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# Immediate effect of sounded blowing exercise in the elderly voice

## *Efeito imediato do exercício de sopro sonorizado na voz do idoso*

**ABSTRACT**

**Purpose:** To observe the immediate effect of the sounded blowing exercise with semi-occluded vocal tract (SOVTE) in the voices of elderly subjects. **Methods:** Thirty-three subjects with 65 years of age or older, with no voice or hearing disorder complaints, and with good self-perceived general health participated in the study. All participants filled in a vocal self-evaluation questionnaire. The sustained vowel /e/ was recorded in three distinct moments: the first, denominated habitual (H), based on the subject's regular production; the second, usage (U), after one minute of continuous spontaneous conversation; the third, exercise (E), carried out after a one-minute execution of the SOVTE. After the exercise, the subjects self-evaluated the changes perceived in their voices. The recordings were edited and randomly paired, considering two moments of the same subject: H/U; H/E and U/E, for further perceptual examination of the better production by three specialized speech-language pathologists. **Results:** There were no differences between H and U ( $p=0.199$ ) and between U and E ( $p=0.773$ ). However, the E production was considered better than the H production ( $p=0.004$ ). In the vocal self-evaluation, most subjects ( $n=25$ , 75.8%) did not observe immediate effects in their voices after the exercise. **Conclusion:** The SOVTE produced positive immediate effects on the vocal quality of elderly subjects, observed only at the perceptual-auditory evaluation.

**RESUMO**

**Objetivo:** Observar o efeito imediato da realização do exercício de sopro sonorizado com o trato vocal semiocluído (ETVSO) na voz de indivíduos idosos. **Métodos:** Participaram 33 indivíduos, com idade igual ou superior a 65 anos, sem queixa de distúrbio de voz e audição e boa saúde geral auto-referida. Todos responderam a questionário de autoavaliação vocal. Foi realizada gravação da vogal “é” sustentada em três momentos distintos: a primeira, denominada habitual (H), a partir da emissão regular do indivíduo; a segunda, uso (U), após um minuto de conversa espontânea, continuada; a terceira, exercício (E), realizada após um minuto de execução do ETVSO. Após a realização do exercício, foi solicitada uma autoavaliação do idoso quanto às mudanças percebidas na voz. As gravações foram editadas e pareadas, aleatoriamente, considerando dois momentos de um mesmo sujeito: H/U; H/E e U/E, para posterior julgamento auditivo da melhor emissão, por três fonoaudiólogos. **Resultados:** Não houve diferença entre H e U ( $p=0,199$ ) e U e E ( $p=0,773$ ). Entretanto, a emissão E foi considerada melhor do que a H ( $p=0,004$ ). Quanto à autoavaliação vocal, a maior parte dos idosos ( $n=25$ ; 75,8%) não observou modificações na voz após a realização do exercício. **Conclusão:** O ETVSO produziu efeito imediato positivo na qualidade vocal dos idosos, observado apenas na avaliação perceptivo-auditiva.

Study carried out at Centro de Estudos da Voz – CEV – São Paulo – Brazil.

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## INTRODUCTION

Aging is a gradual process affecting all the systems in their structure and function, compromising speed, accuracy, resistance, stability, strain and coordination<sup>(1-3)</sup>. Due to aging, structure and functional changes occurs in the larynx characterizing presbylarynx. During this process, gradual calcifications and ossification are observed as well as intrinsic muscle atrophy, reduction in arytenoid excursion and in vocal fold (VF) thickness, VF camber and membranous fusiform gap<sup>(2,4)</sup>.

Presbyphonia is the natural aging of voice that depends on body and mind health to start and develop, and also of the life history, constitutional, racial, hereditary, nutritious, social and environmental factors<sup>(5)</sup>. Some presbyphonia characteristics are: decrease in vital respiratory capacity and in maximum phonation time, increase in fundamental frequency of voice in men and decrease in women, increase in jitter and in fundamental frequency variability, and increase on the nasality degree and on articulatory pauses time; vocal quality decay; vocal instability; decrease in speed rate, vowel loudness, vocal range, diadochokinesia for repetitive syllables and maximum intraoral pressure<sup>(1,6,7)</sup>.

Exercises as the semi-occluded vocal tract exercise (SOVTE) consists in emitting a blow associated to the prolonged sound of vowel "u"<sup>(4)</sup>. This exercise is used on vocal clinics to favor vocal economy and efficiency<sup>(8)</sup>.

Regarding that voice is under the aging effects and the vocal exercises benefit the vocal production, the purpose of this research was to observe the immediate effect of sounded blowing exercise with the semi-occluded tract in elderly voice. Achieving positive results, this exercise could be used to minimize the vocal aging.

## METHODS

This research project was approved by the Ethics Committee of the Centro de Estudo da Voz (CEV), under process number 1415/07. All the participants signed the Free and Informed Consent.

Thirty three elderly subjects, 19 women and 14 men, aged 65 years or higher (mean=75.6) participated in this study. The inclusion criteria was the general health classification as good in the self-evaluation, and the exclusion criteria was the presence of vocal or hearing complaints. All the participants had their voices evaluated in the vocal screening as expected by age<sup>(1-3)</sup>. The vocal screening was done by the main researcher, specialist in voice, using perceptual-auditory analysis of general degree of vocal quality. The participants that showed vocal disturbances not compatible with the physiological changes due to aging were excluded from the sample<sup>(2)</sup>.

The participants followed two main steps, first they answered to a vocal self-evaluation questionnaire and second they were submitted to voice recording to posterior perceptual-auditory evaluation as follow. The used questionnaire had ten multiple choice questions to describe the vocal self-perception and characterize the vocal behavior and habits.

From the total sample, 20% had discrete vocal complaints, compatible with the aging process, without interference on quality of life. The main complaints were: trouble related to vocal frequency and request by others to repeat the sentences said (n=6; 18.1%); difficulty related to vocal loudness (n=5; 15.2%); vocal fatigue (n=3; 9%); lack of air during speech and comments about their voices by others (n=2; 6.1%); trouble to be understood on the telephone (n=1; 3%).

None of the elderly participants reported any previous voice treatment. In the vocal self-evaluation, 19 (57.6%) evaluated their voices as good and 13 (39.4%) as poor. When asked about vocal changes in the last years, 31 participants (93.9%) did not perceived any change related to loudness, 28 (84.8%) related to vocal frequency and 26 (78.8%) related to stability.

The participants received guidance about the recording process and the exercise execution. The recording of vowel /ε/ was made in sitting position in silent environment. The software used to record the emissions was Voxmetria (3.1 version, CTS Informática) installed in a notebook Itautec (Infoway note W7636). The microphone used was a Plantronics headset, positioned at 45° from the participant mouth. The material submitted to perceptual-auditory evaluation was the vowel /ε/ recorded in three different moments, respectively: habitual, use, and exercise.

The first moment recording, called habitual (H), was collected from the regular sound emission of the participant. The second moment, called use (U), was collected after one minute spontaneous talking, without pauses for resting. The spontaneous talking was about an interesting theme for the elderly participant with the time controlled by the researcher. The third moment, called exercise (E), was collected after one minute execution of the sounded blowing semi-occluded vocal tract exercise (SOVTE). The one-minute time of execution was controlled by the researcher.

After the third recording the participants reported if they had or not perceived vocal changes after the exercise execution and if this change was positive or negative. The vocal self-evaluation was not required after the second moment called U of spontaneous talking, once the result of this task was considered as a control to the comparison to the results of the exercise execution.

The audio samples were edited in the same software of recording Voxmetria (CTS Informática), despising the first two seconds and selecting the next three seconds in order to eliminate the typical instability of the beginning of the emission. The vocal samples were randomly paired between the three moments of evaluation for each participant: habitual x uso, habitual x exercise and use x exercise. This way, each participant had three pairs of samples (H x U, H x E and U x E), totalizing 99 audio samples for the perceptual-auditory evaluation by experienced judges.

The perceptual-auditory evaluation was done by three speech-language pathologists, voice specialists, whom listened to the 99 audio samples added 10% of repetition (12 pairs of repetition, 111 pairs of sample), in order to verify the intra-judge reliability. The result of intra-judge reliability

was superior to 80% for each judge and, therefore, all the judgments were valid. For the perceptual-auditory evaluation, the judges should note in a specific protocol which emission was the best or if the two emissions were similar. The samples were played in speakers for the three judges at the same time, and they could listen to the audio files as many times as necessary. Therefore, 297 notations were included to analysis (three pairs of moments of 33 participants evaluated by three judges, in other words,  $3 \times 33 \times 3 = 297$ ), excluding the repetition samples used just to evaluate judges reliability.

The results were compiled and submitted to statistical analysis. The test of equal proportions was used to characterize the results for each moment. The level of significance adopted was 0.05 or 5%.

## RESULTS

The answers of the three judges for the perceptual-auditory evaluation regarding the best vocal emission were presented (Table 1). It is noteworthy that the number of answers computed was 297 once it was opted to maintain all the obtained answers since all the judges had high reliability intra-judge and similar agreement (Table 2). The moments comparison revealed difference only between H and E ( $p=0.004$ ) and the emissions after SOVTE (56 occurrences; 56.6%) were judged as better. It is noteworthy that between the two moments there was the recording of moment U (spontaneous talking) and therefore the comparison H x E is not temporal direct.

**Table 1.** Auditory judgment of best emission in pair comparison between the recording moments in elderly participants

Recording situation	n	%	p-value
<b>Habitual/Use</b>			
H better	41	41.4	0.199
U better	50	50.5	
H=U	8	8.1	
<b>Use/Exercise</b>			
U better	42	42.4	0.773
E better	40	40.4	
U=E	17	17.2	
<b>Habitual/Exercise</b>			
H better	36	36.4	0.004*
E better	56	56.6	
H=E	7	7.1	

\* Significant values ( $p \leq 0.05$ ) – Test of equal proportions

The agreement between the three judges about the perceptual-auditory evaluation of the best emission was done by the Kappa coefficient index (Table 2). The agreement result between the judges was considerate good, value equal to 0.342

**Table 2.** Kappa coefficient index between the three judges

	Kappa	Inferior limit	Superior limit	p-value
H/U	0.342	0.178	0.504	<0.001*
H/E	0.516	0.351	0.681	<0.001*
U/E	0.517	0.371	0.663	<0.001*
Total	0.557	0.376	0.557	<0.001*

\* Significant values ( $p \leq 0.05$ ) – Kappa coefficient index

( $p < 0.001$ ) in H x U situation and poor values in the other studied situations. As quoted, by option all the answers of judges were presented once they had no judgment differences to the three pair of moments (Kappa=0.557;  $p < 0.001$ ) totalizing 297 answers (33 pairs x three moments x three judges). This option offered the possibility to higher reliability to the made analysis. Furthermore, the analysis from the responses of three judges, or by choosing one of them, did not alter the conclusion of the study and, therefore, we opted to maintain all three of them.

As to vocal self-evaluation, done after the last recording moment, most of elderly ( $n=25$ ; 75.8%) did not perceive vocal changes after the SOVTE execution which indicates the exercise did not provide immediate vocal effect perception (Table 3). However, five (15.1%) participants observed positive effect on voice as easier emission, better voice or brighter voice and better respiratory coordination during the emission. In the other way, three participants (9%) reported negative voice effect as breakdowns and oscillations in emission and the dry throat sensation.

**Table 3.** Self-evaluation immediate effects on voice after SOVTE in elderly participants

Vocal self-evaluation	n	%
Without effect	25	75.8
Positive effect	5	15.1
Negative effect	3	9

Test of equal proportions:  $p < 0.001$

## DISCUSSION

Many of the characteristics presented by presbyphonia or other dysphonia types are similar to those showed in prolonged vocal rest. The muscle disuse observed in elderly causes muscle fiber loss<sup>(3)</sup>. However, it is observed in people with vocal training, classical and popular singers with long career and elderly physically active show good vocal results at this period of life. This indicates that vocal exercises, including SOVTE, may contribute to minimize age effects on voice.

Voice therapy programs directed to vocal quality and phonoarticulatory dynamics provide vocal improvement on vocal pattern, communication and vital capacity in health elderly<sup>(9)</sup>. Vocal exercises have been proposed to improve glottal closing,

enhance subglottic pressure and vocal loudness, improve vocal quality stability and fundamental frequency, besides the global improvement in speech functional system<sup>(10)</sup>.

The effect of vibrating lips exercise, considered one kind of SOVTE, was verified in voice of people above 60 years old<sup>(11)</sup>. The research concludes that there is improvement in vocal quality and loudness, enhancing glottal closure and aerodynamics respiratory and larynx mioelastic forces equilibrium. There is also improvement in vocal fold tonus, enhancing the sound emission, with positive change in resonance focus and increase in pitch<sup>(11)</sup>.

The semi-occluded vocal tract exercise in anterior region enhances the interaction between source and filter, increasing the glottic and subglottic pressure. The impedance tune for the vocal fold adduction and the narrow of epilarynx tube make the voice production more efficient and economic regarding the tissues collision<sup>(11)</sup>. This source-filter interaction decreases the photrauma risk. Therefore, SOVTE is used as for vocal warming as for vocal projection in people with or without vocal disturbances<sup>(12-15)</sup>.

According to the participants' characteristics of this research, the vocal deviation and disturbances reported or observed were typical from the physiological aging process, allowing maintaining all participants in the study. A previous research<sup>(16)</sup> with elderly between 60 up to 80 years old, from both sexes, students of a third age university showed the participants had a positive vocal self-image, despite vocal quality deviation due to aging.

The vocal training is known to provide vocal changes in elderly. Besides this could potentially contribute to reduce the aging effects related to vocal quality and phonoarticulatory dynamics<sup>(4)</sup>.

This research evaluated just the vocal quality and vocal self-perception of elderly after one minute exercise execution, therefore the immediate effect. Perhaps a larger group of participants or a sequential program of exercises with higher execution time could offer brighter results.

Presbyphonia is the vocal disturbance caused by the natural aging that may not be related to presbylarynx. The indicated treatment as for presbilarynx as for presbyphonia is vocal rehabilitation focusing hyper functional supraglottic compensation, with simultaneous stimuli to vocal attack, besides the improvement of respiratory support to speech<sup>(4)</sup>. SOVTE is an exercise that provides the glottic compression and supraglottic constriction and the vocal tract expansion, stimulating resonance and improving the pneumo-phono-articulatory coordination. Although it is not possible to confirm whether the participants of this research had presbyphonia and/or presbylarynx once this was not the purpose of the study, it was expected the exercise to benefit the elderly vocal quality. Probably if the studied group presented vocal complaints and presbyphonia the results should be different. Besides the increase in execution time also could generate a positive impact on voice in a higher number of elderly<sup>(17,18)</sup>.

The SOVTE is not universal technique and the elderly need to be carefully evaluated when indicating the exercise. While some elderly people might benefit with SOVTE, others could

benefit with the principles of Lee Silverman Voice Treatment – LSVT<sup>19</sup>, for instance.

Vocal field needs more research that proves the efficacy of some techniques. It is necessary epidemiological surveys characterizing the aging process that might commit laryngeal functions as phonation and swallowing<sup>(20)</sup>.

## CONCLUSION

The sounded blowing semi-occluded vocal tract exercise produces positive immediate effects on elderly vocal quality observed in perceptual-auditory evaluation. After the exercise execution, the elderly voice improved comparing to the habitual emission although this effect was not self-perceived.

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