sample was selected through a convenience criterion. After authorization from the director of the school unit and with the signing of the agreement, the team members together with the researcher responsible for the study attended Complementary Activities (CAs) and classes intervals to present the project and invite for participation. All practicing teachers were invited to participate in the research. Those who showed an interest in attending received an envelope containing two copies of the Free and Informed Consent Form (FICF), one copy belonged to the teacher and the other was signed and returned to the team, and the questionnaire entitled «Teaching Conditions» which contained questions on sociodemographic, functional situation, work environment, work organization, vocal, emotional, musculoskeletal aspects, habits and lifestyle.

To participate in the study, teachers should meet the following criteria: present the use of professional voice only in the teaching activity and have a minimum workload of 20 hours per week in the teaching activity. Exclusion criteria were: to have an influenza or upper respiratory tract infection at voice recording times, to be over 65 years old, to be having vocal phonotherapy at the same time of the study and not to participate in all stages of the research.

Vocal recording

The pre-recording protocol created by the research team was used to investigate the presence of influenza, lower respiratory infections and/or respiratory allergies that could prevent the teacher from participating in the study, according to the exclusion and inclusion criteria .

Once the criteria were verified, the participants had their voice samples recorded and archived through *VoxMetria* software from CTS Informática, installed on a *DELL* laptop, *model Inspiron 14R 5437-A10*, *Intel® Core™* i5 processor at 1.60GHz , *MAXXAUDIO4* sound system 64-bit, in a compact, properly calibrated *OTOBEL BEL-BABY2* audiometric booth.

The emissions were captured by a *SHURE SM10A* unidirectional headset microphone, connected to a *SHURE X2U XLR* preamplifier and positioned at a distance of 4cm and at a 45º angle from the mouth of the speaker, according to the instruction of the *VoxMetria* manufacturer.

For voice recording in the pre- and post-intervention moments, the protocol of «Consensus Auditory-Perceptual Evaluation of Voice (CAPE-V) was applied. It consisted of the sustained emission of vowels /a:/ and /i:/, lasting from 3 to 5 seconds; reading of five phonetically balanced phrases; answering to the question «How is your voice today?»; in addition to the CAPE-V questions, it was also requested to emit the vowel /ɛ:/ from 3 to 5 s and at maximum phonation time. Teachers were asked to remain seated inside the booth and emit the sequences in usual tone and intensity.

Perceptual-auditory evaluation

The protocol Consensus Auditory-Perceptual Evaluation of Voice (CAPE-V) was applied as an instrument of perceptual-auditory evaluation of the vocal quality. The CAPE-V was developed as a tool for voice evaluation by speech and language therapists of the *American Speech-Language-Hearing Association* (ASHA), translated into portuguese by Behlau[14]. The purpose of the CAPE-V is to describe the severity of a vocal problem by means of perceptual-auditory parameters. This protocol evaluates six predetermined parameters: overall level of severity, roughness, soprosity, tension, pitch and loudness, with the possibility of adding two additional aspects by the evaluator, besides the resonance evaluation by means of 3 distinct tasks: sustained vowels, specific sentences and spontaneous speech. To analyze the degree of observed deviation, a linear analogue scale with a 10 cm extension (0 to 100 mm) is used, where zero means no vocal alteration and one hundred means marked vocal alteration. The evaluator should make a dash, perpendicular to this line, in order to identify the level of alteration of the evaluated voice samples.

In Brazilian voices, the scores between 0 and 35.5% are considered normal; between 35.6% and 50.5%, suggest that vocal quality has a mild to moderate deviation; from 50.6% to 90.5%, indicate that the change goes from moderate to severe and above 90.6%, indicate that the change is marked[15].

In the present study, the «overall level of vocal severity» parameter was used for the evaluation of vocal samples and statistical analysis.

The material with the vocal samples was sent to three judges, speech therapists specialists with experience in acting together with teachers. In the CD, there was still a file for professionals calibration, with samples of types of voices present in the CAPE-V protocol and the respective operational definition. The judges were asked to read the operational definition and listen to voice samples using a *CLONE®* headset with controled volume. Samples of teachers' voices sent to each evaluator were previously randomized through the *Research Randomizer* program to allow blinding pre and post-intervention and 20% of the recordings were replicated to calculate the internal agreement of the evaluators.

Vocal self-assessment

Participants completed the «Screening Index for Voice Disorder" (SIVD)[16] self-assessment protocol at two distinct times, before and after the intervention. We also applied and analyzed the responses to the open questions «Pre-intervention Expected Effects» and «Post-intervention Perceived Effects» developed by the team and questions about «Post-intervention Perception», adapted from Roy *et al*[17].

The SIVD is a tool used for vocal screening and is highly sensitive. Thus, its use should aid in mapping teacher's voice disorder. The instrument is validated and presents 12 vocal symptoms. The participant should score how often he/she experiences such symptoms: «never,» «rarely,» «sometimes,» or «always.» Each score in the categories «sometimes» or «always» represents a point. The total SIVD score is calculated by means of the simple addition of the obtained points. Values equal to or greater than five suggest the presence of a voice disorder [16].

The «Pre-intervention Expected Effects» and «Post-intervention Perceived Effects» protocols presented the following open questions: «In your opinion, what effects will the intervention have? « and «Cite the effects you noticed after the intervention». The answers to these questions were categorized by means of content analysis and simple frequency distribution[18].

The «Post-intervention Perception» protocol analyzed the teachers' perception regarding the intervention and improvements promoted in the speech. On a frequency scale («None/Little», «Moderate» and «Very Much»), the teachers pointed out how much they perceived improvement in «vocal quality», «clear voice», «speaking ease» criteria and «if they believed in the intervention».

Intervention

All the procedures of preparation and execution of the intervention were carried out by the members of the research team. The team previously received training through workshops to ensure homogeneity of procedures and monitor teachers during the intervention period.

Before the intervention all the subjects had previous contact with the instruments that would be applied, they were also trained to follow the procedure and received a manual that helped them in the execution of the intervention.

In the applied intervention, called semi-occluded vocal tract exercise (SOVTE), adapted from Sihvo[19], commercial straw was used. For the execution of the procedure, the teachers were instructed to emit a sound /v:/ or /vu:/ in three sets of ten repetitions in comfortable tone, without tension and in usual tone with a rest interval of one minute between the series[20]. A STRAWPLAST® commercially available plastic straw of 21cm lenght and 1cm diameter was used, immersed approximately 2 to 3 cm into a half-emptied INDAIÁ® 500 ml (mineral water) pet bottle. The execution of the series took place in the morning and evening periods before the start of the work shift.

The total intervention time was four weeks based on the study by Stemple *et al.*[21]. Each participant had their own instruments for the intervention (straw and bottle pet), being renewed whenever necessary. Teachers were daily followed up by members of the research team throughout the intervention period.

Data Analysis

The *Statistical Package for Social Sciences* – SPSS software, version 19.0 for *Windows* was used for typing, storing and analyzing the data. The population characterization was obtained through descriptive statistics, presenting minimum and maximum values, mean and standard deviation of the quantitative variables and simple frequencies of the categorical variables.

Continuous variables were evaluated for normality by the Q-Q plot that traces the expected values to obtain the normal distribution against the values actually seen in the data[22]. After normality analysis, the centralization measurements were applied according to the distribution pattern presented. Mean and median for parametric and non-parametric distribution, respectively. The paired t-test was used for the variable «overall level of alteration» and for the mean of the SIVD score the Wilcoxon Signal Post test was used, adopting a significance level of 5%.

For inter and intra-rater agreement analysis an Intraclass Correlation Coefficient (ICC) was used with mixed randomized model and absolute agreement type which is an estimated fraction of the total variability of measures, due to variations between individuals. For ICC analysis, the following classification was adopted: ICC <0.4 = poor; $0.4 \leq$ ICC <0.75 = satisfactory; ICC ≥ 0.75 = excellent. The ICC evaluated the pre- and post-intervention measures of the three judges, with a 95% confidence interval respectively. For this evaluation were used singular measures and the agreement between the averages. In order to evaluate the internal consistency of the pre- and post-intervention measures, the *Cronbach*'s α coefficient was also used. The recommended alpha index should be greater than 0.70, but may be accepted when greater than 0.60, both ways ensuring satisfactory consistency. In addition, the variance difference was evaluated with the F-test and 5% significance level. For the study, the most consistent judge's analysis were with *Cronbach*'s alpha coefficient (pre: $\alpha = 0.86$, post: $\alpha = 0.97$) and the intraclass correlation coefficient (pre: ICC = 0.88 ; post: ICC = 0.95). Both suggest an excellent reliability of this judge. F-test was still applied to ICC (pre: $p = 0.024$, post: $p = 0.001$), with statistical significance ($p < 0.05$).

In order to analyze the content of the open questions, a reading and re-reading of the collected material was carried out, identifying the key categories capable of expressing the reports obtained. Based on this analysis, it was possible to identify the different types of effects reported and to evaluate their frequency. Then, the most mentioned effects were registred as a simple frequency which made it possible to compare the main effects reported in the pre- and post-intervention moments of the teachers' responses. The most frequent responses were «voice improvement», «less fatigue», «less hoarseness», «vocal comfort» and «more powerful voice».

RESULTS

29 teachers participated in the intervention. Mean age was 45.28 years (± 8.48), ranging from 30 to 58 years old, most of them were female, 79.3% (18 female teachers). The working time in the teaching activity ranged from 5 to 35 years with an average of 20.53 (± 7.32) years. The average weekly workload was 37 (± 16.63) hours/week, ranging from 14 to 80 hours / week.

58.6% of the teachers presented vocal alteration; 31% reported already having moved away due to a vocal alteration. The majority did not drink alcohol (55.2%) and never smoked (93.1%). Teachers reported water intake during class (62.1%) and most of them did not save their voice in class intervals (55.2%).

The analyzed parameters showed improvement in the post-intervention scores. The mean of the perceptual-auditory analysis score fell from 19.0 to 14.38 and the mean of the SIVD fell from 4.03 to 2.55, both with statistically significant differences (Table 1).

Table 1. Perceptual-auditory evaluation (pae) scores from cape-v and sivd scores from public school teachers self-assessment questionnaire (no= 29) for pre- and post-intervention. Salvador, bahia, 2015

Outcome	Pre-intervention			Post-intervention			p-value
	Mean	SD	Median	Mean	SD	Median	
Escore PA	19,00	8,90	19,00	14,38	10,08	13,00	0,0100*
Escore ITDV	4,03	2,95	4,00	2,55	3,12	1,00	0,0020**

**T-test for paired samples
** Wilcoxon test

Table 2 shows the self-reported indicators in the open questions of the pre- and post-intervention perception questionnaires. The parameters that showed more significant improvements from the pre- to the post-intervention were: less fatigue in speech (13.8% to 37.1%), lower hoarseness (13.8% to 34.5%) and vocal comfort (13,8% to 27.6%) (Table 2).

Table 2. Indicators of self-reported effects for pre- and post-intervention (sovte) in 29 public school teachers in salvador, bahia, 2015

Variables	Pre-intervention		Post-intervention	
	No	%	N	%
Voice improvement	12	41,4	11	37,9
Less vocal fatigue	4	13,8	11	37,9
Less hoarseness	4	13,8	10	34,5
More powerful voice	8	27,6	6	20,7
Vocal comfort	4	13,8	8	27,6
Do not know	3	10,3	2	6,9

Table 3 shows the frequency of post-intervention questionnaire variables. The data obtained reveal that most of the subjects adhered and believed very much in the intervention (70.3% and 72.4%, respectively). The subjects reported that there was a moderate improvement in vocal symptoms (44.8%) and that the voice became clearer (41.4%) after the intervention. When asked about the ease of speaking, (48.3%) they reported that this improvement was significant (Table 3).

Table 3. Frequency of post-intervention questionnaire variables applied after the use of sovte in 29 public school teachers in salvador, bahia, 2015

Variables	Frequency (%)		
	None/Little	Moderate	Very much
Adherence to intervention	----	20,7	70,3
Improvement in vocal symptoms	13,8	44,8	41,4
Clearer voice	24,1	41,4	34,5
Ease of speaking	10,3	41,4	48,3
Believe in the intervention	3,4	24,1	72,4

DISCUSSION

The present study had the aim of verifying the changes in the perceptual- auditory evaluation and in the self-reported issues after the phonation exercise with commercial straw immersed in water in the voice of state public teachers in Salvador, Bahia. The results evidenced an improvement in the perceptual-auditory evaluation in the overall level of alteration after the application of the technique and in the self-referenced data such as «voice improvement», «less fatigue», «less hoarseness», «vocal comfort» and «more powerful voice», there was also a mean decreasing in the SIVD score, a self-assessment protocol used.

The profile of the group of teachers in this research is similar to other studies carried out on these professionals, predominantly female, with a workload of more than 20 hours/week (mean 37 hours/week)[1,23,24].

Studies show that between 54% and 79.6% of this population presents vocal alteration, corroborating with the finding in this study in which 58.6% of the teachers reported some vocal alteration at the moment of the research. This percentage decreased when the teacher was asked if there was any vocal problem in the last six months (55.2%), but still remaining high, as observed in other studies[25,26].

In the perceptual-auditory evaluation, a decrease in the «overall level of severity» of vocal deviation was observed, comparing the pre- and post-intervention moments with statistical significance ($p = 0.01$). Even with vocal quality improvement after the intervention, the means of the percentages before and after the intervention were within pre (19.00%) and post (14.3%) normality standards. In Brazilian voices, the scores between 0 and 35.5% are considered normal[15]. In a study carried out with teachers from all elementary schools in the city of Santa Maria, Rio Grande do Sul, was observed that the findings in the perceptual-auditory evaluation, also evaluated in the CAPE-V scale, were within the normality pattern, as well as in the present study[27]. Another study found opposing results in teachers of a pre-college course and verified that 50% presented mild to moderate alteration, not specifying the tool used to evaluate these voices and also no intervention with a protective measure was performed[28]. In any case, it should be noted the fact that data highlighted the investigated parameters, showing that the teachers were in the normal range, this is not unexpected as there were studied teachers who were in actual professional practice. Occupational studies have shown that workers, in general, are healthier than the general population, since they are continually in selection process - sick workers do not remain active. This effect has been called a healthy worker effect, indicating that only the healthier ones remain in the professional activities[29,30]. Anyway, what stands out here is that the intervention allowed a very significant reduction in the analyzed parameter, strengthening the hypothesis of beneficial effects of the performed intervention.

Most of the studies performed with SOVTE evaluate the overall voice improvement, however, without quantifying the degree of change. In a study of 25 teachers with chronic dysphonia, it was observed that 60% of them had an improvement in vocal quality assessed by CAPE-V after performing the technique with the glass tube[20]. In another study in which the effect of the technique was evaluated using a high-resistance straw in two groups (with and without laryngeal lesion), although voice improved after the technique application there was no statistically significant overall level of alteration in either groups[31].

Self-assessment of voice is widely used in vocal techniques researches and, consequently, it increases the importance of understanding the effects and findings related to the perception of individuals regarding voice after the application of the techniques.

It is a non-invasive procedure that has its own characteristics directed to the needs of individuals, aiming to provide elements for individual and epidemiological[32]. It favors the subjects' adherence to certain preventive actions, as they feel real benefits. Therefore, it is expected the continuity of the technique application and having, in this way, a protective measure to avoid later vocal disorders[13,33,34].

In this study, there was a mean decrease in the SIVD score after the intervention. This demonstrates that the participants of the present study perceived a lower intensity of vocal signs and symptoms after the four weeks of use of the SOVTE technique, causing them to report improvement in vocal emission.

No mention was found in the literature concerning the application of SIVD after the technique performed in this study in teachers. However, in a randomized clinical trial with similar protocol, the *Voice Handicap Index* (VHI), a significant reduction in the protocol score was observed after six weeks of intervention[35]. It is important to emphasize that this study presents a longer intervention time and does not specify the characteristics of the researched population. Another point to be taken into account is the high correlation between the two protocols mentioned above, but they differ from each other. The SIVD consists in detecting the frequency of vocal symptoms, while the VHI verifies the impact of the voice problem on daily life activities[16].

In the present study, it was verified that the teachers expected the beneficial effects of the intervention, as shown by the responses indicated by the teachers in the post-intervention questionnaire where 72.3% reported that they highly believed in the intervention. Since the great majority believed in the benefits, they showed satisfactory adherence (70.3%) at the end of the intervention.

After intervention the improvement in the vocal effects is in agreement with other researches that verified positive effects. In a study carried out with SOVTE on high resistance straw phonation and the technique of *finger kazoo*, it was observed in the self-assessment that the subjects reported more positive effects after the application of the techniques[13]. Another research conducted with only one individual observed that after the execution of the glass and plastic tube he reported more projected voice and with less effort in both exercises[33].

The results found in the current research are in agreement with the results of a study conducted in 46 women (with and without vocal complaints) regarding the vocal self-assessment that showed positive effects with a higher frequency of «easier and better» voice responses[36].

In a research on the immediate effect of a sequence of four SOVTE techniques into tubes, with 24 individuals with dysphonia, there was a predominance of self-reference positive effects, such as greater vocal stability and relaxed muscles[34].

Resonance tubes immersed in water have been described since the 1960s with experiments with different diameters and lengths[37,38]. Two variations of SOVTE performed with resonance, glass and flexible tubes have been described. In general, the effects of these variations are the same, the voice flow and its reflection in the water increases the pressure in the airways which helps to keep the larynx wide and open, avoiding excessive effort, reducing the force of collision between the folds and producing a massage effect on the soft tissues of the mouth and larynx[13,19,20].

Analyzing the existing literature on the effect of SOVTE exercises, it is concluded that a great part observes the immediate effect of these exercises which makes it difficult to compare with the current research[13,20,31,34,36]. The observation of the prolonged effect is important to understand the perception of the individuals in relation to vocal emission.

It should also not be forgotten that the restricted number of subjects limited the study. As it is a convenience sample, without a sample calculation, the results of this research based on a non-probabilistic sampling do not allow generalizations regarding the population of interest. The reduced number of subjects may generate a type II error (false negative) which consists in stating that there is no statistical difference in the studied group[39]. As a result of this small sample, it was not possible to do a random allocation with the use of control group. In addition, improvement in self-perception after intervention may be due to the Hawthorne effect: the fact that teachers feel valued for the care and attention given during the research tends to reinforce the perception of positive behavior change, they tend to meet the research's supposed expectations[40].

As already mentioned above, another limiting factor is the so-called effect of the healthy worker, much found in occupational studies which justifies the low occurrence of teachers with moderate and intense vocal changes self-reported at the beginning of the intervention. The subjects could be away, readapted or abandoned the activity by the vocal aggravation itself,

underestimating the actual frequency of the studied phenomenon. The research was carried out with the teachers who remain in work activity[29,30].

Another limitation of this research is related to the fact that it did not observe the analysis of confounding variables that could influence the aspects studied, due to the small number of samples which also did not allow the build of a control group.

CONCLUSION

The exercise of the semi-occluded vocal tract with commercial straw promoted improvement in vocal quality and self-reported beneficial effects after four weeks of intervention. With this, the technique can be used in vocal health programs as a protective measure for voice in populations that are more exposed to vocal alterations, such as teachers. It also suggests a reflection regarding environmental and organizational determinants of schools which have a direct influence on the voice disorder in teachers, and should be the object of investigations in future studies. The need for collective improvements is essential for the care of teacher's vocal health.

REFERENCES

1. Lima-Silva MFB, Ferreira LP, Oliveira IB, Silva MAA, Ghirardi ACAM. Distúrbio de voz em professores: autorreferência, avaliação perceptiva da voz e das pregas vocais. Rev Soc Bras Fonoaudiol. 2012;17(4):391-7
2. 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(2):143-55.
3. Xavier IALN, Santos ACO, Silva DM. Saúde vocal do professor: intervenção fonoaudiológica na atenção primária à saúde. Rev. CEFAC. 2013;15(4):976-85
4. Hillman RE, Holmberg EB, Perkell JS, Walsh M, Vaughan C. Objective assessment of vocal hyperfunction: an experimental framework and initial results. J Speech Hear Res. 1989;32(2):373-92.
5. Titze IR, Svec JG, Popolo PS. Vocal dose measures: quantifying accumulated vibration exposure in vocal fold tissues. J Speech Lang Hear Res. 2003;46(4):919-32.
6. Mehta DD, Van Stan JH, Zañartu M, Ghassemi M, Guttag JV, Espinoza VM et al.Using ambulatory voice monitoring to investigate common voice disorders: research update. Front Bioeng Biotechnol. 2015;3:155.
7. Van Stan JH, Mehta DD, Zeitels SM, Burns JA, Barbu AM, Hillman RE. Average ambulatory measures of sound pressure level, fundamental frequency, and vocal dose do not differ between adult females with phonotraumatic lesions and matched control subjects. Ann Otol Rhinol Laryngol. 2015;124(11):864-74.
8. Alves LP, Araujo LTR, Xavier Neto JA. Prevalência de queixas vocais e estudo de fatores associados em uma amostra de professores de ensino fundamental em Maceió, Alagoas, Brasil. Rev. bras. saúde ocup. 2010;35(121):168-75.
9. Dragone MLOS. Programa de saúde vocal para educadores: ações e resultados. Rev. CEFAC. 2011;13(6):1133-43.
10. Anhaia, TC, Klahr PS, Ourique AAB, Gadenz CD, Fernandes RA, Spagnol PE et al. Efeitos de duas intervenções em professores com queixas vocais. Audiol. Commun. Res. 2014;19(2):186-93.
11. Pedroso MIL. Técnicas vocais para os profissionais da voz [monografia]. São Paulo (SP): CEFAC – Saúde e Educação; 1997.
12. Titze IR. Voice Training and therapy with a semi-occluded vocal tract: rational and scientific underpinnings. J Speech Lang Hear Res. 2006;49(2):448-59.
13. Sampaio M, Oliveira G, Behlau M. Investigação de efeitos imediatos de Dois exercícios de trato vocal semi-ocluído. Pró-Fono R. Atual. Cient.. 2008;20(4):261-26.
14. Behlau M. Consensus Auditory- Perceptual Evaluation of Voice (CAPE-V), ASHA 2003. Refletindo sobre o novo. Rev Soc Bras Fonoaudiol. 2004;9(3):187-9.
15. Yamasaki R, Madazio G, Leão SH, Padovani M, Azevedo R, Behlau M. Auditory-perceptual Evaluation of Normal and Dysphonic Voices Using the Voice Deviation Scale. J Voice. 2016;16(1):1-5.
16. Ghirardi ACA, Ferreira LP, Giannini SP, Latorre Mdo R. Screening Index of Voice Disorder: development and validation. J Voice. 2013;27(2):195-200.
17. Roy N, Weinrich B, Gray SD, Tanner K, Stemple JC, Sapienza CM. Three treatment for teachers with voice disorders: a randomized clinical trial. J Speech Lang Hear Res. 2003;46(3):670-88.
18. Bardin L. Análise de conteúdo. Lisboa: Edições 70, 1977.

19. Sihvo M. Lax voice tube. IALP Congress e PEVOC; 2007 March 26–2, Groningen, Países Baixos. Copenhagem, Dinamarca; 2007.
20. Paes SM, Zambon F, Yamasaki R, Simberg S, Behlau M. Immediate Effects of the Finnish Resonance Tube Method on Behavioral Dysphonia. J Voice. 2013;27(6):717-22.
21. Stemple JC, Sabol JW, Lee L. The value of vocal function exercises in the practice regimen of singers. J Voice. 1995;9(1):27-36.
22. Field A. Explorando dados. In: Fild, A; Tradução Lorí Viali. Descobrindo a estatística usando o SPSS. Porto Alegre (RS); 2ª ed.; 2009. p. 85-155.
23. Silva GJ, Almeida AA, Lucena BTL, Silva MFBL. Sintomas vocais e causas autorreferidas em professores. Rev. CEFAC. 2016;18(1):158-66.
24. Ceballos AGC, Carvalho FM. Araújo TM, Reis EJFB. Avaliação perceptivo-auditiva e fatores associados à alteração vocal em professores. Revista Brasileira de Epidemiologia. 2011;14(2):285-95.
25. Luchesi KF, Mourão LF, Kitamura S, Nakamura HY. Problemas vocais no trabalho: prevenção na prática docente sob a óptica do professor. Saúde soc. 2009;18(4):673-81.
26. Hermes EGC, Bastos PRHO. Prevalência de sintomas vocais em professores na rede municipal de ensino em Campo Grande - MS. Rev. CEFAC. 2015;17(5):1541-55.
27. Ribeiro VV, Cielo CA. Medidas vocais perceptivo-auditivas e acústicas, queixas vocais e características profissionais de professoras de Santa Maria (RS). Audiol., Commun. Res. 2014;19(4):387-98.
28. Vieira AC, Behlau M. Análise de voz e comunicação oral de professores de curso pré-vestibular. Rev. soc. bras. fonoaudiol. 2009:14(3):346-51.
29. Araújo, TM, Carvalho FM. Condições de trabalho docente e saúde na Bahia: estudos epidemiológicos. Educ. Soc.2009;30(107):427-49.
30. Pereira LPP, Masson MLV, Carvalho FM. Vocal warm-up and breathing training for teachers: randomized clinical trial. Rev. Saúde Pública. 2015;49:67.
31. Costa CB, Costa LHC, Oliveira G, Behlau M. Immediate effects of the phonation into a straw exercise. Braz. j. otorhinolaryngol. 2011;77(4):461-5.
32. Almeida SIC, Pontes P, Bussacos MA, Neves L, Zambon F. Questionário de auto-avaliação vocal: instrumento epidemiológico de controle da síndrome disfônica ocupacional em professores. *Arquivos* Int. Otorrinolaringol. 2010;14(3):316-21.
33. Laukkanen AM, Titze IR, Hoffman HH, Finnegan E. Effects of a semioccluded vocal tract on laryngeal muscle activity and glottal adduction in a single female subject. Folia Phoniatr Logop. 2008;60(6):298-311.
34. Guzmán M, Higueras D, Fincheira C, Muñoz D, Guajardo C. Efectos acústicos inmediatos de una secuencia de ejercicios vocales con tubos de resonancia. Rev. CEFAC. 2013;14(3):471-80.
35. Kapsner-Smith MR, Hunter EJ, Kirkham K, Cox K, Titze IR. A randomized controlled trial of two semi-occluded vocal tract voice therapy protocols. J Speech Lang Hear Res. 2015;58(3):535-49.
36. Maia MEO, Maia MO, Gama ACC, Behlau M. Efeitos imediatos do exercício vocal sopro e som agudo. J. Soc. Bras. Fonoaudiol. 2012:24(1):1-6.
37. Simberg S, Laine A. The resonance tube method in voice therapy: Description and practical implementations. Logopedics Phoniatrics Vocology. 2007;32(4):165-70.
38. Cielo CA, Lima JPM, Christmann MK, Brum R. Exercícios de trato vocal semiocluído: revisão de literatura. Rev. CEFAC. 2013;15(6):1679-89
39. Malavolta EA, Demange MK, Gobbi RG, Imamura M, Fregni F. Ensaios clínicos controlados e randomizados na ortopedia: dificuldades e limitações. Rev. bras. ortop. 2011;46(4):452-9.
40. Santos, IS. Victora, CG.. Serviços de saúde: epidemiologia, pesquisa e avaliação. Cad. Saúde Pública. 2004;20(Supl 2):337-41.