Case Report

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Intensive voice therapy for the elderly

Método intensivo de terapia vocal para idosos

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ABSTRACT

The aim of this study is to describe the results of intensive voice therapy in a presbyphonia case and to propose a voice treatment program for the elderly by demonstrating vocal quality, quality of life and laryngeal image results. The Voice Therapy for the Elderly (VTE) program consisted of a sequence of exercises that aimed at increasing intensity, pneumo-articulatory coordination, mucosal vibration and resonance balance, and increasing frequency variation and control. The therapeutic model in question was applied to an 87-year-old female subject with complaints of a weak voice and difficulty to be heard by others. This therapy program was applied with an intensive approach over 16 sessions, 30 minutes each session, four times a week, with assigned homework. The intensive voice therapy format demonstrated positive effects on vocal quality with an overall reduction in voice deviation, breathiness, and roughness on sustained phonation and speech. Vocal performance improvement showed a subsequent increase in the physical and general aspects of voice-related quality of life. There was also improvement in glottic closure. Voice treatment via the VTE method, with an intensive approach revealed to be positive in the treatment of presbyphonia and can potentially promote benefits for the elderly in terms of voice quality, voice-related quality of life, and laryngeal changes.

Keywords: Voice; Aging; Vocal training; Dysphonia; Voice disorders

RESUMO

O objetivo deste relato de caso é descrever os resultados da terapia fonoaudiológica intensiva em um caso de presbifonia e apresentar uma proposta de tratamento vocal para idosos demonstrando seus resultados na qualidade vocal, qualidade de vida e imagem laríngea de um paciente com presbifonia. O programa Terapia Vocal para Idosos (TVI) é constituído por uma sequência de exercícios que visam o aumento da *loudness*, coordenação pneumofonoarticulatória, melhora na vibração de mucosa e equilíbrio de ressonância, além da variação e controle da frequência. O modelo terapêutico em questão foi aplicado em um indivíduo do gênero feminino com 87 anos de idade e queixas voz fraca e dificuldade em ser ouvido. As vterapias ocorreram de maneira intensiva em 16 sessões com 30 minutos de duração, quatro vezes por semana e com realização de exercícios em casa. A experiência de aplicação do programa em formato intensivo mostrou efeitos positivos na qualidade vocal com diminuição do desvio global da voz, soprosidade na emissão sustentada e rugosidade na emissão sustentada e fala. A melhora no desempenho vocal refletiu em aumento nos valores dos domínios físico e global do protocolo de qualidade de vida relacionada a voz. Houve também melhora no fechamento glótico. O tratamento vocal com o método TVI intensivo demonstra efeitos positivos no tratamento da presbifonia, e tem o potencial de promover benefícios na qualidade vocal, na qualidade de vida relacionada a voz e nos aspectos laríngeos dos idosos.

Palavras-chave: Voz; Envelhecimento; Treinamento vocal; Disfonia; Distúrbios da voz

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INTRODUCTION

According to a study that analyzed the results of randomized clinical trials involving surgical approaches and voice therapy, voice therapy should be the first choice of treatment for presbyphonia. The authors considered therapy to be less invasive and to present with a positive quality of life results[1]. A study by Oates[2] on voice therapy in the elderly showed a diversity between the interventions, as well as in the methodology of application and evaluation of the proposed therapeutic models. Most of the studies use established therapeutic methods, such as Vocal Function Exercises (VFE)[3] and Lee Silverman Voice Treatment (LSVT®)[4]; however, they are not specifically aimed at presbyphonia. The only treatment specifically designed for the elderly is the PhoRTE method, which focuses primarily on aspects of speech with increased loudness[5].

The laryngeal and vocal aspects affected by aging are atrophy of the vocal folds, glottic gaps and changes in the mucosal wave[6], which cause breathy, asthenic and rough vocal quality[7]. As such, the literature suggests that the goals and therapeutic exercises for the elderly should include exercises designed to increase respiratory support, glottic adduction, sustained phonation, vocal stability, vocal extension, and exercises to improve resonance and articulatory precision[8], as well as to promote increased phonatory energy or vocal effort[9].

Thus, a therapeutic approach focusing not only on a louder vocal emission, but also favoring mucosal vibration, resonance, pitch modulation and control, and phono-respiratory coordination, can bring great benefits, also helping to prevent dysphonia in earlier cases of vocal aging, and the use of diverse exercises, as in clinicians in Brazil, may favor the achievement of each one of these goals specifically.

In terms of frequency of therapy sessions, there is currently no ideal definition in the literature. However, there are studies emphasizing the benefits of intensive treatment[4]. This type of approach hypothetically favors motor learning, behavioral change and improved muscle performance in a shorter time than traditional therapy.

The purpose of this case report is to describe the results of intensive voice therapy and present the Voice Therapy for the Elderly Program (VTE), a vocal therapy model developed specifically to treat presbyphonia. This study also aims to demonstrate the results in terms of vocal characteristics, voice-related quality of life, and laryngeal changes of an elderly patient with presbyphonia.

CLINICAL CASE PRESENTATION

The proposed therapy model involves exercises of various techniques intended to work in a single therapy session, with one common therapeutic goal. Throughout the process, the new phonation pattern is established in a balanced way. It is important to address that the development of the program was made by two of the authors with experience treating aging voice, after discussing which techniques they used to use in the treatment of the elderly with voice complaints related to aging. After the selection of the sequence of the exercise, the program was applied as a pilot study for a year before being used for research purposes.

The treatment involved 16 sessions, lasting about 30 minutes each, four times a week. The frequency of the sessions and its total number was based on the voice therapy method described as intensive and with proven efficacy for treating the aging voice, LSVT®[4]. The subject was an 87 years old female, presenting with age-related vocal complaints. An initial speech-language and otolaryngological evaluation yielded a diagnosis of presbyphonia.

The case reported derives from a previous study submitted and approved by the Ethics Committee of the Faculdade de Odontologia de Bauru – Universidade de São Paulo (CAAE: 07814412.4.0000.5417, protocol: 160.793). The participant signed an Informed Consent Form, agreeing to participate in the study.

Patients characteristics included: general stable health conditions and cognitive and motor conditions that allowed the accomplishment of the evaluation and therapy procedures; vocal complaints originating in the aging period; respond positively to the techniques proposed in the therapeutic program; no reported neurological problems; no structural changes or laryngeal lesions not consistent with the physiological changes due to aging; no previous laryngeal surgery; never smoking; no complaints of hearing loss that interfere with the understanding of the instructions given during the assessments and therapy sessions.

A sustained vowel /a/ and counting from one to 10 was recorded one week before the beginning of treatment and one week after treatment. For the recording sessions, a head microphone (AKG model C444PP) located 45 degrees and 4 cm away from the subject's mouth was used. The recordings were performed in an acoustically treated room using professional audio software Sound Forge 10.0, Creative Audigy II sound card computer, a sampling rate of 44.100 Hz, Mono channel at 16 Bit, amplifier model 3710 (Pentax). Spectrogram of the sustained vowel was extracted using Real-Time Spectrogram (Pentax), narrowband filter. The sampling rate was adjusted to 11.025 Hz, 16 bit and 5.000 Hz resolution.

The patient also answered the self-assessment questionnaire Voice Related Quality of protocol (VRQOL), validated to the Brazilian Portuguese[10], pre- and post-treatment. In addition, an evaluation of the laryngeal structures was performed during phonation through telelaryngoscopy, videostroboscopy, and nasolaryngoscopy.

A speech-pathologist and an otolaryngologist without any access to the treatment procedures carried-out all the procedures during the assessment sessions. In the same way, the laryngeal and vocal perceptual analyses were performed by blinded researchers with no access to the treatment or the moment of the evaluation (pre- or post-treatment).

For the perceptual auditory analysis, a single speech pathologist with more than five years of experience in this kind of assessment was presented to a total number of 126 pairs of the sustained /a/ emission, and 126 pairs of the connected speech from elderly patients with vocal

complaints who underwent therapy. Each pair corresponded to different moments of vocal assessment (before or after therapy), but without any identification. There was a repetition of 10% of the sample, calculating the evaluator's reliability. The evaluator should identify if the second emission presented had improved, got worsen or presented with no differences comparing to the first one, in relation to the following parameters: a general degree of deviation, roughness, breathiness, loudness, and instability (this last one only for the sustained vowel).

In the same way, the visual-perceptual evaluation of 126 laryngoscopy examinations was presented to a single experienced evaluator, with a repetition of 10% of the total sample. The exams were presented in pairs without the identification of patients and the time of evaluation. The following parameters were analyzed: vocal fold bowing; the prominence of vocal processes; glottal closure; medial or anterior-posterior vestibule constriction; and alteration of mucosa vibration. The evaluator should indicate whether appearance increased, decreased or presented no difference. Both evaluators presented with substantial reliability (kappa 0.78 and 0.75 respectively).

The exercises were selected based on their physiology, with the intention of improving the vocal aspects altered by aging. The exercises of the proposed therapy program are described in Table 1. All of them were performed in all sessions, with an average duration of 30 minutes. Each one of them was performed for four minutes counted by a stopwatch, with the exception of the last one, which was performed for two minutes due to the effort needed to perform it.

The patient was instructed to perform the voice exercise program twice a day at home on days when she did not participate in voice therapy, and once a day on the day she attended the therapeutic sessions. This practice began from the fourth face-to-face session when the patient was already able to perform the exercises with autonomy.

The three VRQOL scores were calculated for the analysis of the therapy results: physical, social-emotional and total. The comparison of these scores showed an increase in the physical and total score values after voice therapy. At baseline, the physical score was 91.7% and after therapy, it was 95.8%; the social-emotional score was 100% at baseline and remained unaltered after therapy; the total score was 95% at baseline, and increased to 97.5% by the end of the vocal intervention.

Vocal quality was characterized as rough and weak before the treatment. At the end of the therapeutic process, the evaluator's assessment yielded an improvement in vocal projection, with increased loudness and decreased breathiness and instability. There were improvements for both sustained vowel and connected speech, which provided family and patient satisfaction, with reportedly improved communication effectiveness. These changes were demonstrated by spectrogram analysis of the emission of a sustained vowel /a/ in a habitual pitch and loudness, in the pre-therapy period (Figure 1) and in the post-intervention period (Figure 2).

The initial laryngeal evaluation showed vocal fold bowing, prominence of vocal processes, and spindle-shaped glottic chink during phonation (Figure 3). The post-therapeutic intervention showed improved glottic closure (Figure 4).

Table 1. Exercises of the proposed vocal therapy program

Technique	Exercise	Desired Effects
Tong or Lip Trills	**Tongue or lip trill** with continuous phonation	Improves mucosal vibration of vocal folds and assists in normotensive vocal production[11].
Nasal sound technique	**Nasal sound** "m" phonation continuous or chewed	It facilitates vocal production with less effort, decreases roughness and balances resonance[12].
Musical scales technique	Ascending and descending **vocal glissandos**, associated with facilitating sounds, such as: trill, nasal or fricative "z"	It increases vocal flexibility[13] and improves glottic closure[12].
Maximum phonation time technique	Sustained vowel emission at the **maximum phonation time, with stronger vocal intensity than usual**, maintaining adequate mouth opening, without excessive muscular effort, controlling the vocal quality throughout the emission.	It increases sound pressure levels[14], improves glottic closure and increases resistance to expiratory air passage, helping to improve phonatory stability. It is highly effective in situations of vocal hypotonia and in this case, the exercise should be performed at slightly stronger vocal intensity than usual[12].
Water-tube phonation	**Prolonged sound phonation** similar to "u" or "v" in a **silicon tube** of 35 cm in length and 9-12 mm in diameter placed in the mouth, between or in front of the incisor teeth and above the tongue that should be relaxed and may lightly touch the tube without occluding it, the other end being dipped into a water bottle with a capacity of about 500 ml of liquid and filled with fence of 2/3 of water. **The tube should be immersed 1-2 cm in the liquid**.	It enlarges the vocal tract and reduces the collision force between the vocal folds[15].
Deep water tube phonation	**Short sound phonation** similar to "u" or "v", in a **silicon tube** as described in the previous exercise, but **the tube should be immersed 10 cm in the liquid.**	It activates the laryngeal musculature and performs compensation, as a strengthening exercise, aiding in glottic closure[15].

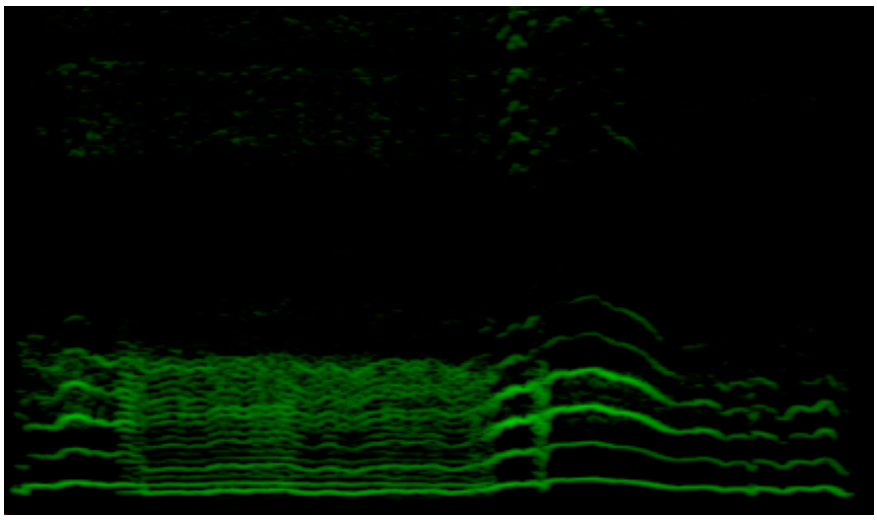

Figure 1. Spectrographic image of the sustained vowel "a" extracted prior to the beginning of the treatment intervention with Real-Time Spectrogram (Pentax). It is observed the presence of irregular tracing with noise, few harmonics and presence of sub-harmonics especially at the beginning of the emission, besides instability

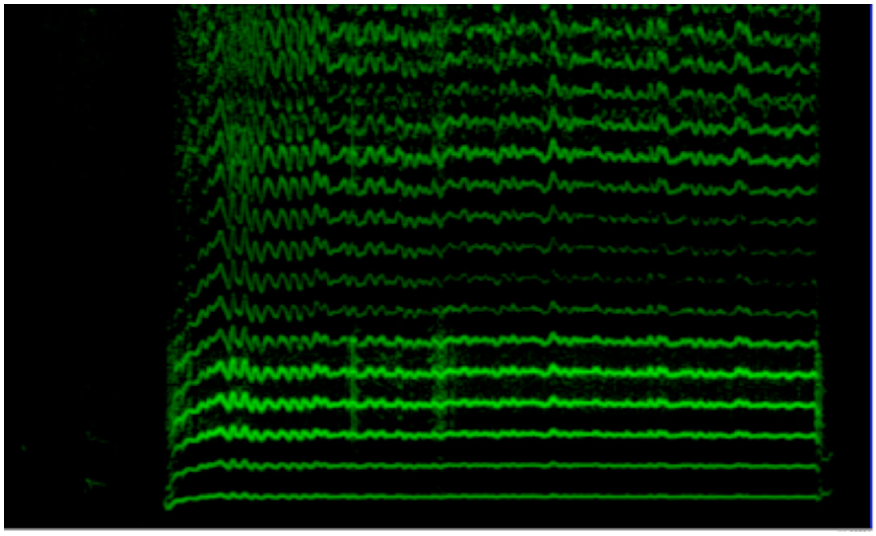

Figure 2. Spectrographic image of the sustained vowel emission "a" extracted at the end of the therapeutic process using Real-Time Spectrogram (Pentax). It is observed the presence of a greater number of harmonics, the absence of sub-harmonics, with reduction of noise and improvement in controlling frequency

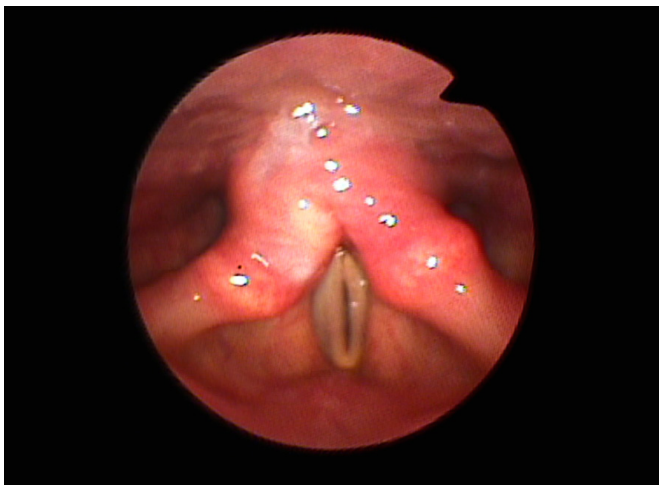

Figure 3. Laryngoscopy performed one week prior to the beginning of voice therapy

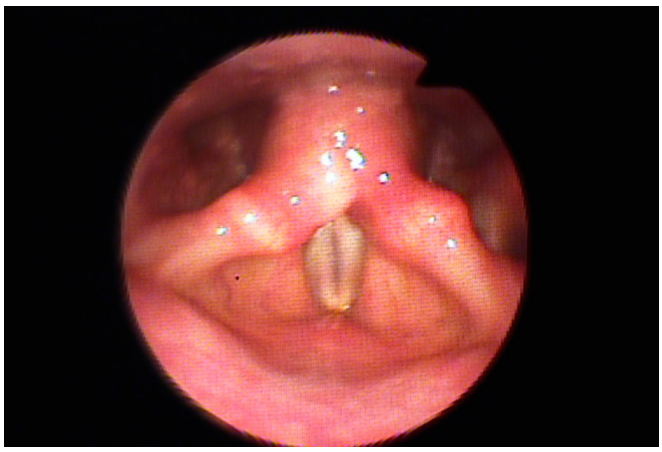

Figure 4. Laryngoscopy performed one week after the completion of the therapeutic process

DISCUSSION

In Brazil, it is common to use combined vocal exercises belonging to more than one therapeutic approach[12], taking into consideration that dysphonia derives from more than one altered vocal aspect. Also, the use of a diverse approach, allows the clinician to choose exercises from various techniques and even mix them, which can make the therapy most attractive, allowing for the achievement of various therapeutic goals.

Aging may lead to morphological changes in the larynx[6], which may lead to changes in mucosal vibration. Vibrating exercises can maximize the vibration amplitude of the vocal folds' mucosa[13], allowing for a more comfortable phonation with a greater number of harmonics, and it may had an important role in this specific case, as in the spectrogram after treatment (Figure 2).

The use of nasal exercises may have favored a more balanced resonance and helped in the improvement of vocal projection, reducing the excessive use of laryngeal resonance. This can promote a better vocal balance during phonation with less effort, which facilitates vocal production[12], allowing for a more loud and projected voice. Additionally, patients with presbyphonia tend to compensate for the weak voice with strain, and resonance exercises seem to improve the loudness without additional tension during emission and seemed to help on a better performance for the subsequent exercises.

In the frequency variation during phonation, ascending and descending glissandos helped improve vocal extension and flexibility[13]. The literature also suggests that this technique assists in closing the gaps to produce vocal fold stretching and shortening[12]. In addition, the Vocal Function Exercises (VFE) also includes this type of exercises, and have shown positive results in patients with presbyphonia[3].

The exercises that prioritize Maximum Phonation Time or sustained phonation at a louder voice are already used in presbyphonia therapy, as they promote greater phonation stability, better airflow control and better projection associated with increased loudness. These results are also described for VFE[3], LSVT®[4] and PhoRTE[5] methods, which use similar types of exercise.

The water tube phonation exercises involve partial occlusion of the vocal tract and are performed with tubes or straws of various materials and dimensions. The resonance tube technique, with silicon material, is one such method. Tube phonation exercises are intended to promote a more balanced phonation with less laryngeal structural interference, thus useful to promote vocal improvement in cases of hypophonia. For this last purpose, the literature[15] suggests deep immersion of the tube into the water and the production of short vocal phonations, generating an additional effort that facilitated the approximation of the vocal folds and activated the thyroarytenoid muscle, promoting improvement in glottic closure.

Thereby, it is suggested that the improvement in vocal quality and the patient's glottic closure occurred in response to the exercise combination, considering the literature description. The proposed therapy program presented here is expected to improve the parameters of roughness, breathiness, as well as decrease the global deviation of the voice because it consists of exercises that aim, among other aspects, to improve mucosal vibration, glottic closure and increase vocal intensity and stability. Other specific voice therapy programs for presbyphonia, containing one or more of the here proposed exercises, also achieved the objective of improving vocal quality[2-4]. Such improvement may have a direct influence on the physical score of the VRQOL questionnaire, providing an overall improvement in the post-therapy, even if small, since the patient in question already had a pre-treatment high score, showing a good voice-related quality of life from the beginning. Other similar studies have also demonstrated positive results in the self-assessment questionnaires in the elderly undergoing voice therapy[2,5].

Some elderly patients with vocal complaints due to aging present with a strain vocal quality, either due to inadequate vocal behavior or as a way of compensating for altered vocal changes. When tension in the voice is exacerbated, it is suggested to modify VTE or combine it with other therapeutic methods, in order to balance the increased vocal strength (which is the goal of the program), with reduced vocal strain. The use of the same exercises each session was done here with research purposes. However, clinicians should be encouraged to use the techniques they feel comfortable with, as long as the physiology of the vocal exercises is related to the physiology of what is happening to the patient's laryngeal mechanism.

Another aspect to be aware of is the presence of wet vocal quality due to excessive secretions accumulated in the larynx, which is common in this population. In these cases, it is important to investigate altered digestive aspects, especially regarding the presence of swallowing disorders and laryngopharyngeal reflux, following the necessary guidelines and providing the necessary referrals.

Also, the performance of speech-associated exercises is suggested to promote generalization of improvement in vocal quality when it is not achieved only with the proposed exercises of the VTE program. The case presented improved voice during sustained phonation and speech; however, speech techniques aiming to generalization are also important.

Concerning the intensive approach, voice therapy studies vary with respect to a number of sessions, frequency, and duration of the sessions. For the purpose of this study, the LSVT® methodology was chosen as a model in terms of a number of sessions, because it is the voice therapy method with the best scientific evidence, and it is specifically designed for patients with hypophonia[4]. As the goal of vocal rehabilitation in presbyphonia is to diminish the effects of laryngeal hypofunction, an intensive voice therapy emphasizes repetition and stimulates the best possible voice production, allowing a fast improvement and generalization.

The limitations of this study are related to the report of only one case. It is important to test the program in a larger number of cases. Future research should investigate the optimal time to perform each of the vocal exercises during therapy with the elderly. In addition, controlled and randomized clinical trials will produce scientific evidence regarding the effects of VTE in the intensive treatment format.

FINAL COMMENTS

VTE is a program that showed positive effects in the treatment of presbyphonia. It is geared towards the needs of the elderly in a comprehensive way and involves techniques that are generally known to the Brazilian clinicians. These techniques are easily accessible and applicable and benefit the patient's voice, quality of life and laryngeal configuration.

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