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Brief Communication

Comunicação Breve

Cognitive Vocal Program applied to individuals with signals presbylarynx: preliminary results

Programa Vocal Cognitivo aplicado a indivíduos com sinais de presbilaringe: resultados preliminares

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Keywords

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ABSTRACT

Purpose: To propose and verify the feasibility of a vocal program intervention in patients with presbylarynx signs with or without vocal complaints. **Method:** Among 20 elder participants of the current research, 3 female patients with median age of 67 years were chosen for the pilot study. Laryngological examination, vocal recording with CAPE-V (Consensus Auditory-Perceptual Evaluation of Voice) protocol, and Screening Protocol of Risk of Dysphonia (SPRD) were conducted before and after the program intervention. They joined the Cognitive Vocal Program for presbyphonia based on the genetic epistemology by Jean Piaget associated with vocal techniques based on scientific literature. This program is structured with six sessions and each one of them is focused in different aspects of vocal production. **Results:** After the program intervention, some aspects such as loudness, coordination between breathing and speaking, accuracy in articulatory movements, jitter, and harmonics-to-noise ratio improved with parameters within the expected range for the age group. Three female participants were observed for better vocal quality, higher fundamental frequency, and better maximum phonation time. In two cases, tension related to loudness elevation and better scores on SPRD was observed. Using by high-speed laryngeal image, we also observed reduction of presbylarynx signs, and remarkable improvement in glottis closure competence and mucosal wave movement of the patients with and without vocal complaints. **Conclusion:** The preliminary results suggest encouraging prospects for the proposal with improvement in the aspects analyzed. This program was well designed and did not require any further adjustments.

Descritores

Voz
Distúrbios da Voz
Fonoterapia
Idoso
Saúde do Idoso
Envelhecimento
Cognição

RESUMO

Objetivo: Propor e verificar a exequibilidade de programa de intervenção fonoaudiológica para indivíduos com sinais de presbilaringe com ou sem queixa vocal. **Método:** Dentre 20 idosos integrantes da pesquisa, participaram deste piloto três idosas com média de 67 anos. Antes e após o programa, realizaram exame laringológico, gravação da voz com protocolo CAPE-V, responderam ao Protocolo de Rastreio de Risco de Disfonia (PRRD) e participaram do Programa Vocal Cognitivo para presbifonia elaborado com fundamentação teórica na epistemologia genética de Jean Piaget associado a técnicas vocais baseadas na literatura. É composto por seis sessões, cada uma com ênfase em diferentes aspectos da produção vocal. **Resultados:** Após o programa, *loudness*, coordenação pneumofonoarticulatória, clareza articulatória, *jitter* e proporção harmônico-ruído melhoraram, ficando dentro do esperado para a faixa etária. Nas três participantes observou-se melhora da qualidade vocal, aumento da frequência fundamental e melhora dos tempos máximos de fonação. Em duas observou-se tensão associada à elevação da *loudness* e melhora no escore PRRD. Observou-se nas participantes redução dos sinais de presbilaringe observados ao exame de laringoscopia, com melhora da coaptação glótica e movimentação da onda mucosa. **Conclusão:** Os resultados preliminares apontam perspectivas animadoras em relação à proposta com melhora dos aspectos analisados. O programa proposto mostrou-se exequível e bem delineado, não sendo necessários ajustes para continuidade do projeto.

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INTRODUCTION

Aging may lead do vocal changes such as reduced intensity, increased jitter, changes in vocal quality, decrease of maximum phonation time and diadochokinesia, and lower pitched voice for women and higher pitched voice for men, characterizing presbyphonia[1,2]. Elders with adapted voice are those who present vocal quality with a tendency to instability —slight breathiness and roughness may be observed, the average fundamental frequency of women is around 180 Hz and that of men is around 140 Hz, women's pitch tends to get lower whereas men's go higher, vocal extension is reduced, the identification of gender by voice may be compromised, and the vocal intensity tends to be reduced — as well as loudness, the breathing is more superficial, with an impact on the pneumophonoarticulatory coordination and on the maximum phonation time, which would be around 10 s among women and 15 s among men; vocal attack may be breathy[3]. It is believed that the effects of aging on the voice may be minimized or delayed with speech therapy[2,4] and that a proposal based on the genetic epistemology by Jean Piaget in association with vocal techniques in speech therapy contribute to therapeutic success[5,6]. The objective of this study was to propose and verify the effectiveness of a speech language intervention called Cognitive Vocal Program (CVP) for individuals with presbylarynx signs with or without vocal complaints.

METHODS

This is a longitudinal study approved by the ethics committee of the School of Medicine (No. 120.831). This preliminary phase (predicted total of 20 elderly of both gender) comprised 3 women (aged 65–69 years); of them, 2 had vocal complaints and 1 was diagnosed with presbilarynx according to the otorhinolaryngological evaluation using a high-speed videolaryngoscopy. For this study, the following pre- and post-program assessment data were selected: high-speed videolaryngoscopy, tasks of the Consensus Auditory-Perceptual Evaluation of Voice (CAPE-V) [7] recorded in an acoustically treated room (Audacity software, external USB 5.1 3D soundboard, internal digital amplifier Class B 3D Sound, and AKG-520 headset microphone), and Dysphonia Risk Screening Protocol (DRSP)[8]. This instrument was developed by the service and had its applicability proved among women, children, and elderly, for both clinical and preventive actions; it presents a proposal for calculating the score, granting points to negative answers, considering the more negative the answer is, the higher the score is.

The format of the program, as well as the elected vocal techniques, was based on the literature[9-11], and the cognitive-based repetitive dynamic visual stimuli were based on the genetic epistemology by Jean Piaget[5,6,12]. The full program is presented in Chart 1.

Chart 1. Description of the Cognitive Vocal Program for presbyphonia

Cognitive Vocal Program (CVP) — Presbyphonia

This program was designed to be developed along with patients with vocal changes with hypofunctional components: presbyphonia or signs of presbylarynx with or without vocal complaint.
Justification: the training program present exercises which address respiratory aspects for better pneumophonoarticulatory coordination, and glottal source and filter exercise which are usually used in the vocal alterations above, in order to have a better phonatory adjustment.

Program

1. Laryngological assessment at the *Ambulatório de Otorrinolaringologia* of the teaching hospital;
2. Speech Language assessment applied with the General and Specific Dysphonia Risk Evaluation Protocol for Elderly, Voice Life Quality Questionnaire, recording of tasks of the CAPE-V with subsequent perceptive-auditory evaluation and acoustic analysis;
3. Six weekly sessions with duration of one hour each, sequentially, with possibility of one justified absence, with possibility for replacement session;
4. Immediate reevaluation: Speech Language reevaluation with the same procedures of the evaluation, to be carried out in the following week to the end of the program.

Post-program follow-up

1. Speech Language reevaluation after four weeks of the end of the program; conducting of necessary guidance;
2. Speech Language reevaluation three months after the last reevaluation with necessary guidance;
3. Speech Language/Otorhinolaryngological reevaluation six months after the last reevaluation with necessary guidance.

General guidance for the sessions

Distribution of aspects focused throughout the program:

- Introduction: 1st session;
- Breathing: 1st and 2nd sessions;
- Source: 3rd and 4th sessions;
- Filter: 5th session;
- Conclusion: 6th session.

Chart 1. Continuation

Time distribution in each session:

1st part: cognitive backup and muscle preparation (15 minutes);

2nd part: exercises (30 minutes) — preparation/explanations of the block/completion

3rd part: backup of worked aspects/house guidance (15 minutes).

First session

Objective: introduction and breathing.

1. Methodology of the program.
2. Video and explanation on the physiology of phonation, integration between systems — breathing, glottal source and filter/resonance — and on vocal aging.
3. Explanation on vocal well-being: hydration, nutrition, vocal abuse, drugs, smoking/alcohol, sleep, physical activity.
4. Exercises:
   a. Cervical relaxation/stretching: extension of the neck to the right and left, forth and back, head lateralization to the right and left, arm extension, shoulder elevation and rotation; 15" each movement; interval between movements: one inhale followed by an exhale producing breathing sounds \f\ and \v\ (once each);
   b. Costodiaphragmatic breathing pattern with exercises of air prolongation at one, two and three tempos with sounds of /f/. Perform the complete sequence twice.
5. Extra session tasks (to be noted in a specific protocol):
   a. The same exercises performed in the session (same execution and duration time) – three times a day;
   b. Observe and take notes of vocal habits, vocal abuses and factors which interfere positively or negatively on the voice.

Second session

Objective: Breathing.

1. Review of the extra session tasks (participants hand in a filled out worksheet and solve doubts).
2. Video and review of the main aspects with emphasis on breathing.
3. Exercises:
   a. Cervical relaxation/stretching as in the first session;
   b. Breathing in costodiaphragmatic pattern with exercises of air prolongation in one, two and three times with sounds of /f/. Complete sequence twice;
   c. Breathing in costodiaphragmatic pattern and pneumophonoarticulatory coordination with unvoiced and voiced lip and teeth fricative emissions /f/ and /v/, alveolar emissions /s/ and /z/ and high and medium anterior vowels /i/ and /é/ in maximum phonation time. Vowels must be pronounced at higher intensity. Complete sequence twice.
4. Extra session tasks (to be noted at a specific protocol):
   a. The same exercises performed in the session (same execution and duration time) – three times a day;
   b. Observe and take notes of vocal habits, vocal abuses and facts which interfere positively or negatively on the voice.

Third session

Objective: Glottal source.

1. Review of the extra session tasks (participants hand in a filled out worksheet and solve doubts).
2. Video and review of the main aspects with emphasis on glottal source.
3. Exercises:
   a. Cervical relaxation/stretching of the first session;
   b. Exercises with emphasis on breathing of the second session;
   c. Exercises of vibrant sounds with the tongue:
      - In usual frequency and intensity, with maximum phonation time between three and five minutes;
      - Ascending and descending glissando in maximum phonation time between three and five minutes;
      - Ascending and descending glissando associated to the emission of the vowel /a/ with a progressive increase on intensity; three times ascending and three times descending.
4. Extra session tasks (to be noted at a specific protocol):
   a. The same exercises performed in the session (same execution and duration time) – three times a day;
   b. Observe and take notes of vocal habits, vocal abuses and facts which interfere positively or negatively on the voice.

Fourth session

Objective: Glottal source.

1. Review of the extra session tasks (participants hand in a filled out worksheet and solve doubts).
2. Video and review of the main aspects with emphasis on glottal source.

Chart 1. Continuation

3. Exercises:
   a. Cervical relaxation/stretching of the first session;
   b. Exercises with emphasis on breathing of the second session;
   c. Exercises with emphasis on glottal source of the third session;
   d. Exercises for glottal firmness:
      - Plosive sounds: /p/ and /b/ followed by the vowels, isolated /pa/ and /ba/ ten times each, repetition of syllables /papapa/, /bababa/;
      - /b/ prolonged ten times;
      - Counting of numbers with progressive increase in intensity, sequence from one to ten.
4. Extra session tasks (to be noted at a specific protocol):
   a. The same exercises performed in the session (same execution and duration time), three times a day;
   b. Observe and take notes of vocal habits, vocal abuses and facts which interfere positively or negatively on the voice.

Fifth session

Objective: Resonance/articulation.

1. Review of the extra session tasks (participants hand in a filled out worksheet and solve doubts).
2. Video and review of the main aspects with emphasis on resonance.
3. Exercises:
   a. Cervical relaxation/stretching of the first session;
   b. Exercises with emphasis on breathing of the second session;
   c. Exercises with emphasis on glottal glottal source of the third and fourth sessions;
   d. Humming
      - In usual frequency and intensity and maximum phonation time – ten times;
      - In usual frequency and intensity, maximum phonation time and staccato – ten times;
      - Ascending and descending glissando – ten times;
      - Associated to repetition of syllables "eieiei", "aiaiai" with wide opening of the mouth – five times each.
4. Extra session tasks (to be noted at a specific protocol):
   a. The same exercises performed in the session (same execution and duration time) – three times a day;
   b. Observe and take notes of vocal habits, vocal abuses and facts which interfere positively or negatively on the voice.

Sixth session

Objective: Conclusion.

1. Review of the extra session tasks (participants hand in a filled out worksheet and solve doubts).
2. Video and overall review of the issues discussed in the sessions.
3. Exercises:
   a. Cervical relaxation/stretching of the first session;
   b. Exercises with emphasis on breathing of the second session;
   c. Exercises with emphasis on glottal source of the third and fourth sessions;
   d. Exercises with emphasis on resonance of the fifth session.
4. Talk about the changes observed at the end of the program, facts which interfere positively or negatively on the voice.
5. Reevaluation scheduling.

The perceptual-auditory and acoustic pre- and post intervention vocal findings were compared using the blind analysis made by two speech language pathologists with intrajudgment reliability of more than 80%[13,14]. We also considered the scores obtained with the DRSP using the self-evaluation visual analog scale, laryngological findings, evaluation of the repetitive stimuli (carried out subjectively by the participants and the therapist), and the adherence to the program.

RESULTS

Table 1 presents the parameters assessed in relation to vocal quality in pre- and post-CVP moments. The spectroscopy showed better defined and highly numbered harmonics; in addition to the intensity increase, there was an improvement in the score of two and a worsening in the score of one DRSP. After the program, loudness, pneumophonoarticulatory coordination, articulation clarity, jitter, and harmonics-to-noise proportion improved, becoming such parameters remained within the expected limit for this age range. For these three participants, an evolution in vocal quality was observed. In two of them, a tension associated with the increase of loudness was verified. In all three of them, an increase in fundamental frequency and an improvement in maximum phonation time were observed. The DRSP score of two patients presented better results. Using laryngoscopy, we observed a reduction in the signals of presbylarynx with better glottal closure and movement of the mucosal wave among all elderly women. The repetition of concepts based on the genetic epistemology was considered positive by participants and therapists.

Table 1. Pre- and post-cognitive vocal program evaluation for presbyphonia

Analyzed aspects (analysis/expected)	Patient 1		Patient 2		Patient 3	
	Pre-CVP	Post-CVP	Pre-CVP	Post-CVP	Pre-CVP	Post-CVP
Visual analog scale (straight line of 10 cm, in which 0 represents the best voice and 10, the worst)	4.5	0.0	0.0	0.0	0.0	0.0
Auditory perceptual evaluation	R B (SD)	T (SD)	R B (SD)	R T (SD)	R B A (SD) I (MD)	R B I (SD)
Loudness	Diminished	Adequate	Diminished	Adequate	Diminished	Adequate
Articulation clarity	Diminished	Adequate	Diminished	Adequate	Diminished	Adequate
Breathing–speech coordination	Altered	Adequate	Altered	Adequate	Altered	Adequate
Maximum phonation time (in seconds)	9.60	11.49	4.97	7.39	12.81	19.43
f0 (in Hertz)	178.25	213.52	198.62	217.41	221.49	237.76
Jitter (0.3–0.5%)	1.02	0.50	0.58	0.43	1.26	0.51
Shimmer (3–5%)	12.28	1.51	6.89	2.38	14.88	2.60
Harmonics-to-noise proportion (22 dB)	14.72	25.76	17.43	20.31	11.53	24.76

Caption: CVP = Cognitive Vocal Program; R = roughness; B = breathiness; SD = slight degree; T = tension; I = instability; MD = moderate degree

DISCUSSION

The three patients initially presented vocal changes, regardless voice complaints, with pre-program changes compatible to the presence of presbyphonia[1,2]. The high adherence proved itself relevant to achieve the results, though they shall be more objectively measured in the project's follow-up. The improvements observed in loudness, pneumophonoarticulatory coordination, maximum phonation time, and articulation clarity provided better communicative effectiveness. Vocal instability, in one of the cases, became mild, which contributed to the phonatory pleasantness. The initial vocal complaint ceased at the post-CVP moment, with greater comfort when speaking and more pleasant voice. Despite the scarce normative data on high-speed laryngoscopy in elderly[15,16], the improvements observed at the post-CVP moment reinforced the findings of the perceptive-auditory and acoustic evaluation. The results corroborate studies that indicate speech therapy may minimize or delay the effects of presbyphonia[2,4]. Despite the roughness, breathiness, and asthenia remaining slightly altered, an improvement through the CAPE-V scores was observed. The development of a slight tension in two participants may have contributed to the increase of intensity and the decrease of vocal breathiness, but, so that there is no long-term negative vocal impact in this aspect, it will be monitored in revaluations.

Vocal improvement was also observed in relation to the rise of f0, which minimized characteristic presbyphonia vocal aspects among women. The evaluation presented in the DRSP score corroborates the observed higher body/vocal consciousness, which led participants to change their lifestyles and habits related to the use of their voice. It is noteworthy that all of them joined the program and the aspects related to it will be subject to a specific research.

The emphasis on fundamented cognition in genetic epistemology[12], already success total in use with total laryngectomy elderly patients[5], may be considered one of the positive differences of this proposal.

CONCLUSION

The preliminary results point to encouraging perspectives in relation to the proposal with improvements on the analyzed aspects. The proposed program proved feasible, well designed, and did not require many adjustments for the continuity of the project.

**KN participated in the coordination and conception of the project, the analysis and interpretation of the data, and the writing and final review of the article; GVSS was responsible for the collection of the data and the writing of the article; MSZ supervised the collection and took part in the analysis and interpretation of the data, the critical review of the content, and the final review of the article; DHT, AH, and GFC took part in the conception of the project and supervised data collection; GPN and MED supervised data collection.*

REFERENCES

1. Nascimento LT, Silva AF, Santos FS, Costa MR, Pereira RO. Presbifonia e disfonia na terceira idade: compreendendo os sinais típicos e atípicos. Rev Soc Bras Fonoaudiol. 2011;suplemento especial:1293.
2. Vasconcelos SV, Mello RJV, Silva HJ. Efeitos do envelhecimento e do fumo nas pregas vocais: uma revisão sistemática. ACTA ORL. 2009;27(1):9-14.
3. Behlau M, Azevedo R, Pontes P. Conceito de voz normal e classificação das disfonias. In: Behlau M. Voz: o livro do especialista, 1. Rio de Janeiro: Revinter, 2001. p. 53-79.
4. Siracusa MGP, Oliveira G, Madazio G, Behlau M. Efeito imediato do exercício de sopro sonorizado na voz do idoso. J Soc Bras Fonoaudiol. 2011;23(1):27-31.
5. Nemr NK. A epistemologia genética de Jean Piaget na reabilitação vocal do laringectomizado [tese]. São Paulo: Universidade de São Paulo; 2000.
6. Nemr K, Ramozzi-Chiarottino Z. Fatores cognitivos na adaptação vocal após laringectomia total. Rev Bras Otorrinolaringol. 2002;68(6):805-10.
7. Behlau M. Consensus Auditory – Perceptual Evaluation of Voice (CAPE-V), ASHA 2003. Refletindo sobre o novo/Nex reflexions. Rev Soc Bras Fonoauldiol. 2004;9(3):187-9.
8. Simões-Zenari M, Bonfim ACC, Nemr K. Proposta de protocolo de anamnese fonoaudiológica para a clínica de voz. In: 19º Congresso Brasileiro e 8º Congresso Internacional de Fonoaudiologia; 2011 Out 30-Nov 2; São Paulo. São Paulo: SBFa; 2011; 942.
9. Ferreira LM, Annunciato NF. Envelhecimento vocal e neuroplasticidade. In: Pinho SMR, organizador. Fundamentos em fonoaudiologia: tratando os distúrbios da voz. 2a ed. Rio de Janeiro: Guanabara-Koogan, 2003. p. 117-37.

10. Behlau M, Madazio G, Feijó D, Azevedo R, Gielow I, Rehder MI. Aperfeiçoamento vocal e tratamento fonoaudiológico das disfonias. In: Behlau M, organizador. Voz: o livro do especialista. Rio de Janeiro: Revinter, 2005. Vol. II. p. 409-519.
11. Allali A, Le Huche F. A voz: tratamento dos distúrbios vocais. 3a ed. Porto Alegre: ArtMed, 2006.
12. Piaget J. Fazer e compreender. São Paulo: Melhoramentos, 1978.
13. Silva RSA, Simões-Zenari M, Nemr NK. Impacto de treinamento auditivo na avaliação perceptivo-auditiva da voz realizada por estudantes de Fonoaudiologia. J Soc Bras Fonoaudiol. 2012;24(1):19-25.
14. Nemr K, Simões-Zenari M, Cordeiro GF, Tsuji D, Ogawa AI, Ubrig MT, et al. GRBAS and Cape-V scales: high reliability and consensus when applied at different times. J Voice. 2012;26(6):812.e17-22.
15. Yamauchi A, Imagawa H, Yokonishi H, Nito T, Yamasoba T, Goto T, et al. Evaluation of vocal fold vibration with an assessment form for high-speed digital imaging: comparative study between healthy young and elderly subjects. J Voice. 2012;26(6):742-50.
16. Ahmad K, Yan Y, Bless D. Vocal fold vibratory characteristics of healthy geriatric females – analysis of high-speed digital images. J Voice. 2012;26(6):751-9.