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Controlled and randomized clinical trial of intensive short-term voice therapy with finger kazzo technique in teachers

Ensaio clínico controlado e randomizado de terapia breve e intensiva com *finger kazzo* em professoras: estudo preliminar

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ABSTRACT

Introduction: Knowledge about effective vocal techniques will contributes to the prevention/treatment of work-related voice disorder. **Purpose:** Verifying acoustic vocal, auditory-perceptive and videolaryngostroboscopic measures in dysphonic teachers of two groups before and after a brief and intensive therapy program with finger kazoo technique, comparing to their control groups, and comparing the study groups between themselves. **Methods:** Randomized study, pre-test and post-test, with control group, blind to the evaluator. Two study groups, with and without structural laryngeal affection (24 dysphonic teachers) performed15 sessions of a brief and intensive care with finger kazoo over three weeks and they were compared to two control groups (17 dysphonic teachers), who did not do therapy, in a total of 41 subjects. We carried out vocal acoustic analysis (Multi-Dimensional Voice Program Advanced), perceptual analysis (by three speech therapists) and videolaryngostroboscopy analysis (by three otolaryngologists) to compare the results obtained by each group. **Results:** Significant reduction in harmonic-noise ratio in the study group with alteration after therapy was observed. In the comparison between the study group without affection with the respective control, there was a significant decrease in jitter, shimmer and voiceless segments in favor of the study group. It was also observed a significant reduction in dysphonia, hoarseness, breathiness and tension levels, as well as a lower incidence of triangular slit - level II - and higher amplitude of vibration of the vocal folds in the study group with alteration. **Conclusion:** The brief and intensive care with finger kazoo provided voice, glottal closure and amplitude of mucosal wave vibration of the vocal folds improvements in dysphonic teachers with and without structural alterations of the vocal folds, especially in teachers without structural alterations.

Keywords: Voice; Larynx; Voice quality; Voice training; Voice disorders; Dysphonia; Acoustics; Faculty; Occupational health

RESUMO

Introdução: A efetividade das técnicas vocais contribui com a prevenção/tratamento do distúrbio de voz relacionado ao trabalho. **Objetivo:** Verificar medidas vocais acústicas, perceptivoauditivas e videolaringoestroboscópicas em professoras disfônicas de dois grupos de estudo, antes e após um programa de terapia breve e intensiva com a técnica *finger kazoo*, comparando-os entre si e com respectivos grupos de controle. **Métodos:** Estudo randomizado, pré-teste e pós-teste, com grupo controle, cego ao avaliador. Dois grupos de estudo, com e sem afecção laríngea estrutural (24 professoras disfônicas), realizaram 15 sessões de terapia breve e intensiva com *finger kazoo*, durante três semanas e foram comparados a dois grupos de controle (17 professoras disfônicas), que não fizeram terapia. Realizaram-se análises vocal acústica (*Multi Dimensional Voice Program Advanced*), perceptivoauditiva (três fonoaudiólogos) e videolaringoestroboscopia (três otorrinolaringologistas), para comparação dos resultados. **Resultados:** Observou-se redução significativa da proporção ruído/harmônico no grupo de estudo com afecção, após a terapia. Na comparação entre o grupo de estudo sem afecção e o respectivo controle, verificou-se redução significativa de medidas de *jitter, shimmer* e de segmentos surdos, em favor do grupo de estudo. Constatou-se, também, redução significativa do grau da disfonia, rouquidão, soprosidade e tensão, além de menor ocorrência de fenda triangular de grau II e maior amplitude de vibração das pregas vocais, no grupo de estudo sem afecção. **Conclusão:** A terapia breve e intensiva com *finger kazoo* beneficiou a voz, o fechamento glótico e a amplitude de vibração da onda mucosa das pregas vocais das professoras disfônicas com e sem afecção laríngea estrutural, sobretudo daquelas sem afecção.

Palavras-chave: Voz; Laringe; Qualidade da voz; Treinamento da voz; Distúrbios da voz; Disfonia; Acústica; Docentes; Saúde do trabalhador

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INTRODUCTION

Vocal problems resulting behaviors of vocal hyperfunction are commonly found in voice professionals, especially in teachers[1]. This is due to the specific demands of the teacher, which can be associated with physical, social, environmental, organizational, psychological and overall health[2,3,4]. This statement is illustrated by a recent Brazilian investigation comparing 1.651 teachers to 1.614 other professionals. It was found, with statistical significance that 63% of teachers presented dysphonia history; 29.9% had limitations at work due to voice problems; 12% had already missed work for five days or more and 16.7% even admitted the possibility of future change of profession due to vocal problems[5].

In other study, which involved 675 teachers of both sexes, it was observed that 16.4% of them were undergoing vocal treatment, 71% had sought medical otolaryngologist (ENT), 36.2% went on leave for voice problems and more than half of the sample (52.2%) had never received specific training for the voice[3].

Faced with such evidence on the vocal conditions of teachers and the high dysphonia index, the literature reinforces the need to conduct randomized clinical trials with this population to test different types of interventions by checking which ones are most effective[6,7]. Scientific evidence about the different types of intervention will work so that they can be used more appropriately and safely by speech and language therapists, with the certainty of generating benefits for patients and, thus, indirectly, to society in general[6,7]. Knowledge about effective techniques provided by randomized clinical trials will contribute to the prevention/treatment of work-related voice disorder (WRVD) as well as to the health promotion of teachers[1,6].

There are currently still gaps in speech science in relation to therapy, especially with regard to the number of repetitions of the vocal techniques, Voice Therapy time required for the rehabilitation of different types of dysphonia or laryngeal conditions and number of weekly therapy sessions[6,7,8].

Investigations with therapy in dysphonic subjects which were used different approaches, including vocals and different technical guidelines, showed positive results, however it is not possible to identify the effective role of each approach within the benefits shown at the end of therapy[1,7,8,9,10,11]. Therefore, for the current scan, it was decided to use only an exercise throughout therapy with standard number of repetitions. It is noteworthy that the literature has shown that even exercises classified as semi-occluded vocal tract exercises (SOVTE) are somewhat different in relation to intraoral pressure caused during its execution[12], hoping to different effects also on voice[13], evidencing the importance of studies with only one vocal technique[12,13,14,15,16,17,18].

Works on the immediate effects of FK production show that this technique generates improvement of self-assessment[15,16,19], as well as balance the vocal resonance and the kind of voice with greater stability of the issue. Acoustic analysis showed decrease in noise and higher harmonic energy by the likely improvement of mucosal wave vibration of the vocal folds using this technique in subjects with normal voice[16,18]. The only research that found the immediate effect of FK in dysphonic subjects had as sample teachers with and without laryngeal conditions and there were used six sets of fifteen repetitions of the technique. There were decreased acoustic voice measures of jitter, shimmer, highest fundamental frequency (fhi) and number of voice breaks, besides reduction of breathiness and instability in the study group with no structural laryngeal disorder and instability in the study group with structural laryngeal disorder[19].

Convinced of the benefits of FK, associated with evidence that direct voice therapy is superior to indirect therapy[7,20], once that the latter is only effective when applied in conjunction with the first[1,21], the hypothesis is that FK performed intensively manages benefits over power measurements glottal of dysphonic teachers. Furthermore, the benefits of intensive processing of voice include: voice recovery in a short period of time, increased adherence of the subject, increased use of session time, decreasing the time between sessions and increased ability to transfer strategies learned to everyday life[10,21,22,23]. Thus, it highlights the unprecedented contribution of the ongoing investigation against the current scientific scenario.

This study aims to verify acoustic vocal measures, perceptive hearing and videolaryngostroboscopic in dysphonic teachers from two study groups, one with and the other without structural laryngeal disorder before and after a brief, Intensive Short-Term Voice Therapy (LSVT) with FK technique, compared to the respective control groups as well as to compare the study groups each other.

METHODS

Study design

This was a randomized, pre-test and post-test study (or trial), with a control group, blinded to the evaluator, in which it was decided to perform the analysis of two interventions with their respective control groups, in one trial investigating both the presence/absence of laryngeal alterations and the intervention performed.

Participants

The study was approved of the Ethics Committee of *Universidade Federal de Santa Maria* (23081.016945/2010-76) and all participants signed the Informed Consent (IC), as recommended by the standard 466/2012 of the National Research Ethics Commission. The target population of this

study was made up of working teachers, active in all levels of education[2]. The research was widely publicized in electronic media and access murals to the target population, and schools, colleges and preparatory courses for college entrance and languages have been visited in a medium-sized city in the state.

The criteria described below were based on the literature and the recommendations of the Consolidated Standards of Reporting Trials (CONSORT) for randomized controlled trials. To be included, the subjects should: be a teacher of kindergarten, elementary, middle or top of public or private networks of a medium-sized city of state of inner; being female[3,4,24]; be in the age group between nineteen and sixty years old[4,11,23]; has any of the following laryngeal conditions diagnosed by medical ENT: Normal larynx; posterior glottal opening or medio-posterior glottal opening, anterior gaps (caused by secondary muscle fatigue hypertension), supraglottic hyperconstriction (all of these are classified as "non-structural laryngeal disease") vocal fold nodules, vocal fold polyps, cysts, vasculodysgenesis or even leukoplakia, edema, laryngitis, thickening, irregularities edges of the vocal folds, hyperemia (all those classified as "structural laryngeal disease"); present habits and/or suggestive vocal behavior of hyperfunction[7,10], and hours worked per week at or above to 20 hours.

To ensure the homogeneity of the sample, the following exclusion criteria were established: be on license period, work in breakout rooms or administrative activities; history of neurological, endocrine, psychiatric, stomach or chronic respiratory[4,11,21,23]; account of pregnancy, menstruation or the premenstrual (around five days before the start of menstruation), flu or any respiratory allergy in the days of assessments and reassessments[10,11]; account of alcoholism and/or smoking[4,11]; prior speech therapy report related to voice or singing lessons to avoid the participation of subjects with greater vocal conditioning[21,23]; hearing impairment[10,11,21,23]; stomatognathic system alterations that could interfere in the implementation of FK or voice assessment tasks[12]; participation in less than 70% of therapy sessions[2].

To identify the presence of any of the criteria above mentioned an interview was conducted, during which it was investigated the history, the presence of complaints, vocal demands and habits and incorrect use of the voice. They were considered subjects who had vocal hyperfunction those with vocal complaints associated with one or more patterns of vocal misuse/abuse associated. Still, there were the evaluation of the stomatognathic system, hearing screening (audiometer Fonix FA 12 Digital, Frye Electronics, USA) and stroboscopic.

The flowchart of the participants, according to CONSORT 2010, is presented in Figure 1.

Interventions

The sessions were held in a clinic-school speech therapy institution of higher education, taught by different therapists previously trained (speech and language therapists or academics of speech therapy course) who took turns in the care[6,22,24]. Each therapy session had the following structure: issuing six sets of fifteen repetitions of FK technique[25], with an interval of 1min passive rest (absolute silence) between each series[25]. Water could be consumed freely due to the large airflow during the exercise[17,18].

FK technique should be performed using a set to sound blowing, with rounded and semi occluded lips and the index finger positioned on the lip (as in a silence request gesture), avoiding bulging cheeks or hipertension tongue after comfortable inspiration. The pitch and loudness should remain the same as usual speech. Still, the voice should hear a frictional noise due to airflow in contact with the index finger. Over the repetition of the technique, the teachers should keep steady pace, without using the expiratory reserve or fry the end of the issue and prevent pitch fluctuation and/or loudness, and prevent the upper respiratory tract to breathe before repetitions[14,15,16,17,18,19].

While performing the technique, the teachers remain seated with their feet flat on the floor, back straight to the head without gradients or rotations. In addition, they should not increase muscle contraction of the shoulder girdle and suprahioidea region. The therapist was monitoring these aspects and performed the necessary corrections throughout each session[13]. The teachers were instructed to perform the technique only in the sessions without workout at home, avoiding possible bias of the survey related to the diversity of training time between them[22].

The intervention, that is, the brief and intensive therapy, was carried out with a structure of 15 consecutive sessions, one session per day, over three weeks. The intervention was classified as brief due to the short time in relation to traditional speech therapies, which can last for months, and intensive, since it presented a regime of five weekly sessions[21,22].

Outcomes (assessments)

The SG1 and SG2 performed all evaluations described below before and after 15 sessions of voice therapy[21]. Pre-therapy assessments were always held on Fridays and the first voice therapy session was held on the same day. During the next three weeks, the sessions were held daily, with an interval of two days a week. Post-treatment evaluations were performed after the fifteenth therapy session, that were, always on Thursdays[22]. The teachers of CG1 and CG2 did not receive therapy but performed the evaluations in the same periods of SG. After ending the participation of teachers of CG1 and CG2 in the study, they were asked to perform the same therapy of SG1 and SG2 in the event of interest, to account for the bioethical issues, following the same randomization method described above.

Speech therapy evaluations were performed in a

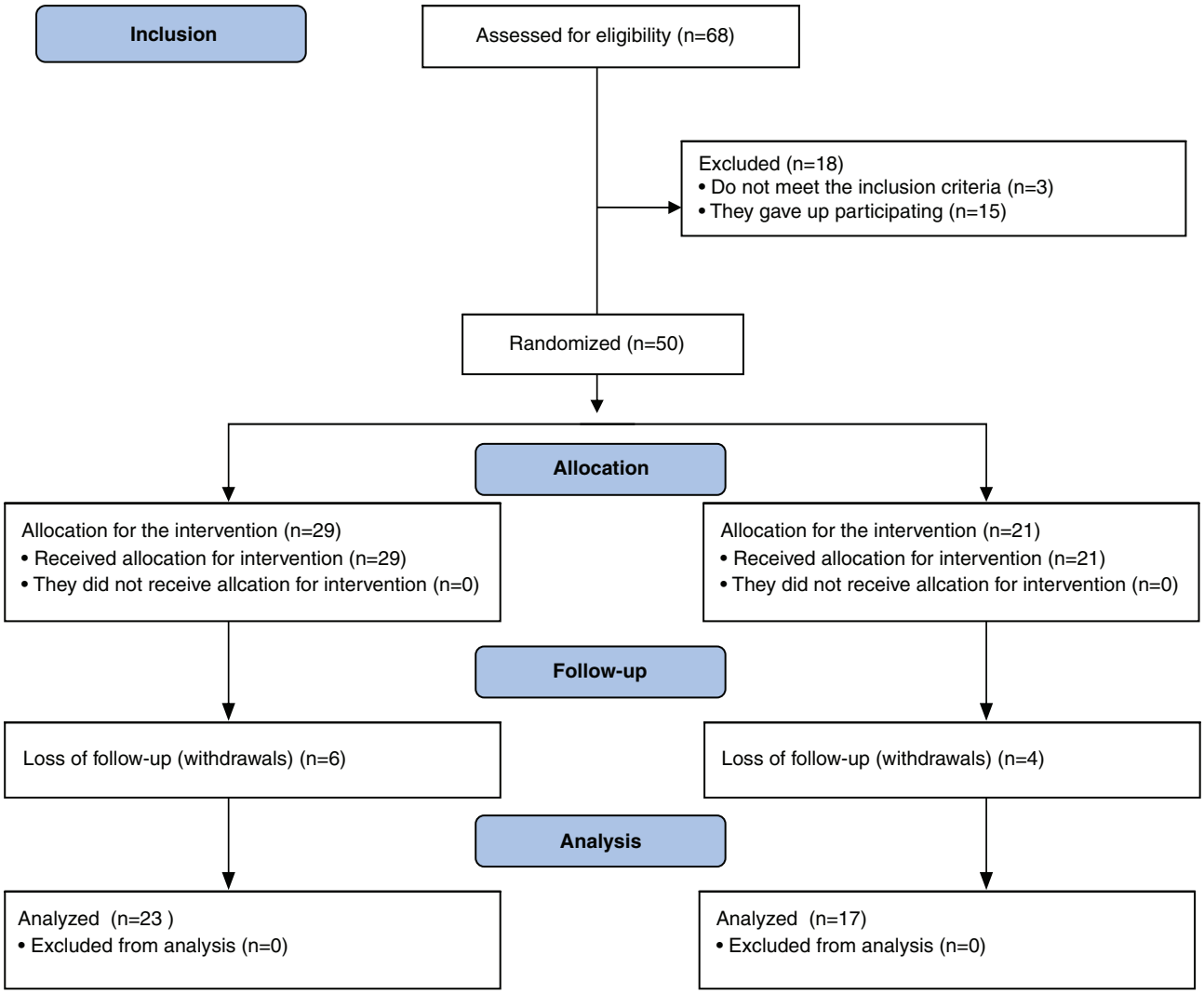

Figure 1. Flowchart of the participants, according to the Consolidated Standards of Reporting Trials (CONSORT 2010)

clinic-school speech therapy institution of higher education in a quiet room with background noise of less than 50dB (measured with Icel® device, DL-4200, Brazil)[4,26]. The vocal emissions were recorded with professional omnidirectional microphone ECM 8000 (Behringer®, Germany) (flat frequency response of 15Hz to 20kHz), coupled to professional digital recorder H4n (Zoom®, United States) (96kHz, 16bits and set at 50% level input signal capture), which was positioned at a distance of 4 cm from the mouth to the tasks of sustained vowels and 10cm for speech tasks, ahead and with 90° angle in relation to the mouth[4,24,26].

- Acoustic analysis: It was used the Multi Dimensional Voice Program Advanced Program (MDVPA) of Kay Pentax® (United States) for the analysis of the vowel /a/, issued in maximum phonation time after a deep nasal inspiration, starting the inspiratory reserve in pitch, loudness and the usual vocal quality, in the standing position until the end of the same expiration starting expiratory reserve; the issue was carried out twice and was considered the highest value[3,4,7,26]. It was eliminated the voice onset and the end of the emissions from all the teachers and it was considered the shorter support of the vowel /a:/ for the time standardization of the window analysis, resulting in a time of four seconds[15,18].

By MDVPA, the following measures were discussed in groups because there is no evidence, yet, of an exact match between each acoustic measurement and physiological phenomenon[26]:

Average fundamental frequency: f0; highest fundamental frequency (fhi); mean f0 (flo); standard deviation of f0 (STD); Frequency disturbance measures: absolute jitter (Jita); Jitter percent (Jitt); relative average perturbation (RAP); Pitch perturbation quotient (PPQ); smoothed pitch perturbation quotient (sPPQ); fundamental frequency (vf0); Amplitude perturbation measures: Shimmer in dB (ShdB); Shimmer percent (Shim); amplitude perturbation quotient (APQ); smoothed amplitude perturbation quotient (sAPQ); Peak-to-peak amplitude variation (vAm); Measures of noise: noise to harmonic ratio (NHR); voice turbulence index (VTI); soft phonation index (SPI); voice breaking action: degree of voice breaks (DVB); number of voice breaks (NVB); Deaf

segments measures or unvoiced: number of unvoiced segments (NUV); degree of voiceless (DUV); Sub-harmonic segments measures: degree of sub-harmonics (DSH); number of sub-harmonic Segments (NSH)[16,26].

- Auditory-perceptual evaluation: The subjects repeated phrases of Consensus Auditory-Perceptual Evaluation protocol of Voice (CAPE-V) and answered the question "What do you think of your voice?" or "What is your vocal complaints?". In addition, the recording of the vowel /a:/ was also used, already mentioned in the acoustic analysis description[26].

Emissions have been edited on computer Asus® Eee PC 1201, Intel Core i7, 1.8GHz, 8GB of RAM, video card Nvidia Geforce 720m and integrated audio card with Sonic Master technology with its unspoilt capture features. The files were transferred to the wave length and the audio format used was PCM; 96kHz; 16bits; Mono. They were subsequently coded and randomized and exported to Dropbox® application to be evaluated by judges. The voices were sent in separate files, by participant and by collection moment, in sequential order and without identification on which moment or subject the file referred, guaranteeing the blinding of the judges.

The vocal auditory-perceptual evaluation protocol was created by the authors based on the CAPE-V protocol[7,26], and RASATI scale[27] considering to review the parameters (hoarseness, roughness, breathiness, asthenia, strained and instability) and overall grade of dysphonia.

For evaluating the degree of deviation observed in each parameter of the auditory-perceptual evaluation, visual-analog scale 10 cm long with limits on the right and left (from zero to 100 mm) was used, where judges should mark a vertical line which best represented your perception for each item evaluated. The left end (zero) was characterized as lack of vocal parameter in question and the right represented the maximum degree of change in the parameter. Thus, the lower the value, the near absence of vocal disorder[2,4,8,26].

Three speech and language therapists judges with proven experience in the voice area, of at least, ten years have held the auditory-perceptual evaluation of consensus and simultaneously[8,26]. There was no previous training of the judges, considering the period of ten years of experience and the consensuality sufficient to carry out the judgments

The judges received guidance on how to proceed with the analysis, and should not do them at the end of the day or being tired, being able to hear the voices through headphones as many times as necessary, in a quiet place[26].

- Stroboscopic parameters of evaluation: The examination was performed by an ENT doctor (equipment Atmos Lenzkirch® - Germany, with optical Storz® 70 -Tuttlingen, Germany), during which the teachers sent the vowels /e/, /i/ and phonation reverse with the head positioned in slight anterior tilt and up[8,21,23].

Examinations were later edited and coded, randomized and written in a pen drive to be evaluated by ENT judges. The aspects evaluated based on a visual-analog scale were: amplitude of vibration of the mucosa, laryngeal vestibule constriction, vibration symmetry and the presence of mucosal wave. In assessing the type of glottal closure, the judges should point out the occurrence of one of the following options for each test evaluated: complete glottic closure, posterior glottal opening, medio-posterior glottal opening, triangular slit to the full extent slit hourglass, spindle chink, chink in dual time and part-spindle chink[8,21,28].

The evaluation of the images of the stroboscopic was performed on consensus and simultaneously for three ENT judges, with experience in laryngology for at least five years. The visual-analog scale used also had 10cm in length (from zero to 100mm) and the judges performed the bypass degree marking considering the left end (zero) as total absence of assessed parameter and the right as the maximum degree of the parameter in question. Thus, the higher the value, the greater the presence of assessed parameter and vice versa[8].

After the evaluations of judges, both speech and language therapists and ENT, marking the visual-analog scale were transformed into the corresponding number in mm through direct reading with a millimeter ruler, so each item evaluated got a zero percentage to 100, considered to statistical analysis of the data. All judges were blinded as to the objectives, methodology of research and the identification of teachers and evaluated moments[18] and did not participate as authors of this paper.

Sample size

A statistical calculation was performed to determine the sample size resulting in ten subjects in each group. This calculation was based on the descriptive results (mean and standard deviation) of a pilot sample of eight subjects.

The following formula was used to determine the sample size:

$$n = \left(\frac{Z \cdot \sigma}{d} \right)^2$$

at where: Z: abscissa of the standard normal curve, set a confidence level; σ: population standard deviation, expressed as a variable unit; d: sampling error, expressed in the unit of the variable.

As a result, we obtained the number of ten subjects for each group, which may have been influenced by the low number of the pilot sample of subjects, and this fact could be considered a limitation in the applicability of the generalization of the results of the present study to other populations.

Randomization

After passing by the criteria above, it was considered the laryngeal condition to randomize the teachers between groups.

Thus, in possession of the ENT report, they were allocated to one of four research groups, namely the first subject without structural laryngeal disease was for the Study Group 1 (SG1) and the following for the Control Group 1 (CG1). Likewise, the first person who showed structural laryngeal disease was for the Study Group 2 (SG2) and next to the Control Group 2 (CG2) and so on[9].

Sixty-eight volunteers contacted the researchers, of which only fifty-three showed up, in fact, to the evaluation. Of these, the medical evaluation, one was excluded for presenting report laryngopharyngeal reflux, one for viewing impossibility of the vocal folds during stroboscopic, due to a strong asymmetry of the arytenoid complex and to present respiratory infection on the day of revaluation.

At the end of the gathering, nine teachers dropped out. Thus, the groups made up fifteen teachers in SG1 (mean age 38.2 years old; 63,86Kg of average weight, average height of 1,64m, ten from the five basic education and higher education; twelve from public schools and three from private schools), nine in the GC1 (mean age 34 years old; average of 69kg of weight, mean height of 1,64m, six from the three basic education and higher education, seven of public education and two private), nine in SG2 (mean age of 41.66 years old; 66,6Kg of average weight, average height 1,64m, all from the basic education; eight from public schools and one from a private school) and eight in GC2 (mean age of 40.62 years old; 66,25Kg of average weight, average height of 1,66m, all from the basic education, six from public schools and two from private schools). All teachers who participated in the study were caucasian.

The groups presented different size due to the withdrawal of certain teachers after allocation in groups and also due to the fact that participants of CG after completion of data collection, have been invited to perform the same therapy of SG[25]. It is noteworthy that, statistically, the difference in size of the experimental and control groups did not affect the analysis of the data, they treated up of independent groups[3,21].

Blinding

It is highlighted that the participants of the research were blinded about the objectives of the proposed intervention. In addition, the judges who performed perceptive audiological and videolaryngoscopy evaluations were blinded regarding the objectives of the research, intervention performed, moment of collection of each participant and groups that were constituted, besides not participating as authors of the work.

Statistical analysis

Wilcoxon test was used for comparison between evaluation and re-evaluation of all variables in the four groups, and the Mann-Whitney test for comparison of all variables between SG with its respective CG and between the two SG. The tests used in this research are not parametric, with the analysis of the data by position; however, the tables, the mean and median values were explained to facilitate the understanding of the behavior of the data. We used the 0.05 significance level (5%).

RESULTS

In the tables, there were presented only significant results, since the large number of variables analyzed and the three comparisons (between assessment and reassessment, among SG1xCG1 and SG2xCG2 and between SG1xSG2) for all of them, the tables would be very large.

Acoustic measurements, perceptive auditory parameters, glottic closure types and videolaryngostroboscopic parameters are presented in Tables 1 to 4.

DISCUSSION

Neuromuscular disorders, such as those from vocal hyperfucntion as well as histological alterations of the vocal folds, interfere in the patterns of glottal vibration, resulting shift in vocal production that can be reflected in the acoustic voice analysis, auditory-perceptual evaluation and stroboscopic. Thus, such assessments may also be useful to measure changes in behavior and vocal production caused with the voice therapy. The objective of the present study was to compare the results of such evaluations in teachers with vocal hyperfunction who performed intervention (TBI with FK) with a group that did not perform it.

In one embodiment of LSVT performed in two SG, the current investigation showed a significant reduction in NHR SG2, after therapy (Table 1), reflecting a reduction in energy and aperiodic higher harmonic component in this group showed structural laryngeal disorder. This result is consistent with a study of 102 teachers, divided into two groups, one of which received guidance on vocal health, and vocal exercises including SOVTE, and the other just received guidance on vocal health. Women in the first group showed a reduction of noise on voice and increased f0 and men, reducing of f0[1].

Prior research with FK pointed out that holding three sets of 15 repetitions of the technique caused a significant decrease in NHR and DSH, showing that there was a reduction of aperiodic energy in the voice signal, even when it comes to women without dysphonia[16], these results were confirmed in the present study, representing evidence that FK, besides useful in the voice processing, can also be used in cases of dysphonia.

Comparing the SG with their CG, important results were revealed. Regarding the frequency disturbance measures, Jita measures, jitt, RAP, PPQ, sPPQ and vf0 showed a significant decrease in SG1 after LSVT with FK (Table 1). The same happened with the amplitude perturbation measures ShdB,

Table 1. Acoustic measures of the study groups compared between evaluation and reevaluation; compared to their respective control group and compared between the two study groups

Comparison of SG1xGC1 e SG2xGC2			Mean	Median	Standard deviation	Normality of MDVPA	p-value
Jita (usec)	Reassessment	GC1	95.0	80.7	65.4	16.654	0.018*
		SG1	48.8	39.8	23.5		
Jitt (%)	Reassessment	GC1	1.58	1.40	0.81	0.351	0.015*
		SG1	0.94	0.87	0.43		
RAP (%)	Reassessment	GC1	0.95	0.87	0.48	0.214	0.020*
		SG1	0.57	0.53	0.27		
PPQ (%)	Reassessment	GC1	0.94	0.91	0.47	0.205	0.012*
		SG1	0.55	0.49	0.25		
sPPQ (%)	Reassessment	GC1	1.67	1.18	1.40	0.220	0.007*
		SG1	0.72	0.64	0.29		
vf0 (%)	Assessment	GC2	2.11	2.21	0.63	1.005	0.043*
		SG2	1.55	1.67	0.40		
vf0 (%)	Reassessment	GC1	4.81	2.34	6.42	1.005	0.029*
		SG1	1.47	1.36	0.62		
ShdB (dB)	Reassessment	GC1	0.45	0.43	0.17	0.071	0.018*
		SG1	0.32	0.28	0.12		
Shim (%)	Reassessment	GC1	5.02	4.80	1.79	0.791	0.023*
		SG1	3.60	3.20	1.33		
APQ (%)	Reassessment	GC1	3.63	3.42	1.28	0.527	0.041*
		SG1	2.72	2.53	0.96		
DUV (%)	Reassessment	GC1	2.83	0.00	4.21	0.100	0.009*
		SG 1	0.00	0.00	0.00		
NVB (%)	Assessment	GC1	1.45	0.00	4.18	0.100	0.025*
		SG1	0.00	0.00	0.00		
NUV	Assessment	GC1	19.27	1.00	41.16	0.200	0.044*
		SG1	1.53	0.00	4.46		
NUV	Reassessment	GC1	5.18	0.00	8.13	0.200	0.009*
		SG1	0.00	0.00	0.00		
Comparison of Assessment and Reassessment			Mean	Median	Standard deviation	Normality of MDVPA	p-value
NHR	SG2	Aval.	0.14	0.14	0.02	0.09	0.021*
		Reav.	0.13	0.13	0.02		
Comparison of GE1xGE2			Mean	Median	Standard deviation	Normality of MDVPA	p-value
There was no significance in this comparison							

*Statistically significant values - Wilcoxon Test and Mann-Whitney Test ($p<0.05$)

Subtitle: CG1 = Control Group 1, no structural laryngeal disorder; CG2 = Control Group 2, with structural laryngeal disorder; SG1 = Study Group 1, no structural laryngeal disorder; SG2 = Study Group 2, with structural laryngeal disorder; NHR = measures of noise to harmonic ratio; Jita = Jitter absolut, Jitt: Jitter percent; RAP = relative average perturbation; PPQ = pitch perturbation quotient; sPPQ = smoothed pitch perturbation quotient; vf0 = f0 variation; ShdB = Shimmer in dB; Shim = Shimmer percent; APQ = amplitude perturbation quotient; DUV = degree of voiceless; NVB = number of voice breaks; NUV = number of unvoiced segments

Table 2. Perceptual auditory vocal parameters of the study groups compared between evaluation and reevaluation; compared to their respective control group and compared between the two study groups

Comparison of Assessment and Reassessment			Mean	Median	Standard deviation	p-value
Breathiness	Reassessment	GC1	8.33	5.00	7.07	0.018*
		SG1	2.31	0.00	3.88	
Comparison of SG1xGC1 e SG2xGC2			Mean	Median	Standard deviation	p-value
Overall grade of dysphonia	SG1	Assessment	16.67	15.00	12.63	0.006*
		Reassessment	6.15	5.00	6.18	
Hoarseness	SG1	Assessment	14.33	10.00	13.07	0.018*
		Reassessment	5.00	5.00	5.77	
Breathiness	SG1	Assessment	9.67	10.00	6.94	0.007*
		Reassessment	2.31	0.00	3.88	
Strained	SG1	Assessment	8.67	5.00	10.93	0.011*
		Reassessment	3.08	0.00	5.60	
Comparison of SG1xSG2			Mean	Median	Standard deviation	p-value
Breathiness	Assessment	SG1	9.67	10.00	6.94	0.036*
		SG2	5.00	0.00	9.68	

*Statistically significant values - Wilcoxon Test and Mann-Whitney Test (p<0.05)
Subtitle: CG1 = Control Group 1, no structural laryngeal disorder; CG2 = Control Group 2, with structural laryngeal disorder; SG1 = Study Group 1, no structural laryngeal disorder; SG2 = Study Group 2 with structural laryngeal disorder

Table 3. Glottal closure types of study groups compared between evaluation and reevaluation; compared to their respective control group and compared between the two study groups

Comparison of Assessment and Reassessment			n (%)	Total of the group	p-value
There was no significance in this comparison					
Comparison of SG1xGC1 e SG2xGC2			n (%)	Total of the group	p-value
There was no significance in this comparison					
Comparison of SG1x SG2			n (%)	Total of the group	p-value
Medio-posterior glottal opening	Reassessment	GE1	2 (13.3)	15	0.031*
		GE2	5 (55.5)	9	

*Statistically significant values - Wilcoxon Test and Mann-Whitney Test (p<0.05)
Subtitle: CG1 = Control Group 1, no structural laryngeal disorder; CG2 = Control Group 2, with structural laryngeal disorder; SG1 = Study Group 1, no structural laryngeal disorder; SG2 = Study Group 2 with structural laryngeal disorder; n: number subjects

Table 4. Stroboscopic videolaryngoscopy parameters of the study groups compared between evaluation and reevaluation; compared to their respective control group and compared between the two study groups

Comparison of Assessment and Reassessment			Mean	Median	Standard deviation	p-value
There was no significance in this comparison						
Comparison of SG1xGC1 e SG2xGC2			Mean	Median	Standard deviation	p-value
There was no significance in this comparison						
Comparison of SG 1x SG2			Mean	Median	Standard deviation	p-value
Amplitude of mucosa vibration	Reassessment	GE1	98.67	100.00	5.16	0.031*
		GE2	91.11	100.00	10.54	

*Statistically significant values - Wilcoxon Test and Mann-Whitney Test (p<0.05)
Subtitle: CG1 = Control Group 1, no structural laryngeal disorder; CG2 = Control Group 2, with structural laryngeal disorder; SG1 = Study Group 1, no structural laryngeal disorder; SG2 = Study Group 2 with structural laryngeal disorder

Shim, APQ and measures of deaf or unvoiced segments NUV and DUV (Table 1). These results relate to the higher quality of the voice signal, delivered with greater frequency and stability and improved neuromuscular control, showing reduction of global voice deviation. Also, meet a recent survey of teachers who had hyperfunctional dysphonia, which showed that the FK promoted reduction of jitter (sPPQ), shimmer (Shim and APQ), frequency (fhi) and vocal breaks (NVB) in group with no structural laryngeal disorders. The group with laryngeal disorders showed no change in acoustic vocal measures after a single training session[19].

As this research on FK technique in vocal therapy is unprecedented, there were not found, to the date, similar findings to compare the results. However, the positive results found in the acoustic analysis are according to two studies that performed a form of LSVT in subjects with vocal fold nodules and showed significant reduction of jitter and shimmer and increased f0[21,23], as well as reducing the NHR [23]. The first study was conducted with 53 women and their goal was to compare the LSVT (eight sessions in three weeks) to traditional therapy (eight sessions in eight weeks). The second was carried out with ten women using the LSVT only (eight sessions in three weeks)[23] and both studies used direct therapy associated with vocal health guidelines.

After ten voice therapy sessions, held twice a week in three groups according to laryngeal disorders (Reinke's edema, polyps and cysts), the subjects showed reduced measures of NHR, jitter and shimmer. However, the study does not clarify which techniques were used because the authors report that the therapy ranged according to each case, not being unified for all subjects[9].

The absence of significant differences between SG2 with its respective control can be seen as a sign that in the presence of structural laryngeal disorder, might become higher time needed therapy to promote changes in the larynx and thereby, positive effects more pronounced on the voice. Giving basis for that assumption, an investigation with 97 workers who took voice therapy for six to twelve months showed that this time was enough to reduce the size of vocal vocal fold nodules in 92.8% of cases, completely disappeared in 49.5% of cases[28]. Thus, in the current check, the time of three weeks of therapy was effective to generate positive effects in the voice of the two SG, but the group without structural laryngeal disorder showed more positive results than the SG with structural laryngeal disorder.

Other studies with teachers who had hyperfunctional dysphonia also showed similar results, showing the benefit of therapy through vocal acoustic analysis and auditory-perceptual evaluation, although using traditional therapy[11,24].

In the case study, with teachers who had larynx with and without disorders, the therapeutic program used focused on the technique of nasal sounds, one SOVTE, as well as guidance on anatomy and physiology of the vocal apparatus, vocal health, including therapy to improve hydration and aspects of breathing during 16 sessions held once a week. As a result, there was a decrease in vocal acoustic measures NSH and DSH after therapy. In vocal auditory-perceptual evaluation, although without significance, it was observed that roughness was eliminated in both cases that presented hoarse-breathy voice quality[11].

In order to compare the effects of the perilaryngeal manual massage to the traditional vocal training, with vocal exercises and guidelines, there were eight sessions of group therapy (once a week) for both modes of therapy. In the acoustic analysis, comparing the groups, there were no differences, showing that both interventions promoted benefits, while significantly reducing the shimmer has occurred only in the group that performed the traditional therapy. In auditory-perceptual evaluation, there was no significance, but in the group that underwent massage there was an increased percentage of subjects with normal voice[24].

Regarding to the auditory-perceptual evaluation, the teachers of the SG1 showed a significant reduction in the general level of dysphonia, roughness, breathiness and strained after LSVT with FK (Table 2) and compared the revaluation between SG1 and CG1, breathiness showed significant decrease in SG1 (Table 2). These results again reflect the benefits in therapy on voice quality in SG1, enhancing the acoustic findings already mentioned.

The literature showed a percentage decrease in vocal instability immediately after a therapy session using the FK technique[16]. Another study didn't show changes in auditory-perceptual evaluation, possibly because the FK runtime was only one minute[15]. Moreover, these two investigations were carried out with subjects without dysphonia, so they did not show major differences in auditory-perceptual evaluation prior to completion of the FK[15,16]. However, the only research with dysphonic teachers using the FK showed reduction of breathiness and instability in the group that had no structural laryngeal disorder and reducing instability in the group with structural laryngeal disorder[19], results similar to this job.

Analysis compared a form of LSVT to traditional therapy with a weekly session at 53 women with vocal fold nodules, and in both therapy methods were based on Lessac-Madsen method and vocal function exercises. There were observed significant improvements in voice quality, with reduced roughness and tension after two modes and reduction of breathiness and asthenia after LSVT[21], results that also converge with those of the present study as the effectiveness of LSVT on the vocal quality in dysphonic individuals.

Using forms of traditional therapy, other studies showed positive effects on perceptive hearing aspects in subjects with hyperfunctional dysphonia[2,8], including in subjects with structural conditions in the larynx[9,11,23]. This makes it clear that vocal therapy, traditional or LSVT, is the method of primary choice for treating hyperfunctional dysphonia with

or without secondary laryngeal lesion. However, the reported studies did not describe accurately the effects of each approach in therapy, being composed of guidance on vocal health and various exercises, sometimes even with variation of exercises between subjects from the same survey, requiring studies of more controlled and defined methods.

Regarding to the structural laryngeal assessment, there was a significant decrease in the occurrence of medio-posterior glottal opening in SG1 after LSVT with FK (Table 3) as well as significant increase in amplitude of mucosa vibration in SG1 relative to SG2 (Table 4). These results show increased glottal closure and vibration of the vocal folds mucosa of the largest in SG1, it is possible that the LSVT time of this research was not enough to interfere positively about the present laryngeal disorders in SG2. This statement is in agreement with the literature which shows the need to modify laryngeal longer disorders[28].

Reaching out to these results, a study that compared the LSVT (eight sessions in three weeks) to traditional therapy (eight sessions in eight weeks) in subjects with vocal fold nodules, showed significant improvements in the presence of mucosal wave, linearity of the edge of the vocal fold, regular vibration of the vocal folds and glottal closure in the attendees of the traditional therapy group. In the LSVT group, only the parameter presence of mucosal wave showed significant improvement, agreeing with the present findings; as well as significant reduction in the size of the vocal fold nodules and swelling in both groups[21]. Thus, the group that underwent the therapy in longer time, indicated to perform the exercises at home, had the greatest number of benefits over the laryngeal conditions, reinforcing the hypothesis that, in the presence of structural laryngeal disorder, maybe it is necessary more time of voice therapy, which would explain the findings of the SG2 of this study (Tables 3 and 4).

There were no works found using stroboscopic to check the immediate effects or over time with the FK and even studies with other SOVTE using such examination are limited. This complicates the discussion of the results, highlighting the need for further research on the laryngeal aspects related to vocal speech therapy techniques.

Nevertheless, theoretically, the lower occurrence of medio-posterior glottal opening and the increased amplitude of mucosal wave vibration of the vocal folds may have occurred because the SOVTE tend to lower the standard of hyperfunction due to partial occlusion of the lips that promotes resonance retroflex and expansion of the entire area of the vocal tract, from the mouth to the larynx[12,13]. It is possible that FK has favored decreased muscle activity of the larynx, with decreased collision force between the vocal folds, resulting in an easier speech and normotensive[12,13]. The literature also points out that vocal exercises that require high elasticity of thyroarytenoid muscle promote greater mobilization of the mucosa of the vocal folds[12] explaining the positive effects laryngeal, auditory-perceptual evaluation and acoustic found in this study .

Using other vocal techniques in speech therapy with teachers, the literature indicates increased glottal closure and mucosal wave[11,23], linearity freeboar[23], decreased edema in the arytenoid region and the vocal folds with partial resorption of vocal nodules[11].

The current observation revealed many positive effects on the voice with the use of a single exercise during the entire period of LSVT, which can be seen as an indicator of the effectiveness of FK technique when practiced intensively. Thus, FK can be used as a resource for speech and language therapists in the treatment of hyperfunctional dysphonia, as clinical experience has also shown that the therapeutic plan shall be flexible according to the requirements of each subject.

One of the concerns of this study was to develop a faster method of therapy because it is known that voice disorders cause many disorders in the lives of teachers[21] and the positive effects seen through the LSVT with FK were obtained without the need of removal of the teaching activities.

Regarding the fact that most of the teachers in the sample are primary and the public school workers, it is possible that these two categories show more dysphonia in characteristics due to the desktop as many students in the halls and infrastructure deficit, reflecting a higher level of noise, as well as intense hours worked per week, due to the lower wage income than those who work in the private and/or higher education sector, generating lack vocal rest[4,6]. Or, such a result may have occurred since the public educational institutions and offering basic education are the majority in the county where the study was conducted, compared to private education and those that offer higher education.

As limitations of the investigation, it is considered the small number of subjects who did not reach the suggested by the sample calculation due to loss of teachers who, after starting the participation in research, have not completed data collection. In SG1 and SG2, 28.5% of teachers who dropped out were already in the final stage, and we can assume that felt vocal improvements. The other teachers "lost" while collecting data, 14.25% were excluded from the revaluation by the exclusion criteria (presence of respiratory allergy) and 28.55% dropped out experience other health problems during therapy (colds report, pneumonia and influenza); only 29.75% of dropouts occurred in the first half of therapy, without justification, reflecting lack of engagement in the therapeutic process.

The withdrawal of the treatment is present in published reports around the world and, in the case of teachers, the reasons are due to problems with the detachment to the location of the session, lack of coverage of health plans and lack of confidence in the results of voice[6,21,23].

Thus, it is suggested that future studies with larger samples to confirm the results of current research. In addition, they

can also determine the influence of variables that were not considered for randomization of subjects, such as weight, height, body mass index and age, since, to the date, there is no evidence that these conditions would cause differences between groups in relation to the intervention used. Therefore, it sought to homogenize the groups regarding laryngeal conditions and sex, as there are variables identified in the literature that could cause differences between the groups regarding intervention[25], as evidenced in the current check on the laryngeal condition.

CONCLUSION

The brief and intensive therapy with finger kazoo provided numerous positive effects on perceptive hearing parameters, acoustic and laryngeal (glottal closure and amplitude of mucosal wave vibration of the vocal folds) in dysphonic teachers with and without structural laryngeal disorder. The benefits were more evident in those without structural laryngeal disorder. Thus, finger kazoo can be used as a speech feature for the speech and language therapists treatment on the treatment of hyperfunction dysphonia on teachers.

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