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Effect of performance time of the high-pitched blowing vocal exercise in the voice of women

Efeito do tempo de execução do exercício vocal sopro e som agudo na voz de mulheres

Keywords

Speech-language Pathology
Dysphonia
Acoustics, Speech
Voice Disorders
Speech Therapy
Voice Training
Perception

Descritores

Fonoaudiologia
Disfonia
Acústica da Fala
Distúrbios da Voz
Fonoterapia
Treinamento da Voz
Percepção

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Received: January 29, 2016

Accepted: June 16, 2016

ABSTRACT

Purpose: To analyze the results of the runtimes of one, three, five, and seven minutes of the high-pitched blowing vocal exercise in women without voice complaints and with dysphonia and vocal nodules. **Methods:** This is an experimental study with a consecutive and convenience sample of 60 women divided into two groups: 30 participants with dysphonia caused by vocal fold nodules (study group - SG) and 30 participants without vocal complaints (control group - CG). All participants performed the high-pitched blowing vocal exercise for one, three, five, and seven minutes. Sustained vowels /a/ and counting from one to ten were recorded before and after each exercise runtime. The recordings were randomized and evaluated by comparison task by four speech-language pathologists using the parameters grade of vocal deviation, roughness, breathiness, asthenia, strain and instability (GRBASI). The acoustic parameters analyzed were fundamental frequency, jitter, shimmer, period perturbation quotient, amplitude perturbation quotient, and harmonics-to-noise ratio. After each vocal exercise runtime, the participants responded whether they had felt vocal discomfort using a visual analogue scale. **Results:** Auditory-perceptual analysis in the SG showed improved overall severity of dysphonia and breathiness after three minutes and worsening of these acoustic parameters after seven minutes of exercise performance. Participants in the SG reported self-perception of vocal discomfort after seven minutes of exercise performance. **Conclusion:** The ideal prescription time for the high-pitched blowing vocal exercise in dysphonic women is three minutes; worsening of voice quality and perception of vocal discomfort occurs after seven minutes.

RESUMO

Objetivo: Analisar o resultado dos tempos um, três, cinco e sete minutos de execução do exercício vocal sopro e som agudo, em mulheres com disfonia por nódulos vocais e em mulheres sem queixa de voz. **Método:** Trata-se de um estudo experimental com amostra de conveniência consecutiva. Participaram 30 mulheres disfônicas, por nódulos em pregas vocais (GE), e 30 mulheres sem queixa vocal (GC). Todas executaram o exercício sopro e som agudo durante um, três, cinco e sete minutos. As vogais sustentadas /a/ e a contagem de um a dez foram registradas antes e após cada tempo de execução do exercício. As gravações foram randomizadas e avaliadas por tarefa de comparação por quatro fonoaudiólogos utilizando os parâmetros grau de desvio vocal, rugosidade, sopro, antenia, tensão e instabilidade (GRBASI). Para a análise acústica, foram obtidos os parâmetros de frequência fundamental, jitter, shimmer, o quociente de perturbação de frequência, quociente de perturbação de amplitude e proporção harmônico ruído. Depois de cada momento de realização do exercício vocal, as participantes responderam em uma escala visual analógica de desconforto vocal. **Resultados:** A análise perceptivo-auditiva no GE demonstrou melhora do grau geral da disfonia e da sopro após três minutos e piora destes parâmetros auditivos após sete minutos de realização do exercício. Houve autopercepção do desconforto vocal após sete minutos de realização do exercício no GE. **Conclusão:** O tempo ideal de prescrição do exercício vocal sopro e som agudo para o grupo das mulheres disfônicas foi de três minutos. O mesmo grupo, após sete minutos, apresentou piora na qualidade da voz e autorreferiu desconforto.

Study carried out at Graduate Program in Speech and Hearing Sciences, Universidade Federal de Minas Gerais – UFMG - Belo Horizonte (MG), Brazil.

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Financial support: nothing to declare.

Conflict of interests: nothing to declare.

INTRODUCTION

There are many vocal methods and techniques used in the treatment of dysphonia⁽¹⁾, and several studies⁽²⁻⁶⁾ have been conducted to verify their effect. The positive effects of tongue trill performance techniques⁽²⁾, high-pitched blowing vocal exercise⁽³⁾, exercises with resonance tubes^(4,5), Finger Kazoo⁽⁶⁾, among others are described in the specific scientific literature.

Semi-occluded vocal tract exercises (SOVTE) are among the most widely used techniques in vocal therapy. These exercises are designed to promote vocal economy and efficiency generating a phenomenon called retroflex resonance, which favors the coaptation of the vocal folds during vibration^(1,7).

The SOVTEs are performed based on vocal tract occlusion⁽⁸⁾. They aim to promote aerodynamic and vocal tract changes^(9,10) and increase the filter-source interaction by increasing supraglottic and intraglottic pressure, consequently favoring impedance through adduction of the vocal fold and narrowing of the epilarynx tube, which result in vocal production with less effort and greater efficiency and economy^(7,10).

In the literature, there is evidence that the performance of SOVTEs produces immediate positive effects such as increase in the vocal fold contact quotient⁽⁹⁾, vocal economy, and improvement of the vocal quality⁽¹⁰⁾, acoustic measures, and vocal self-perception. Such results were obtained in the assessment of individuals without vocal complaints^(2,3,6,11-13), the elderly^(5,14), dysphonic individuals⁽¹⁵⁾, teachers with behavioral dysphonia⁽¹⁶⁾, and voice professionals⁽¹⁷⁾.

The high-pitched blowing vocal exercise is performed from a labial semi-occlusion, producing a continuous blow, thereupon the emission of a high-pitched sound is initiated⁽¹⁾. This exercise aims to favor glottic coaptation without involving the supraglottis, with less involvement of the laryngeal vestibule⁽¹⁾. Its immediate effects were analyzed in dysphonic and non-dysphonic individuals, with observation of improvement in the auditory-perceptual and acoustic parameters of the voice, laryngeal configuration, and vocal self-assessment⁽³⁾.

Despite the results of the immediate effects of the SOVTE presented in the literature^(2,3,5,6,9-17), there are few studies analyzing the time needed for the performance of vocal techniques and their results in the voice of dysphonic individuals and individuals without vocal complaint^(12,18-21).

Some studies^(12,18,19) sought to investigate the optimal performance time for the tongue trill technique in vocally healthy and dysphonic individuals. These studies described improvement in vocal quality, acoustic and spectrographic measurements, and vocal self-assessment after three minutes of exercise^(18,19), as well as predominance of positive vocal responses at the 5-minute exercise runtime⁽¹²⁾.

Other studies^(20,21) investigated the time of completion for the resonance tube exercise, applied to dysphonic women and children and to women without vocal complaints, and also reported positive vocal changes for the exercise runtime of three minutes.

No research addressing the ideal prescription time for the high-pitched blowing vocal exercise was found in the literature.

The purpose of this study is to analyze the results of the runtimes of one, three, five, and seven minutes of the high-pitched blowing vocal exercise in women with dysphonia caused by vocal fold nodules and without voice complaints.

METHODS

This experimental study with consecutive and convenience sample was approved by the Research Ethics Committee of the aforementioned institution under no. COEP ETIC 14990813.4.0000.5149. All participants signed an Informed Consent Form (ICF) prior to study commencement.

The study sample comprised 60 women aged 18 to 55 years divided into two groups: a study group (SG) composed of 30 individuals (mean age=37.8 years; SD=7.0), with otorhinolaryngological diagnosis of vocal fold nodules and speech-language pathology assessment of organofunctional dysphonia, who searched for assistance at the Speech-language Therapy Outpatient Clinic of a Higher Education Institution (HEI) between July 2013 and December 2014, and a control group (CG) composed of 30 individuals (mean age=36.2 years) with neutral voice quality and without voice complaints. Participants of the latter group were recruited at the same outpatient clinic while accompanying patients.

The groups were matched according to gender and no differences were observed between the ages of both groups ($p=0.40$). Only individuals who had the ability to perform the high-pitched blowing vocal exercise, which was evaluated by the researcher, were included in the study sample. Exclusion criteria comprised women with otorhinolaryngologic diagnosis of dysphonia caused by organic lesion in the vocal folds; smokers; singers; women in the menstrual period on the test day, with inflammatory and allergic alterations at the time of collection, and with complaint of hearing loss. Exclusion criteria for SG also comprised individuals with diagnosis of severe dysphonia established by speech-language pathology assessment and having undergone speech-language therapy in the six months prior to the date of collection.

The high-pitched blowing vocal exercise, which was previously demonstrated by one of the study participating researchers, consists in comfortably sustaining the vowel /u/ at high-pitched register in a continuous blow.

Participants of both groups were submitted to the same collection process. Initially, the women were instructed on the procedures and remained in absolute vocal rest for five minutes; after that, the vocal emissions were recorded at five runtimes: prior to exercise commencement (rt0), after one minute (rt1), three minutes (rt3), five minutes (rt5), and seven minutes (rt7) of the high-pitched blowing vocal exercise.

All vocal emissions were recorded in acoustic booth directly on a computer (Dell®, model Optiplex GX260) equipped with professional sound card (Direct Sound®) using the CSL software (Kay Pentax®) and an omnidirectional capacitor microphone (Shure®) positioned 10 cm away from the mouth, diagonally at 45° angle. Participants were requested to habitually sustain the vowel /a/ and count from one to ten. Exercise runtimes were rt0, rt1, rt3, rt5, and rt7.

In the auditory-perceptual analysis, repeated emissions were edited using the Audacity–Win® 2.0.6 software, randomized, and presented to four speech-language therapists with expertise in voice. Auditory-perceptual analysis was conducted using the Consensus Auditory-perceptual Evaluation of Voice (CAPE-V) protocol, which was created specifically to compare pairs of recordings and previously tested in a study⁽¹²⁾.

The voices of the participants of both groups and the exercise runtimes were randomized and presented to the referees in pairs. The following comparisons were considered: rt0-rt1, rt0-rt3, rt0-rt5, and rt0-rt7. Thus the referees could not identify to which group (SG or CG) or which runtime (rt0, rt1, rt3, rt5, or rt7) the pairs of voices belong.

For each pair of voices heard, the referees were instructed to examine whether the second voice emission had improved (better), worsened (worse), or not changed (unchanged) compared with the first emission. When changes were observed in the pairs of voice emissions, the evaluators should indicate the two auditory-perceptual parameters that most influenced voice modification according to the GRBASI (grade, roughness, breathiness, asthenia, strain, instability) scale⁽²²⁾.

In order to determine the concordance between the judges, 20% of the sample was randomly replicated. Of the four referees, the one who presented the best intra-rater agreement (60%) was selected⁽²³⁾, and only the analyses conducted by this assessor were considered.

Habitual sustained emission of the vowel /a/ was used in the acoustic analysis of voices; the initial and final parts of the emission were disregarded because of their irregular characteristics. The following acoustic parameters were selected: fundamental frequency (f0) in Hz, jitter (%), shimmer (%), period perturbation quotient (PPQ) (%), amplitude perturbation quotient (APQ) (%), and harmonics-to-noise ratio (HNR) in dB, obtained by means of the CSL software (Kay Pentax®). The normality values of acoustic measurements described in the program manual are as follows: f0 243.97 Hz, jitter 0.63%, shimmer 1.99%, PPQ 0.36%, APQ 1.39%, and HNR 0.11dB.

The Visual Analog Scale (VAS) was used for the vocal discomfort self-perception analysis at the runtimes rt1, rt3, rt5, and rt7. This scale is graded from 0 to 10 (Figure 1), where 0 shows absence of phonatory discomfort and 10 means very intense discomfort. For this evaluation, the participant should

indicate the corresponding level of discomfort on the VAS (Figure 1) after each exercise runtime.

The following tests were used to statistically analyze the data of the present study: Chi-square, Fisher's exact, paired *t*, and Tukey multiple comparison using R 3.2.

The intra-rater concordances were verified using the Kappa correlation coefficient according to the following classification scale: poor: < 0.2; weak: 0.2-0.4; fair: 0.4-0.6; good: 0.6-0.8; very good: 0.8-0.9.2; and excellent: 0.9-1.0⁽²³⁾.

The significance level of 5% (0.05) was adopted for the application of all statistical tests.

RESULTS

The results of the auditory-perceptual assessment showed improvement in the vocal quality of women with dysphonia (SG) at the 3-minute high-pitched blowing vocal exercise runtime. In the CG, worsening of voice quality was observed at the 7-minute exercise runtime (Table 1).

The auditory-perceptual parameters presented changes along the different exercise runtimes in the SG, with improved overall severity of dysphonia and breathiness after three minutes (Figure 2) and worsening of these acoustic measures after seven minutes (Figure 3).

In the comparison between the groups with respect to the auditory-perceptual analysis, it was possible to observe, for the high-pitched blowing vocal exercise, improvement in vocal quality at the 3-minute exercise runtime and an improvement tendency at the 5-minute runtime for dysphonic women (SG); the same results were found for women without vocal complaints (CG) (Table 2).

Acoustic analysis results in both groups did not show differences in the comparison between the high-pitched blowing vocal exercise runtimes, except for the harmonics-to-noise ratio (HNR) measure, which decreased after seven minutes of exercise performance, but maintained the altered results in the group of women with dysphonia caused by vocal fold nodules (SG) (Table 3).

Regarding vocal discomfort self-perception, no differences were observed when each group was analyzed separately. In the comparison between groups, greater vocal discomfort self-perception was reported by participants of the SG at the 7-minute exercise runtime (Table 4).

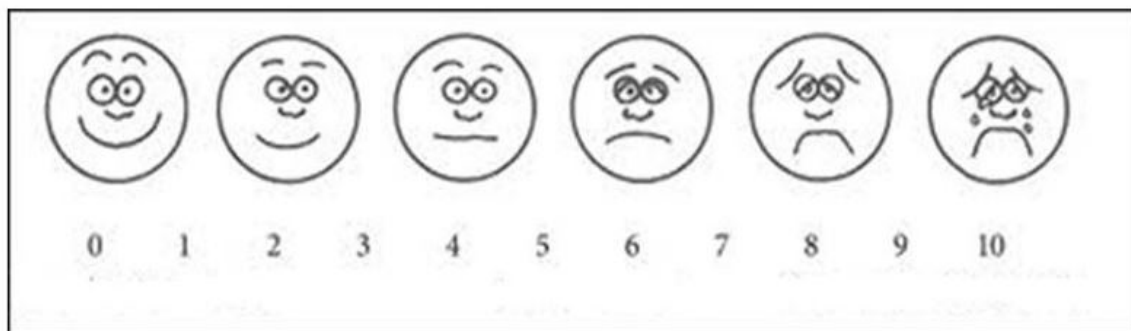


Figure 1. Visual analogue scale (VAS)⁽²⁴⁾

Table 1. Results of the auditory-perceptual assessment of voice at the different high-pitched blowing vocal exercise runtimes for the Study (SG) and Control (CG) groups

Vocal Condition	SG							
	rt0 x rt1		rt0 x rt3		rt0 x rt5		rt0 x rt7	
	n	%	n	%	n	%	n	%
Better	7	23.33	11	36.67	8	26.67	4	13.33
Worse	8	26.67	3	10.00	7	23.33	11	36.67
Unchanged	15	50.00	16	53.33	15	50.00	15	50.00
Total	30	100.00	30	100.00	30	100.00	30	100.00
Significance level (p)	0.149		0.013*		0.149		0.045*	

Vocal Condition	CG							
	rt0 x rt1		rt0 x rt3		rt0 x rt5		rt0 x rt7	
	n	%	n	%	n	%	n	%
Better	3	10.00	2	6.67	2	6.67	4	13.33
Worse	6	20.00	5	16.67	4	13.33	6	20.00
Unchanged	21	70.00	23	76.67	24	80.00	20	66.67
Total	30	100.00	30	100.00	30	100.00	30	100.00
Significance level (p)	9.142		2.498		3.736		0.0005*	

*Significance level (p) ≤ 0.05

Caption: rt = runtime. Chi-square test

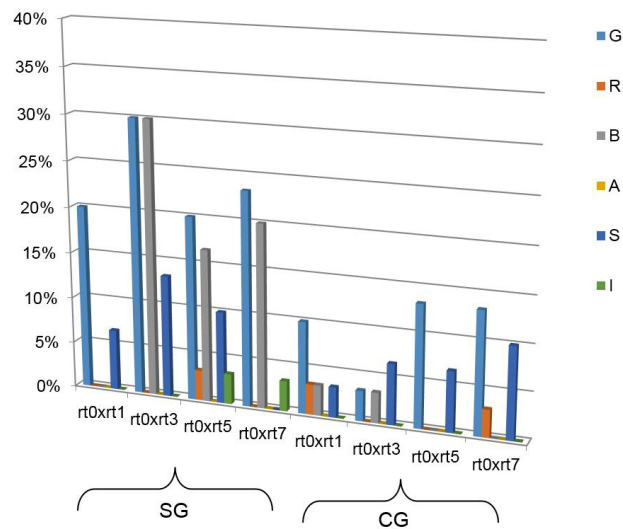


Figure 2. Percentage of improvement occurrence of auditory-perceptual parameters for the seven exercise runtimes for the Study (SG) and Control (CG) groups

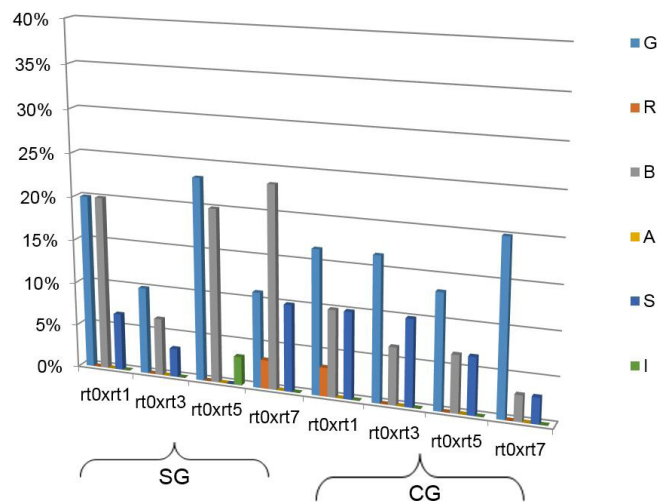


Figure 3. Percentage of worsening occurrence of auditory-perceptual parameters for the seven exercise runtimes for the Study (SG) and Control (CG) groups

Table 2. Results of the auditory-perceptual assessment of voice between the Study (SG) and Control (CG) groups at the different high-pitched blowing vocal exercise runtimes

Runtime	Vocal Condition	Study and Control Groups				p value
		SG		CG		
		n	%	n	%	
rt0 x rt1	Better	7	0.23	3	0.10	0.236
	Worse	8	0.27	6	0.20	
	Unchanged	15	0.50	21	0.70	
	Total	30	100.00	30	100.00	
rt0 x rt3	Better	11	0.37	2	0.07	0.018*
	Worse	3	0.10	5	0.17	
	Unchanged	16	0.53	23	0.77	
	Total	30	100.00	30	100.00	
rt0 x rt5	Better	8	0.27	2	0.07	0.038*
	Worse	7	0.23	4	0.13	
	Unchanged	15	0.50	24	0.80	
	Total	30	100.00	30	100.00	
rt0 x rt7	Better	4	0.13	4	0.13	0.335
	Worse	11	0.37	6	0.20	
	Unchanged	15	0.50	20	0.67	
	Total	30	100.00	30	100.00	

*Significance level (p) ≤ 0.05

Caption: rt = runtime. Chi-square test

Table 3. Results of the acoustic measures at the different high-pitched blowing vocal exercise runtimes for the Study (SG) and Control (CG) groups

Parameters		SG					CG					
		rt0	rt1	rt3	rt5	rt7	rt0	rt1	rt3	rt5	rt7	
f0	Mean	196.14	198.70	200.61	198.81	203.83	211.07	211.1	215.3	214.71	216.1	
	SD	24.26	36.35	33.04	30.09	31.66	31.64	27.56	25.05	25.45	27.79	
	t Test		0.64	0.34	0.51	0.08		0.99	0.29	0.36	0.23	
	Tukey M. C.		rt0 = rt1 = rt3 = rt5 = rt7						rt0 = rt1 = rt3 = rt5 = rt7			
JITTER	Mean	2.16	1.9	1.91	1.96	1.91	1.13	1.14	1.07	1.13	1.07	
	SD	1.73	1.3	1.64	1.44	1.45	0.95	0.77	0.78	0.85	0.6	
	t Test		0.13	0.22	0.41	0.17		0.93	0.8	0.98	0.76	
	Tukey M. C.		rt0 = rt1 = rt3 = rt5 = rt7						rt0 = rt1 = rt3 = rt5 = rt7			
SHIMMER	Mean	6.99	6.02	5.9	5.68	5.7	5.18	5.51	4.91	4.79	4.57	
	SD	3.99	2.09	3.38	2.47	2.44	2.12	2.33	1.93	1.57	1.76	
	t Test		0.28	0.27	0.16	0.17		0.33	0.43	0.31	0.12	
	Tukey M. C.		rt0 = rt1 = rt3 = rt5 = rt7						rt0 = rt1 = rt3 = rt5 = rt7			
PPQ	Mean	1.27	1.14	1.16	1.18	1.13	0.67	0.66	0.59	0.63	0.63	
	SD	1	0.81	1.04	0.92	0.9	0.59	0.41	0.41	0.43	0.35	
	t Test		0.14	0.36	0.5	0.18		0.85	0.55	0.66	0.65	
	Tukey M. C.		rt0 = rt1 = rt3 = rt5 = rt7						rt0 = rt1 = rt3 = rt5 = rt7			
APQ	Mean	4.54	4.12	4.32	4.02	3.96	3.63	3.83	3.38	3.28	3.17	
	SD	2.38	1.39	3.26	1.93	1.63	1.47	1.64	1.24	1	1.19	
	t Test		0.26	0.68	0.22	0.17		0.4	0.26	0.17	0.08	
	Tukey M. C.		rt0 = rt1 = rt3 = rt5 = rt7						rt0 = rt1 = rt3 = rt5 = rt7			
HNR	Mean	0.17	0.15	0.16	0.15	0.15	0.13	0.14	0.13	0.13	0.13	
	SD	0.07	0.05	0.09	0.07	0.04	0.03	0.04	0.03	0.03	0.03	
	t Test		0.21	0.37	0.16	0.05*		0.16	0.38	0.32	0.91	
	Tukey M. C.		rt0 = rt1 = rt3 = rt5 > rt7						rt0 = rt1 = rt3 = rt5 = rt7			

*Significance level (p) ≤ 0.05

Caption: rt = runtime; SD = standard deviation; Tukey M. C. = Tukey multiple comparison test; Paired t test

DISCUSSION

The American College of Sports Medicine has defined that components such as frequency, duration, intensity, and progression should be present in the prescriptions of muscular exercises in order to produce the expected effects⁽²⁵⁾. These

principles should be applied to vocal training; however, other aspects such as exercise sequence, number of series, and rest period between them should also be considered⁽²⁶⁾.

Prescriptions of muscle exercises should consider individual characteristics and frequency of the exercises should be related to their intensity. Exercise recommendations include a weekly

Table 4. Results of the auditory-perceptual assessment of voice for the independent comparison of the groups and for the comparison between the Study (SG) and Control (CG) groups

Independent comparison of the groups												
Group	Cat.	rt1 x rt3	(p) value	R	rt1 x rt5	(p) value	R	rt1 x rt7	(p) value	R	(p) value	R
SG	N-L	18	0.43	rt1 = rt3	18	0.3	rt1 = rt5	18	0.12	rt1 = rt7	0.12	rt1 = rt7
	M-I	12	0.38	rt1 = rt3	12	0.15	rt1 = rt5	12	0.38	rt1 = rt7	0.38	rt1 = rt7
CG	N-L	24	0.38	rt1 = rt3	24	0.15	rt1 = rt5	24	0.38	rt1 = rt7	0.38	rt1 = rt7
	M-I	6	0.38	rt1 = rt3	6	0.15	rt1 = rt5	6	0.38	rt1 = rt7	0.38	rt1 = rt7

Comparison between the Study (SG) and Control (CG) groups													
Group	Cat.	rt1	(p) value	R	rt3	(p) value	R	m5	(p) value	R	rt7	(p) value	R
SG x CG	N-L	18	0.15	SG = CG	14	0.19	SG = CG	13	0.3	SG = CG	11	0.03*	SG > CG
	M-I	12	0.15	SG = CG	16	0.19	SG = CG	17	0.3	SG = CG	19	0.03*	SG > CG

*Significance level (p) ≤ 0.05

Caption: rt = runtime, R = Result, Cat. = Category, Fisher's exact test

three-time frequency and intensity according to individual response. Exercise progression should be slow and gradual to reduce the incidence of injuries and the order of the exercises should be initiated by those that require greater muscle resistance⁽²⁶⁾. Inclusion of new exercises should occur later in the training program. Finally, the rest period should consider exercise intensity: the higher the exercise intensity, the longer the rest period needed between training series⁽²⁶⁾.

Regarding training duration, some studies show that ideal vocal exercise runtime ranges from three to five minutes and that, after seven minutes of performance, voice quality tends to worsen and presence of vocal fatigue is observed^(12,18-21). The results of the present survey indicate that the optimal prescription time for the high-pitched blowing vocal exercise in women with dysphonia caused by vocal fold nodules is three minutes, and that worsening of voice quality and perception of vocal discomfort occurs after seven minutes.

The high-pitched blowing vocal exercise was selected to conduct this research not only for its positive vocal effects, but also because, to date, there are no studies in the literature investigating the ideal runtime of this exercise to obtain satisfactory vocal responses.

Concerning auditory-perceptual analysis, the results show that dysphonic women benefit from the high-pitched blowing vocal exercise after three minutes of performance (Table 1), with improved overall grade (G) of dysphonia and breathiness (B) (Figure 1), and that worsening of these measures occurs at the 7-minute exercise runtime, probably due to vocal fatigue (Figure 2).

Such findings are similar to those reported by other studies which used the tongue trill performance technique and the resonance tube method^(12,18-20). Their results described predominance of positive vocal responses at the 3- and 5-minute runtimes of the vocal exercises, as well as a tendency to vocal strain and fatigue and to deterioration of voice quality after seven minutes. The aforementioned studies described significant changes in some acoustic parameters, such as improved overall severity of dysphonia, roughness, and breathiness^(12,18-20). This improvement in vocal quality can be explained by the increased myofunctional and aerodynamic balance of phonation, which probably occurred owing to enhanced glottic coaptation and filter-source interaction.

With respect to the worsening of vocal quality and the presence of self-reported phonatory discomfort after seven minutes of performance of the high-pitched blowing vocal exercise (Table 4), it is reasonable to infer that vocal fatigue, which is described in the literature as negative vocal adaptation that occurs as a consequence of prolonged voice use indicating unwanted changes in the functional status of the vocal folds and laryngeal mechanism, can explain such results⁽²⁷⁾.

A trend towards improved vocal quality was also observed at the 5-minute exercise runtime in women with dysphonia and vocal nodules (SG), whereas a tendency to vocal quality worsening was noticed in women without vocal complaints (CG) (Table 2). In spite of their statistical significance, these results were not valued because they presented a small change in the number of participants with variation in the vocal framework.

Studies with larger samples ought to be conducted to analyze the real behavior of such results.

Regarding the acoustic analysis (Table 3), in the group of dysphonic individuals (SG), although the measures remained altered, decreased values of HNR were observed from runtime 0 to runtime 7. This change suggests reduction of vocal emission noise, corroborating the results of previous studies that showed decrease of vocal noise at the 1- and 3-minute runtimes in the performance of the tongue trill technique and resonance tube method^(12,18-20).

Studies that investigated the behavior of acoustic parameters at different runtimes of vocal exercises described increased fundamental frequency, decreased harmonics-to-noise ratio, and improved jitter^(12,18-20). Such differences can be justified by methodological matters involving the type of vocal exercise and the methods used to collect acoustic measures of different sound-wave analysis software suites.

Self-perception of vocal discomfort was reported by women with dysphonia (SG) after seven minutes of the high-pitched blowing vocal exercise (Table 4). Conceivably, the continued performance of this technique for seven minutes may favor vocal fatigue in individuals with altered voices. These results are consistent with those of a study conducted with dysphonic and vocally healthy patients which observed that the self-perception of phonatory effort was worse in the group of dysphonic patients compared with that of the group of patients without vocal complaints after a seven-minute performance of the flow-resistant straw exercise⁽²⁰⁾. Such results suggest that the prescription of vocal exercises for more than seven minutes may be harmful to patients, generating a process of muscular fatigue with symptoms of voice worsening and vocal discomfort.

Results of the literature^(12,18-21) and the findings of this research allow us to conclude that the ideal prescription time for vocal exercises ranges from three^(18-21,28) to five^(12,28) minutes, and that this prescription should be correctly and assertively indicated, providing improvement of the vocal framework of individuals. Excessively long performance of vocal exercise, as in cases of prescriptions of seven minutes or longer, have proven to produce vocal discomfort and worsening of voice quality.

The results of this study will assist and guide Speech-language Therapy clinical practice regarding the prescription of vocal techniques in the therapeutic process.

Studies investigating the effects of performance time of vocal exercises in the male population are necessary, in addition to studies on the use of laryngeal analyses, including the functional results of vocal folds in the different runtimes of vocal techniques.

The speech-language therapist - as a vocal clinician - should consider the recommendations on the prescriptions of exercises, analyzing both their immediate and long-term effects, also considering the number of daily repetitions of the vocal techniques.

CONCLUSION

Performance of the high-pitched blowing vocal exercise improves the voice quality of women with dysphonia and vocal fold nodules.

Improvement in vocal quality is observed after three minutes of exercise performance, with reduction in the overall severity of dysphonia and breathiness. After seven minutes of exercise performance, worsening of vocal quality is observed and self-perception of vocal discomfort is reported.

The optimal prescription time for the high-pitched blowing vocal exercise in dysphonic women is three minutes.

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Author contributions

Both authors conceived and planned the study project. FSM was in charge of the collection and analysis of data; ACCG was responsible for the organization and critical review of the manuscript.