Revista CEFAC
Speech, Language, Hearing Sciences and Education Journal

Rev. CEFAC. 2016 Jan-Fev; 18(1):263-272 doi: 10.1590/1982-021620161810115

Case reports

Vocal therapy and nasal sounds: effects on Hyperfunctional dysphonia

Terapia vocal e sons nasais: efeitos sobre disfonias hiperfuncionais

Simone Rattay Andrade[1]
Carla Aparecida Cielo[2]
Karine Schwarz[3]
Vanessa Veis Ribeiro[4]

[1] Universidade Federal de Santa Maria/ UFSM, Santa Maria, RS, Brasil.
[2] Departamento de Fonoaudiologia e Programa de Pós-Graduação em Distúrbios da Comunicação Humana da Universidade Federal de Santa Maria/ UFSM, Santa Maria, RS, Brasil.
[3] Hospital de Clínicas de Porto Alegre/ HCPA, Porto Alegre, RS, Brasil.
[4] Universidade de São Paulo FOB/USP, Bauru, SP, Brasil.

Sources of aid for research: CAPES

Conflict of interest: non-existent

Received on: January 20, 2015
Accepted on: March 16, 2015

Mailing address:
Vanessa Veis Ribeiro
Rua Professor Vitor do Amaral, 1142, Centro
Irati – PR – Brasil
CEP: 84500-000
E-mail: vanessaribeirooo@hotmail.com

ABSTRACT

We sought to evaluate the effects of a phonotherapy program that included vocal and postural orientation, respiratory function adequation and the technique of nasal sounds in hyperfunctional dysphonia. It was carried out an observational, longitudinal and non-controlled study of clinical cases with quantitative character that analyzed three female subjects with mean age of 31,33 years who had hyperfunctional dysphonia. The subjects were submitted to: laryngoscopy, perceptual voice assessment and acoustic collection of maximum phonation time, postural screening and determination of the respiratory tract during speech before and after a therapeutic program. This consists of orientation, awareness and vocal training with nasal sounds during 16 speech therapy sessions, once a week at patient home. Data were analyzed using the non-parametric Mann-Whitney and Chi-square, with 5% significance level. Post-treatment, it was observed that the posture passed aligned and misaligned to the upper respiratory tract to costodiaphragmatic abdominal; there was a decrease in the acoustic measurement degrees and in the number of significant subharmonics in most subjects. Furthermore, were identified tissue improvements and edema remission in the mucosa of the vocal folds and arytenoid region, besides improved glottal closure. After the execution of a phonotherapy program with vocal and postural orientation, respiratory function adequation and use of the technique of nasal sounds in hyperfunctional dysphonia, we observed significant improvement of body posture, of respiratory type, of acoustic measurements related to vocal noise production and positive effects on the tissue and the closure of the vocal folds.

Keywords: Health Evaluation; Voice Disorders; Diagnosis; Voice Training; Voice

RESUMO

Buscou-se verificar os efeitos de um programa fonoterapêutico que incluiu orientação vocal e postural, adequação da função respiratória e a técnica de sons nasais em disfonias hiperfuncionais. Foi realizado um estudo de casos clínicos, observacional, longitudinal, não controlado, de caráter quantitativo que analisou três sujeitos do sexo feminino com idade média de 31,33 anos que apresentavam disfonias hiperfuncionais. Os sujeitos foram submetidos a: videolaringoscopia, avaliação vocal perceptivoauditiva e acústica, coleta de tempos máximos de fonação, triagem postural e determinação do tipo respiratório durante a fala, antes e após um programa terapêutico composto por orientação, conscientização e treinamento vocal com sons nasais durante 16 sessões de fonoterapia, uma vez na semana com treinamento em domicílio. Os dados foram analisados por meio dos testes não-paramétricos Mann-Whitney e Qui-quadrado, com nível de significância de 5%. Pós-terapia, observou-se que a postura corporal passou de desalinhada para alinhada e o tipo respiratório de superior para costodiafragmático abdominal; houve diminuição das medidas acústicas em relação ao grau e número de subharmônicos na maioria significante dos sujeitos, além de melhoras teciduais e diminuição do edema na mucosa das pregas vocais e na região aritenoide, e melhora da coaptação glótica. Após a execução de um programa fonoterapêutico com orientação vocal e postural, adequação da função respiratória e uso da técnica de sons nasais em disfonias hiperfuncionais, observou-se melhora significante da postura corporal, do tipo respiratório, das medidas acústicas sugestivas de ruído à emissão vocal, e efeitos positivos sobre o tecido e o fechamento das pregas vocais.

Descritores: Avaliação em Saúde; Distúrbios da Voz; Diagnóstico; Treinamento da Voz; Voz

INTRODUCTION

The technique of nasal sounds is a semi-ocluded vocal tract exercise is considered a facilitator of phonation balance, providing the interaction between source and filter, once the voiced retroflex energy, besides minimizing the impact suffered by the vocal folds during phonation and reducing the risk of trauma, it improves the resonance and vocal projection[1,2]. This technique, also named *humming*, resonance technique or voice placement "in mask" and it is also used in the resonant voice method, being indicated for the treatment of dysphonias, especially the hyperfunctional ones, characterized by excessive muscle tension[1-6]. The main benefits of the nasal sound technique are the resonant balance; the enrichment of the harmonic energy of the glottal signal; reduction and balance of laryngeal and mandibular pressure, as well as of all the vocal apparatus; smoothing of the emission; vocal projection improvement; balance of vocal attack; increase of the maximum phonation time (MPT); improvement of vocal self-monitoring[1-5].

The speech therapy is characterized as a process in which some particular objectives and steps are involved, in order to perform a positive impact. Then, phonotherapy should include orientation, awareness and vocal training with specific exercises[3,4,7]. Considering the participation of incorrect uses of voice in hyperfunctional or behavioral dysphonia, the orientation work aims to offer to the patient the understanding about the basic principles of anatomy and physiology and vocal health. In this step, the orientations on adjustments of posture and respiratory aspects that influence the development of a proper phonation are also included. The awareness must show how the voice can be interpreted by the listener, as it cannot be separated from the body and emotions[3,4,7-10].

These steps can be considered as phonotherapy of basis, once with the initial work of explanation and preventing the patient can systematically try to reverse the improper vocal behavior. In the literature, there are reports indicating that the work of orientation to the patient proves to be a valuable approach to vocal therapy, as in many cases, it occurs the overcoming of the vocal problem only with the use of this mean, without the need for any other therapeutic approach, showing effectiveness and elimination of inadequate vocal adjustments[11,12].

Considering that, the aim of the study was to investigate the effects of a phonotherapy program that included vocal and postural orientation with adequate respiratory function and the technique of nasal sounds in cases of hyperfunctional dysphonias.

CASE REPORT

A clinical case, observational, longitudinal and non-controlled study with quantitative approach, approved by the Ethics in Research Committee of the institution of origin under the protocol No. 100/05. The study had teachers with characteristics of hyperfunctional dysphonia as the population-target

For the selection of cases, 11 educational institutions were contacted, informed and made aware of the proposal through meetings in which the responsible was invited to sign the Institutional Authorization Form. After the authorization of the educational institution, for the dissemination and contact with teachers, meetings were conducted with faculty, clarifications about the research were made and then they were invited to sign the Informed Consent Form (ICF). In addition, the dissemination was also carried out with some otolaryngologists and directly with the people they know.

The following inclusion criteria were established: female, once they are majority in teaching and they are characterized by higher search for health treatments, as well as it is the gender sex with a highest incidence of dysphonia by the incorrect use of the voice, middle-posterior triangular vocal fissure and vocal nodules; aged between 19 and 60 years for the exclusion period of vocal alterations and presbyphonia; presenting otorhinolaryngological medical report of normal larynx or with affections of hyperfunctional origen, such as edema, polyps, cysts, nodules and/or middle-posterior triangular vocal fissure, among others; the presence of vocal complaints related to incorrect behavior or hyperfunctional vocals uses; adherence to the ICF [3,4,8,10,12-17].

The following exclusion criteria were established: reports of allergic, respiratory or gastric crises or hormonal dysfunctions due to pregnancy or menstrual period while the data collection of the assessment and re-assessment, as they could produce deviations in vocal parameters; oral or mixed breathing mode at rest; reports of neurological, metabolic, endocrine, syndromic and/or psychiatric disorders; being a smoker and/or making use of alcohol, because these agents are aggressive to larynx and they can lead to the formation of laryngeal disease; presenting a history of laryngeal surgery and/or surgery for head and neck; having performed speech and/or otorhinolaryngological treatment for voice; presenting hearing disorders previously detected in hearing screening,

because they can modify the self-monitoring of voice, compromising voice quality; making use of the singing voice of professional or amateur way; presenting stomatognathic system alterations that could prevent the proper implementation of the proposed phonotherapy program[3,4,8,13,14].

For the application of the selection criteria was used a questionnaire; a full assessment including videolaryngoscopy with otorhinolaryngological specialist, with a rigid telescope, which was recorded on VHS tape; one hearing screening through scan of pure tones at frequencies of 500, 1000, 2000 and 4000 Hz at 25 dB, only by air; a orofacial speech assessment that examined tone and the function of phono-articulatory organs, occlusion, articulation and respiratory mode[3,8].

From 12 volunteers who applied to the research, some of them were excluded: three for smoking; two by making use of amateur singing voice; two by having previously performed speech therapy for voice; one by otorhinolaryngological diagnosis of laryngopharyngeal reflux. In addition to this, a teacher was lost during the research, prompting his resignation for personal issues. We highlight that the results of individual assessments were not revealed to schools, preserving the right to privacy of the teachers involved in the research.

Then, the group for the study consisted of three female subjects with vocal complaints, aged 23, 40 and 51 years (mean age of 31.33 years), teachers who presented, respectively, otorhinolaryngological diagnostics: 1) edema of the arytenoid region, small lump on the right vocal fold, middle-posterior triangular fissure and bleeding points in both vocal folds; 2) lump in the left vocal fold and fissure in the middle third; 3) larynx with no alterations.

The subjects underwent vocal characterization through vocal, perceptive-auditory and acoustic assessments, MPT collection, postural screening and determination of the respiratory tract during speech and otorhinolaryngological assessment before and after a therapeutic program described below.

The therapeutic program consisted of two parts, the base of speech therapy with orientation on anatomy and physiology of the vocal apparatus; vocal health, including hydrotherapy and aspects of breathing and posture. The second part consisted of the technique of nasal sounds.

The anatomy and physiology and vocal production were explained with the help of illustrative drawings and prints. The vocal health was addressed through orientation on the voice front damage to certain harmful vocal and behavioral habits, as well as orientations that promote vocal benefits. Such explanations were supplemented by explanatory texts that contemplated the following topics: smoking; frequent exposure to pollution and air conditioning; abusive vocal habits such as throat clearing, coughing, sound competition, the screaming, the whisper; excessive alcohol intake; the use of homemade solutions; the influence of hormonal alterations; inadequate consumption of spicy foods, caffeinated drinks and dairy products; the consumption of honey and apple; the use of non-prescription drugs, as well as tablets and sprays; exposure to sudden changes in temperature; clothing; rest; and questions about gastroesophageal reflux[3,4,8,9].

In addition to general aspects of the voice health, hydrotherapy was also discussed together with the subjects of the research, namely, the advice to the adequate fluid intake (approximately eight glasses of water a day), in order to promote vocal efficiency by the increase of indirect laryngeal hydration[3,4].

Regarding the orientation of adequacy of posture for the phonation, this research aimed to disable the inadequate muscle adjustments that cause bad posture with the use of a mirror, showing and making the patient realize that an erect posture favors the functioning of the vocal apparatus for providing, mainly, the free vertical larynx movement and the free diaphragmatic movement and thoracic cavity, favoring a more appropriate breathing to the vocalization[3,4,9].

The adaptation work of the respiratory tract was carried out with explanations and monitoring the movement of the structures involved in the respiratory maneuver. There was the implementation of specific exercises to promote costodiaphragmatic-abdominal standard with the inspiration expanding this region and the expiratory control of air output, prolonging it, in order to conditioning and strengthening the respiratory muscles[3,4,9].

After observing this stage of phonotherapy of basis, there was the inclusion of the sounds technique of nasal support, being selected to carry out the exercise of the nasal sound /m/ sustained[2-4].

The nasal sound was emitted as the following: continuous emission of sound, with the use of costo-diaphragmatic-abdominal breathing in usual pitch and loudness, standing position in front of a mirror, without head movements, without increasing muscle contraction of shoulder girdle and suprahyoid region, without muscular hypertension of the lips, tongue, jaw or pharynx, recessed jaw without occlusion of the teeth,

lips united, divided emission between oral and nasal cavity to the resonant balance, face vibration perception in the region of the nose and mouth, in addition to preventing the elevation of pitch or loudness[3,4].

The subject should also avoid abrupt vocal attacks at the initial sonorisation of the nasal sound and they should emit the /m:/ in order to the larynx would remain low in the neck, trying to reduce the tension and improvement in vocal quality. During the training, we tried to offer patients visual, auditory and proprioceptive cues that could favor the correct emission of the nasal sound, as the perceived intensification of vibration in the face region, especially nose, lips and cheeks or " itch "in these regions[3,4].

The subjects performed three sets of ten minutes of emission of the nasal sound, adding up to 30 minutes of speech therapy per session. The interval between each of the three series was a moment of absolute voice rest, i.e., absolute silence. 16 speech therapy sessions were carried out, once a week, in a total of four months. The orientations and exercises worked in the sessions should also be performed at home by the subject for another four days a week, once a day[2,4].

In pre and post-therapy, postural screening was performed with the individual in standing position, observing the position of the head (standing and sitting), shoulders, hip, knees, feet, and deviations of the spine, in the front, back and profile position. We also carried out the determination of the the respiratory tract during speech by visual observation of the stem where the moving the expansion of the thoracic structures was concentrated at the inspiratory time, with the individual in standing position, being possible to classify into upper, abdominal, costodiaphragmatic-abdominal or mixed[8,9].

To collect the MPT, the participants were asked to emit in a sustained way the vowels /a/, /i/ and /u/ and the fricatives /s/ and /z/ in the standing position, usual pitch and loudness, after deep breath, emitting in MPT[8,9,13,14]. The emissions were captured by digital recorder type media player 3 (MP3) DVR, Centon®, keeping the distance of four centimeters between the microphone and the mouth for the emissions[18]. Each vowel and fricative was emitted three times, considering for the analysis the longest time in seconds; then, we carried out the mean of the highest MPT of the three vowels[8,9].

For the acoustic analysis of glottal source we used the sustained vowel /a/, eliminating the vocal attack and discarding the end of the emission, in order to avoid the influence of natural periods of instability of the voice[4,18]. Consequently, the shortest time edited among all subjects was used as standard for analysis.

We used the Multi-Dimensional Voice Program Advanced, a Kay Pentax® software (MDVPA), with sampling rate of 44kHz and 16bit. The extracted measures were: fundamental frequency (f0); pitch perturbation quotient (PPQ); coefficient of variation of f0 (vf0); coefficient of variation of amplitude (vAm); amplitude perturbation quotient (APQ); noise-harmonic ratio (NHR); soft phonation index (SPI); voice turbulence index (VTI); number of voice breaks (NVB); degree of speech breaks (DVB); degree of unvoiced segment (DUV); number of unvoiced segment (NUV); Numbers of sub-harmonic segments (NSH), and degree of sub-harmonic components (DSH). In the acoustic assessment, the normal parameters were used for females, proposed by the program itself[18].

The vocal, perceptive-auditory and acoustic assessments were performed by using a protocol developed by the authors based on the literature[4,8,9]. For this analysis, we used the sample voice of the MPT /a/ of the subjects, investigating the perceptive-auditory parameters of vocal type (hoarse, breathy, compressed, rough, bitonal or other), resonant focus (balanced, high or hypernasal, pharyngeal, laryngeal or laryngopharyngeal), pitch (adequate, low or loud) and loudness (adequate, increased or decreased).

The voice samples were converted into waveform length and sent by e-mail to three speech therapists, not authors, with experience of at least five years in the area. The judges were blinded to the study objectives, to the replication of emissions, to the assessment the judges and to the time of recording (pre or post-therapy), being informed only about the mean age of the subjects. Each judge received 12 samples, corresponding to the time before and after therapy of subjects, which were duplicated and randomly arranged in the material delivered for analysis. The judges were asked to listen to the voices many times as necessary in a quiet environment, with headset and the analysis were performed by means of the proposed protocol. Then, the analysis by agreement or predominance between the findings of the three judges for all the answers assigned to vocal parameters of the same subject were performed[14].

The otorhinolaryngological assessment, which was considered as a criterion for inclusion was carried out again for the same post-phonotherapy physician through the videolaryngoscopy for visualization of

laryngeal conditions and adjacent structures. The results of these assessments were described in medical reports and to the patients (Figure 1).

The data were analyzed descriptively and through the non-parametric Mann-Whitney and chi-square tests, adopting the significance level of 5%.

Patient	Moment	Otolaryngology Report
Patient 01	PRE	Swelling of the arytenoid region; small lump on the right vocal fold; medium-posterior chink; bleeding points in both vocal folds
	POST	Small lump on the right vocal fold with decreased vocal slot
Patient 02	PRE	Lump in the left vocal cord; slit in the middle third
	POST	Decrease in folds and the left vocal cord nodule
Patient 03	PRE	Larynx wihout changes
	POST	Larynx without changes, with improvement in mucosal wave of vocal folds

Caption: PRE=moment pre-therapy; POST=moment post-tharapy

Figure 1. Description on otolaryngology report about the patients.

RESULTS

Table 1 shows the comparison of screening results pre and post-therapy on the respiratory tract and body posture.

Table 2 shows the comparison of MPT assessment results before and after therapy.

Table 3 shows the comparison of pre perceptual voice assessment and post-therapy.

The comparison of the results of the acoustic analysis of pre glottal source and post-therapy can be seen in Table 4.

Table 1. Comparison on results corporal screeningand respiratory tract pre and post therapy

Type of evaluation	Variable rates	Classification	Moments PRE n (%)	Moments POST n (%)	Value of p
Body screening	Respiratory tract	Upper	2 (66,67)	0 (0,00)	0,049*
		Mix	1 (33,33)	0 (0,00)	
		CDA	0 (0,00)	3 (100,00)	
	Body posture	Aligned	0 (0,00)	3 (100,00)	0,049*
		Desaligned	3 (100,00)	0 (0,00)	

*p>0,005 – Qui- square assessment
Caption: PRE=moment pre-therapiy Post=moment post-therapy; n=number of subjetcs; %=percent of subjects; CDA=costodiafragmáticoabdominal.

Table 2. Comparison on results in evaluation maximum times phonation pre e post-therapy

MPT	Moment	Mean	Median	Desviation Standard	Value of p
MPT/a,i,u/ (s)	PRE	9,93	12,83	3,22	0,275
	POST	11,30	14,33	3,22	
MPT/s/ (s)	PRE	11,63	12,65	1,84	0,512
	POST	12,75	12,79	1,84	
MPT/z/ (s)	PRE	10,31	10,57	2,51	0,827
	POST	11,07	12,50	2,51	

*p>0,005 – Mann-Whitney assessment
Caption: PRÉ=moment pre-therapy; Post=moment Post therapy; s=seconds ; MPT- maximum phonation time.

Table 3. Comparison on results the perceptual voice assessment pre and post therapy

Type of evaluation	Variable	Classification	Moments		Vaue of de p
			PRE n (%)	POST n (%)	
Vocal assessment auditive perceptual	Vocal type	hoarse, breathy and compressed	1 (33,33)	1 (33,33)	0,135
		Bitonal	2 (66,67)	0 (0,00)	
		Soprosa	0 (0,00)	2 (66,67)	
	Ressonant focus	Laringofaríngeo	2 (66,67)	0 (0,00)	0,135
		Hipernasal	0 (0,00)	2 (66,67)	
		Adequated	1 (33,33)	1 (33,33)	
	Pitch	Low	1 (33,33)	3 (100,00)	0,083
		do	0 (00,00)	0 (0,00)	
		Adequated	2 (66,67)	0 (0,00)	
		Intense	0 (0,00)	0 (0,00)	
	Loudness	Adequate	1 (33,33)	2 (66,67)	0,188
		Increased	0 (0,00)	1 (33,33)	
		Decreased	2 (66,67)	0 (0,00)	

*p>0,005 – Qui-square assessment
Caption: PRE=moment pre-therapy; POST=moment post-therapy; n=number of subjects; %=percentage of subjects.

Table 4. Comparison on results of analysis on acoustic glotic pre and post therapy

Acoustic analysis	Moment	Mean	Median	Standard deviation	Value of p
f0	PRE	237,30	204,20	33,58	0,512
	POST	254,93	252,51	33,58	
PPQ	PRE	2,20	1,40	0,71	0,275
	POST	1,07	0,93	0,71	
vf0	PRE	23,00	4,25	14,12	0,275
	POST	2,13	1,89	14,12	
APQ	PRE	8,30	8,91	1,82	0,275
	POST	4,44	5,23	1,82	
vAm	PRE	31,05	25,29	7,30	0,126
	POST	15,31	17,42	7,30	
NHR	PRE	0,36	0,27	0,11	0,184
	POST	0,14	0,14	0,11	
VTI	PRE	0,07	0,07	0,00	0,261
	POST	0,05	0,06	0,00	
SPI	PRE	8,65	10,44	2,88	0,512
	POST	6,99	4,00	2,88	
DVB	PRE	0,33	0,00	0,23	0,317
	POST	0,00	0,00	0,23	
DSH	PRE	9,81	9,23	3,38	0,049*
	POST	0,70	0,63	3,38	
NVB	PRE	0,66	0,00	0,47	0,317
	POST	0,00	0,00	0,47	
DUV	PRE	15,53	19,75	5,67	0,121
	POST	0,00	0,00	5,67	
NSH	PRE	11,66	12,00	3,49	0,049*
	POST	1,00	1,00	3,49	
NUV	PRE	24,00	32,00	8,64	0,121
	POST	0,00	0,00	8,64	

* p> 0.005 - Mann-Whitney test
Caption: f 0 = fundamental frequency; PRE = pre-therapy time; POST = post-therapy time; PPQ = ratio of disturbance of the pitch; vf0 = coefficient of variation of f0; vAm = coefficient of variation in amplitude; APQ = quotient of amplitude perturbations; NHR = noise-harmonic ratio; SPI = soft phonation index; VTI = voice turbulence index; NVB = number of voice breaks; DVB = degree of voice breaks; DUV = degree of unvoiced segment; NUV = number of unvoiced segment; NSH = number of sub-harmonic segments; DSH = degree of sub-harmonic components.

DISCUSSION

The vocal hyperfunction or hypertension is one of the main features of the functional and organo-functional dysphonia, it generates increased tension in the laryngeal muscles and also affects external muscles [3,4,8,9]. Overall, the loss in vocal production is related to inadequate respiratory function, misuse of sounding boards, hypertension lingual, laryngeal and perilaryngeal and cervical muscles[6,19,20]. In such cases, they are common the presence of edema or nodules, glottal gaps and high larynx, and these features more commonly found in women[15-17].

In this study, it was observed that the posture passed misaligned to aligned for all subjects (Table 1). We believe that the work of guidance on the postural adaptation, associated with the nasal sound, that is also relaxing to be offered subject to improvement in blood pressure and body balance, it also helps to release tension of the vocal apparatus, the cervical muscles and waist scapular. Disharmony posture generally is related to the vocal change of hyperfunctional purpose and it can be related to the vocal change as a result of imbalances in the craniocervical muscles[3,4,6,8,9,19,21]. Thus, upright posture allows greater freedom of vertical movements of the larynx and avoids the tension of cervical muscles and shoulder girdle, improving vocal production as a whole [3,4,6-8,9,21].

This study aimed to identify the influence of body posture on the teachers´ vocal production and the analysis was based on the MPT of the vowel / a / in three different postures: standing (A), with forward head associated with the extension of the cervical spine (B) and an increase thoracic kyphosis associated with forward head (C) by means of photogrammetry, perceptual and acoustic vocal assessment. The results showed variation of jitter between positions A and B and auditional vocal perception changes between postures in A- B and A- C regarding to the resonance, pitch and voice quality, concluding that upright posture is the most suitable for vocal production[21]. So, the results meet this research.

In general, the presence of postural change may also occur in loss of respiratory mechanism. Thus, the postural adaptation process associated with respiratory adequacy conducted during this study, based on the exploitation of promotion of all lung area and control the respiratory muscles [3,4,8,9] also seems to have influenced the improvement of vocal production observed.

It was found in assessing the respiratory tract was higher in two of three subjects pretreatment and got on to costodiaphragmatic-abdominal in all post-therapy (Table 1), resulting from work with explanations and monitoring the movement of the structures involved in breathing, with the execution of specific exercises for promoting costodiaphragmatic-abdominal pattern that consists of opening the ribs, external projection of bone, lowering the diaphragmatic muscle and abdominal expansion to greater air control of phonation [4,8,9]. Together with postural changes, inefficient breathing patterns can lead to laryngeal hyperfunction, according to the findings of this study and in accordance with literature [4,8,9].

Despite the improvement of the MPT, there was no significant difference in the mean of vowels, voiced and fricative sound pre and post-therapy (Table 2). However, all the MPT showed an increase compared to the position gains, and respiratory tract, showing that speech therapy is effective in regard to improving pneumo-phono-articulatory coordination of study subjects. However, it is believed that the time of completion of therapy has not been sufficient to significantly increase the MPT of the individuals and standardize them, as they remained below the recommended in the literature for female gender [8].

In perceptual voice assessment there were no significant results related to vocal type, resonant focus, pitch and loudness (Table 3). However, in qualitative analysis, there was a change in the resonant focus Laryngopharyngeal to hypernasal, the pitch that has become loud, decreased hoarseness and modification reduced for proper loudness.

The resonant focus is directly related to the area of the vocal tract where there is prevalence of voice amplification. Thus, the source-filter interaction is less efficient when there is excessive concentration of power in a specific area and can cause poverty in the amplification and harmonics, precluding a proper phonation[4,7-9,18] . In Laryngopharyngeal focus occurs the concentration of muscular overload in the neck (larynx and pharynx), generating a compressed sound or surface strangled and without projection[22].

One might think that the use of the basic speech therapy allied to the systematic execution of nasal sounds promoted dissipation of laryngeal tension verified in this assessment. In addition to soften the issue, nasal sounds cause retroflex resonance due to the articulation occlusion in the oral cavity, causing a flow of energy to the nasal cavity and a reflux into the larynx. The reflected impedance break laryngeal tension, helps to relax this muscle, softens the sound,

improves resonance and vocal projectionl[1,2,4,9]. The resonant improvement can also be related to the spectral energy produced by the nasal sound that influences the perceptual sense, and results from a new set of vocal tract[2,5].

In most of the subjects in this research, we found that the resonant focus shifted to laryngopharyngeal hypernasal, which can be considered as a benefit to the use of speech therapy nasal sounds dissipation of hypertension laryngeal and pharyngeal area, a good preliminary issue Vocal[2]. Furthermore, we believe that this focus shift to higher resonance due to an overcorrection of the subject, was used by way nasal sound, directing the vocal utterance to "mask" out of focus for a low upper and automating this pattern for spontaneous speech, since the nasal sounds improved proprioception, increasing the sensation during and after exercises[2].

It is believed that the use of higher resonance focus is not harmful to vocal health because in some languages people use more nasality as standard voice, since this is an indicative factor of dysphonia. It is considered that the length of therapy with nasal sounds made in isolation, may have influenced the subjects, who transferred the new possibilities of adjustments engines for speech generating increased nasality in the voice[2,4].

As for louding the pitch, how individuals had dysphonia arising from incorrect vocal uses that manifested by hyperfunction and focus resonant Laryngopharyngeal, confirming over-voltage, you could consider this pitch elevation, combined with discreet acoustic lifting f0, as a positive aspect obtained by phonotherapy program implemented by this study, since the pitch slightly more acute, since without hyperfunction and held in modal voice record is not a problem for the laryngeal muscles and in the case of women, can be considered adequate[2,9.]

Although not significant, it was observed that the two cases had hoarse-breathy vocal quality eliminated hoarseness and just kept breathiness. These findings corroborate those of an international study that examined the effect of humming on voice quality and noted elimination of roughness, and maintenance of breathiness in the voice, attributing this change to glottal configuration produced by nasal sound, which relaxes the muscles and makes the start the easy and without phonation presence of excessive tension, resulting in periodic glottal vibration and high harmonicals [2,8]. The maintenance of breathiness was attributed by the authors to the short length of therapy did not allow the complete elimination of the lesion and the presence of edema that may have hindered a complete glotic coaptation [5].

There was a decrease of acoustic measures of NSH and DSH post-therapy compared to pre-therapy time (Table 4), respectively number and degree of sub-harmonic components, which may correspond to loud voices, diplophnics or issues in basal sound when higher [13,14,18]. The improvement of these measures suggests decrease in irregularity of the vibration of the vocal folds, decrease of aperiodic energy, agreeing with the findings of vocal quality [2,13,14,18] , which although not significant, showing the elimination of hoarseness in two cases that have gone hoarse-breathy to breathy, as well as the tissue improvements found by the evaluation.

This study of clinical cases sought to verify the short-term changes in vocal quality after running two weeks of therapy humming in a group of dysphonic and non-dysphonic of depression of post-therapy roughness in both groups, however, we do not analyzed the subharmonics measures, only jitter, shimmer, f0 and harmonic-noise ratio. Nevertheless the results show decrease in noise and confirm the technical use efficiency of nasal sounds in cases of hyperfunctional dysphonies[5], corroborating the findings of this research. In the cases studied hyperfunctional dysphonia, these improvements appear to benefit the course of vocal therapy with emphasis on the nasal sounds which soften the emission and increase the number of harmonics and consequently reduce the noise present in the voice [1,2,5].

Strengthening auditive perceptual and acoustic vocal findings that show decreased noise, it was observed in videolaryngoscopy that there was a decrease of edema in the arytenoid region and the vocal folds with partial resorption lump, improved glottal closure and mucosal wave with decreased vocal slot and tissue improves with the disappearance of bleeding points (Figure 1). The literature[2,23] shows that SOVTE such as nasal sounds, can cause changes in the vocal tract, the glottal closure coefficient, increased vibration from all over the laryngeal framework, higher activity of thyroarytenoid muscle, decreased medial laryngeal vestibule constriction, decreased burden during the adduction of the vocal folds, which can justify the ENT improvements found.

Randomized study analyzed the use of resonant voice, a method that is used primarily of nasal sounds

in subjects with acute edema of the vocal folds, showed effectiveness in reducing the nasal sound edema[24], converging with the findings of this research on laryngeal tissue improvements and glottal closure observed by medical evaluation.

Still, the realization of new longitudinal studies it is necessary to deploy this therapeutic program with larger samples to ascertain whether the findings of this study of clinical cases are confirmed in other populations and in both sexes, adding up instruments of vocal self-assessment.

CONCLUSION

In the three female subjects studied after the execution of a phonotherapy program that included vocal and postural orientation, adequacy of respiratory function and technical application of nasal sounds in dysphonia hyperfunctional, we observed improvement of body posture and the respiratory tract, improvements acoustic measurement suggestive of noise to the vocal production and positive effects on the fabric and the closure of the vocal folds.

REFERENCES

1. Pereira EC, Silvério KCA, Marques JM, Camargo PAM. Efeito imediato de técnicas vocais em mulheres sem queixa vocal. Rev CEFAC. 2011;13(5):886-95.
2. Cielo CA, Lima JPM, Christmann MK, Brum R. Exercícios de trato vocal semiocluído: revisão de literatura. Rev CEFAC. 2013;15(6):1679-89.
3. Pinho SMR. Terapia Vocal. In: Pinho SMR. (Org.). Tópicos em voz. Rio de Janeiro: Guanabara Koogan, 2001.P. 1-17.
4. Behlau M. Voz: o livro do especialista. 2. Ed. Rio de Janeiro: Revinter, 2005.
5. Yiu EM-L, Ho EY-Y. Short-term effect of humming on vocal quality. Asia Pacific Journal of Speech, Language and Hearing. 2002;7(1):123-37.
6. Cielo CA, Christmann MK, Ribeiro VV, Hoffmann CF, Padilha JF, Steidl EMS et al. Síndrome de tensão musculoesquelética, musculatura laríngea extrínseca e postura corporal: considerações teóricas. Rev CEFAC. 2014; 16(5):1639-49.
7. Behlau M, Pontes P, Vieira VP, Yamasaki R, Madazio G. Apresentação do programa integral de reabilitação vocal para o tratamento das disfonias comportamentais. CoDAS. 2013;25(5):492-6.
8. Behlau M. (Org.). Voz: o livro do especialista. (1st ed.). v. 1. Rio de Janeiro, RJ: Revinter, 2001.
9. Pinho SMR. Avaliação e tratamento da voz. In: Pinho SMR. Fundamentos em fonoaudiologia: tratando os distúrbios da voz. São Paulo: Guanabara Koogan, 2003. P. 3-36.
10. Kasama ST, Martinez EZ, Navarro VL. Proposta de um programa de bem estar vocal para professores: estudo de caso. Disturb Comun. 2011;23(1): 35-42.
11. Penteado RZ, Ribas TM. Processos educativos em saúde vocal do professor: análise da literatura da Fonoaudiologia brasileira. Rev Soc Bras Fonoaudiol. 2011;16(2):233-9.
12. Anhaia TC, Gurgel LG, Vieira RH, Cassol M. Intervenções vocais diretas e indiretas em professores: revisão sistemática da literatura. ACR. 2013;18(4):361-6.
13. Roman-Niehues G, Cielo CA. Modificações vocais acústicas produzidas pelo som hiperagudo. Rev CEFAC. 2010;12(3):462-70.
14. Beber BC, Cielo CA. Características vocais acústicas de homens com voz e laringe normais. Rev CEFAC. 2011;13(2):340-51.
15. Zheng YQ, Zhang BR, Su WY, Gong J, Yuan MQ, Ding YL et al. Laryngeal aerodynamic analysis in assisting with the diagnosis of muscle tension dysphonia. J Voice. 2012;26(2):177-81.
16. Angsuwarangsee T, Morrison M. Extrinsic laryngeal muscular tension in patients with voice disorders. J Voice. 2002;16(3):333-43.
17. Silverio KCA, Siqueira LTD, Lauris JRP, Brasolotto AG. Dor musculoesquelética em mulheres disfônicas. CoDAS. 2014;26(5):374-81.
18. Barros APB, Carrara-De Angelis E. Análise acústica da voz (2002). In: Dedivitis RA, Barros APB. (Org.). Métodos de avaliação e diagnóstico da laringe e voz. São Paulo, SP: Lovise, 2002. P.185-200.
19. Van Houte E, Van Lierde K, Claeys S. Pathophysiology and treatment of muscle tension dysphonia: a review of the current knowledge. J Voice. 2011;25(2):202-7.
20. Menoncin LCM, Jurkiewicz EL, Silvério KCA, Camargo PM, Wolff NMM. Alterações musculares e esqueléticas cervicais em mulheres disfônicas. Arq Int Otorrinolaringol. 2010;14(4):461-6.
21. Carneiro PR, Teles LCS. Influência de alterações posturais, acompanhadas por fotogrametria computadorizada, na produção da voz. Fisioter Mov. 2012;25(1):13-20.

22. Soares EB, Brito CMCP. Perfil vocal do guia de turismo. Rev CEFAC. 2006;8(4):501-8.
23. Cielo CA, Lima JPM, Christmann MK. Evidências científicas sobre exercícios de trato vocal semiocluído - revisão de literatura. In: Pró-Fono. (Org.). Terapia fonoaudiológica baseada em evidências. 1. Ed. Barueri: Pró-Fono, 2013. P. 403-20.
24. Abbott VK, Li NY, Branski RC, Rosen CA, Grillo E, Steinhauer K at al. Vocal exercise may attenuate acute vocal fold inflammation. J Voice. 2012;26(6):814.e1-13.