

# Ideal duration of vocal techniques in dysphonia training: a scoping review

## Tempo ideal de execução de técnicas vocais no treinamento das disfonias: revisão de escopo

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### ABSTRACT

**Purpose:** To map studies that address the ideal duration of vocal techniques in speech-language therapy training. **Research strategy:** This is a scoping review based on the research question: ‘What is the ideal duration of vocal techniques in speech-language therapy training?’ The search was conducted electronically in the following databases: LILACS (BVS), MEDLINE (PubMed), Cochrane, Scopus (Elsevier), Web of Science (Clarivate), and Embase. **Selection criteria:** The selection of studies followed the reading of titles, abstracts, and full texts, applying the established eligibility criteria. A backward search was then performed in the references of the selected articles to identify possible relevant studies to include in the results. The data extracted included information on the author and year of the study, country of publication, type of research design, sample characteristics, type of vocal exercise, exercise duration (dose), treatment duration, and the main results of the studies. These data were summarized and presented in both quantitative and descriptive formats. **Results:** Seven articles were selected from the 3,279 mapped studies. Most referred to semi-occluded vocal tract exercises in women and children, with an ideal duration of three to five minutes for individuals with dysphonia. There were few studies involving men and the elderly. **Conclusion:** Women and children showed better vocal results with a duration of three to five minutes for semi-occluded vocal tract exercises, with deterioration after seven minutes. For the male population, a longer exercise duration is necessary to achieve better vocal outcomes.

**Keywords:** Dysphonia; Voice; Exercise therapy; Speech therapy; Therapeutic uses

### RESUMO

**Objetivo:** mapear os estudos que abordam o tempo ideal de execução das técnicas vocais no treinamento fonoaudiológico. **Estratégia de pesquisa:** trata-se de uma revisão de escopo baseada na questão de pesquisa: “Qual o tempo ideal de execução de técnicas vocais no treinamento fonoaudiológico?”. A busca foi realizada de forma eletrônica nas bases de dados LILACS (BVS), MEDLINE (PubMed), Cochrane, Scopus (Elsevier), Web of Science (Clarivate) e Embase. **Critérios de seleção:** a seleção dos estudos seguiu a leitura dos títulos, resumos e textos completos, aplicando os critérios de elegibilidade estabelecidos. Logo após, foi realizada busca reversa nas referências dos artigos selecionados, visando identificar possíveis estudos relevantes para compor os resultados. Os dados extraídos incluíram informações sobre autor e ano do estudo, país de publicação, tipo de delineamento da pesquisa, característica da amostra, tipo de exercício vocal, duração do exercício, duração do tratamento e principais resultados. Esses dados foram resumidos e apresentados em formatos quantitativo e descritivo. **Resultados:** foram selecionados 7 artigos, entre os 3.279 estudos mapeados. A maioria referiu-se a exercícios de trato vocal semiocluído em mulheres e crianças, com tempo de execução ideal de três a cinco minutos para indivíduos disfônicos. Constatou-se que há poucos estudos com homens e idosos. **Conclusão:** mulheres e crianças apresentaram melhores resultados vocais com o tempo de execução dos exercícios de trato vocal semiocluído de três a cinco minutos e piora com sete minutos. Para a população masculina, é necessário maior tempo de execução dos exercícios, com o intuito de se obter melhores resultados vocais.

**Descritores:** Disfonia; Voz; Terapia por exercício; Fonoaterapia; Usos terapêuticos

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## INTRODUCTION

Dysphonia is a condition that affects voice quality and functionality, resulting in difficult and uncomfortable vocal production<sup>(1)</sup>, posing a significant challenge for the individual to express their words and emotions effectively<sup>(1)</sup>.

Among the treatments for dysphonia, the therapeutic approach based on exercises has been used as a form of vocal rehabilitation since the 1950s, aimed at improving the biomechanics of the voice and restoring vocal function<sup>(2,3)</sup>, as well as increasing the resistance of the muscle groups involved in phonation<sup>(4)</sup>.

Vocal rehabilitation using exercises targets specific phonarticulation muscles. The aim varies depending on the dysfunction, targeting respiratory adjustments, laryngeal muscles, resonance, and oral articulation muscles<sup>(4,5)</sup>.

According to the World Health Organization (WHO)<sup>(6)</sup>, exercise in the context of physical activity concerns bodily movements planned for a specific focus, be it improving the functionality of some structure or promoting well-being<sup>(6)</sup>.

For an exercise to achieve the expected result, the difference between muscle fibers and their physiology must be understood. Skeletal muscles have different types of fibers, predominantly type I, type IIa, and IIb fibers<sup>(7)</sup>. Type I fibers are important for endurance, while type II fibers are important for strength<sup>(7)</sup>.

The laws and principles of training refer to the processes of biological adaptation, which are linked to changes in the individual's metabolism and body shape<sup>(8)</sup>.

Light or resistance exercise mainly stimulates type I muscle fibers. They help the muscle fibers develop more mitochondria, increasing their capacity to produce energy aerobically and making them more resistant to fatigue<sup>(8,9)</sup>.

Conversely, heavy or strength exercises mainly activate type II muscle fibers, which are responsible for strength and explosion. These exercises increase the cross-sectional area of the muscle, causing it to grow (hypertrophy) and change its contractile characteristics. This causes the muscles to generate more force and be more efficient in high-intensity activities<sup>(7-9)</sup>.

In short, light exercises are great for improving muscular endurance, while heavy exercises are ideal for increasing strength and muscle mass<sup>(7-9)</sup>.

The larynx has type I muscle fibers (slow twitch, fatigue-resistant fibers), which are the cricothyroid and posterior cricoarytenoid muscles, and type IIa (fast twitch fibers), which are the thyroarytenoid, lateral cricoarytenoid, and interarytenoid muscles<sup>(10)</sup>.

In dysphonic conditions, the prescription of light or intense exercises depends on the circumstances of the condition and the type of vocal demand that the individual needs. Following the WHO guidelines for exercise prescription, it is crucial to consider aspects such as the type of exercise, its frequency (F), intensity (I), and time (T) of execution<sup>(6,8)</sup>. These factors encompass the number of sets and the rest interval, as well as the load and the duration of the exercise<sup>(6,8)</sup>. These are the key parameters for prescribing exercise, which the speech therapist must be able to define beforehand<sup>(8-11)</sup>.

Frequency (F) concerns the number of exercises performed throughout the day and per week<sup>(8)</sup>. Time (T), in turn, refers to the period in which the exercise is performed, either in seconds or minutes. Time is also defined as the number of repetitions of the vocal technique<sup>(8)</sup>. Intensity (I) describes the amount of effort used to perform the exercise<sup>(8)</sup>. For example, in the semi-

occluded vocal tract (SOVT) exercise with a silicone tube, the intensity will be measured by the depth of the tube/cane in the water, or by its diameter.

When considering an exercise-based approach, a key factor is the exercise loading level, defined as the combination of the parameters of frequency (F), intensity (I), and time (T) of exercise to be performed to achieve a given therapeutic goal. Thus, understanding the ideal exercise execution time for treatment efficacy is key to enhancing the patient's benefit from treatment, as well as preventing harm from excessive exercise (overdose).

The importance of the exercise regimen is well-established regarding the limbs of the body<sup>(12)</sup>, as in the fields of physical education and physiotherapy; however, few studies have defined the ideal course of rehabilitation exercises applied to the voice<sup>(13)</sup>.

## PURPOSE

This research aimed to develop a scoping review on the ideal execution time of vocal techniques in speech therapy training.

## RESEARCH STRATEGIES

This is a scoping review designed following the recommendations of the Extension for Scoping Reviews (PRISMA-ScR)<sup>(14)</sup>. The guiding question for the review was formulated based on the PCC (Population, Concept, Context) strategy<sup>(15)</sup>. The population in this survey consisted of dysphonic individuals or those without vocal complaints, while the concept referred to exercise execution time, and the context concerned speech therapy training. The following question was therefore formulated: "What is the ideal time for performing vocal techniques in speech therapy training?"

The descriptors used were "Dysphonia", "Voice", "Exercise Therapy", "Phonotherapy", "Therapeutic Uses," and "Therapeutics", without restriction as to language or date of publication. The bibliographic search was carried out in March 2024, in the LILACS (BVS), MEDLINE (PubMed), Cochrane, Scopus (Elsevier), Web of Science (Clarivate), and Embase databases. Chart 1 shows the syntactic structures used in each database.

## SELECTION CRITERIA

Eligibility criteria were established for selecting the articles. As inclusion criteria, we selected studies that evaluated and tested the ideal execution time of different vocal techniques, in the various life cycles of dysphonic individuals, as well as those without vocal alterations, without date or language restrictions. In turn, conceptual studies on vocal dosage, vocal methods, and those that evaluated the immediate effect of a vocal technique in a single performance time were excluded.

A survey of studies was then carried out in the VHL, PubMed/MEDLINE, Cochrane, Scopus, Web of Science, and Embase databases. All duplicate articles were automatically excluded using the Endnote software. Subsequently, the inclusion and exclusion criteria were applied by reading the titles and abstracts.

**Chart 1.** Search database syntax. Belo Horizonte, Minas Gerais, Brazil, 2024

Database	Syntax
BVS	((disfonia OR dysphonia OR disfonía OR dysphonie OR voz OR voice OR voz OR voix)) AND ((“Terapia por Exercício” OR “Exercise Therapy” OR “Terapia por Ejercicio” OR “Traitement par les exercices physiques” OR “Exercício Terapêutico” OR “Exercício de Reabilitação” OR “frequência do exercício” OR “intensidade do exercício” OR “tempo do exercício” OR fonoterapia OR “Speech Therapy” OR logopedia OR orthophonie)) AND ((“Usos Terapêuticos” OR “Therapeutic Uses” OR “Usos Terapêuticos” OR “Utilisations thérapeutiques” OR terapêutica OR therapeutics OR terapêutica OR thérapeutique OR tratamento)) AND (db:(“LILACS” OR “IBECs” OR “INDEXPSI” OR “WPRIM” OR “SES-SP” OR “BBO” OR “BDEF” OR “CUMED”))
MEDLINE	(Dysphonia OR Voice) AND (“Exercise Therapy” OR “Speech Therapy”) AND (“Therapeutic Uses” OR Therapeutics)
Cochrane	(Dysphonia OR Voice) AND (“Exercise Therapy” OR “Speech Therapy”) AND (“Therapeutic Uses” OR Therapeutics)
Scopus	(Dysphonia OR Voice) AND (“Exercise Therapy” OR “Speech Therapy”) AND (“Therapeutic Uses” OR Therapeutics)
Web of Science	(Dysphonia OR Voice) AND (“Exercise Therapy” OR “Speech Therapy”) AND (“Therapeutic Uses” OR Therapeutics)
Embase	(Dysphonia OR Voice) AND (“kinesiotherapy” OR “Speech Therapy”) AND (“drug therapy” OR Therapeutics)

Source: Elaborated by the authors, 2024

The articles were selected independently by two reviewers. To ensure consistency and validity in selecting the studies, an initial calibration stage was carried out. In this phase, the reviewers discussed the inclusion and exclusion criteria to guarantee an aligned interpretation. This process allowed possible differences to be identified and resolved, strengthening the degree of agreement between the reviewers before the full articles were screened. This procedure was adopted to maximize accuracy and reliability in the selection of studies included in the review.

In cases of disagreement between the reviewers, a third reviewer was consulted to analyze the titles and abstracts of four disagreeing articles. Next, a reverse search was performed on the references of the selected articles to identify potentially relevant studies to compose the results. Finally, all the selected articles were read in full.

## DATA ANALYSES

The selected articles were organized based on the following information for the analysis matrix: author and year of the study, country of publication, type of research design<sup>(16)</sup>, sample characteristics (dysphonic or without vocal alteration/complaint, gender and age), type of vocal exercise, exercise execution time, treatment duration, and the main results of the studies.

## RESULTS

We identified 3,812 studies in the data sources; however, 533 articles were duplicates. After reading the titles and abstracts of the remaining 3,279 articles, 3,276 articles were excluded for not meeting the eligibility criteria, leaving three articles.

Having read the full text of the three articles, one article was excluded for presenting only conceptual aspects of the exercise regimen. Next, six studies were included through a reverse search. However, after full reading, one article was excluded for not describing the execution time of the exercise studied, resulting in a final sample of 7 articles, as shown in the flowchart (Figure 1).

In terms of year of publication, the studies were published from 2005 to 2021, with two articles between 2005 and 2010 and five between 2011 and 2021.

All articles were based in Brazil. An experimental study design with an intra-subject comparison<sup>(16)</sup> was used to analyze

the effect of time spent performing different vocal techniques in all of the articles reviewed. Chart 2 shows all the above information.

Regarding the characteristics of the sample, two articles assessed the execution time of different vocal techniques in dysphonic individuals, three for a sample of individuals with no vocal alterations or complaints, and two for both samples. Tables 1 and 2 show the results.

## DISCUSSION

A major challenge in the treatment of dysphonia is to establish the ideal amount of vocal exercises selected for the patient. In this context, in the search for an evidence-based approach to speech therapy, this scoping review aimed to map out the ideal execution time for vocal techniques in speech therapy treatment of dysphonia. We found that very few articles have been published and all relate to semi-occluded vocal tract exercises (SOVT)<sup>(17-23)</sup>.

SOVT is widely used in clinical speech therapy practice, both in habilitation and vocal rehabilitation, as it reduces effort during phonation and boosts vocal efficiency<sup>(17)</sup>. These exercises are performed by partially occluding the vocal tract, modifying the acoustic impedance, and providing retroflex energy, moving the vocal folds away from the vibration, thus reducing the risk of speech traumas<sup>(24-25)</sup>. Common SOVT exercises in the vocal clinic include tongue vibration with sound; lip vibration with sound; phonation in tubes, with different types of tubes/sticks, varying in diameter and length; glottal firmness; fricative sounds with sound; production of the prolonged /b/ sound; and humming<sup>(24,25)</sup>.

Among the studies included in this scoping review, we found two articles (28.58%) that investigated SOVT using a rigid plastic tube, among women with behavioral dysphonia<sup>(18)</sup> and children with nodules and cysts<sup>(19)</sup>. One study (14.28%) used a flexible latex tube in female and male amateur singers<sup>(17)</sup>. Two studies (28.58%) investigated the sonorous tongue vibration exercise in women and men without vocal complaints<sup>(22,23)</sup> and one study (14.28%) focused on the lip vibration exercise in women with nodules<sup>(21)</sup>. Finally, the breath exercise sustaining the vowel [u] in the high register was developed in one study (14.28%) involving women with vocal nodules<sup>(20)</sup>.

Women comprised the most researched population among the articles analyzed, due to the higher prevalence of dysphonia

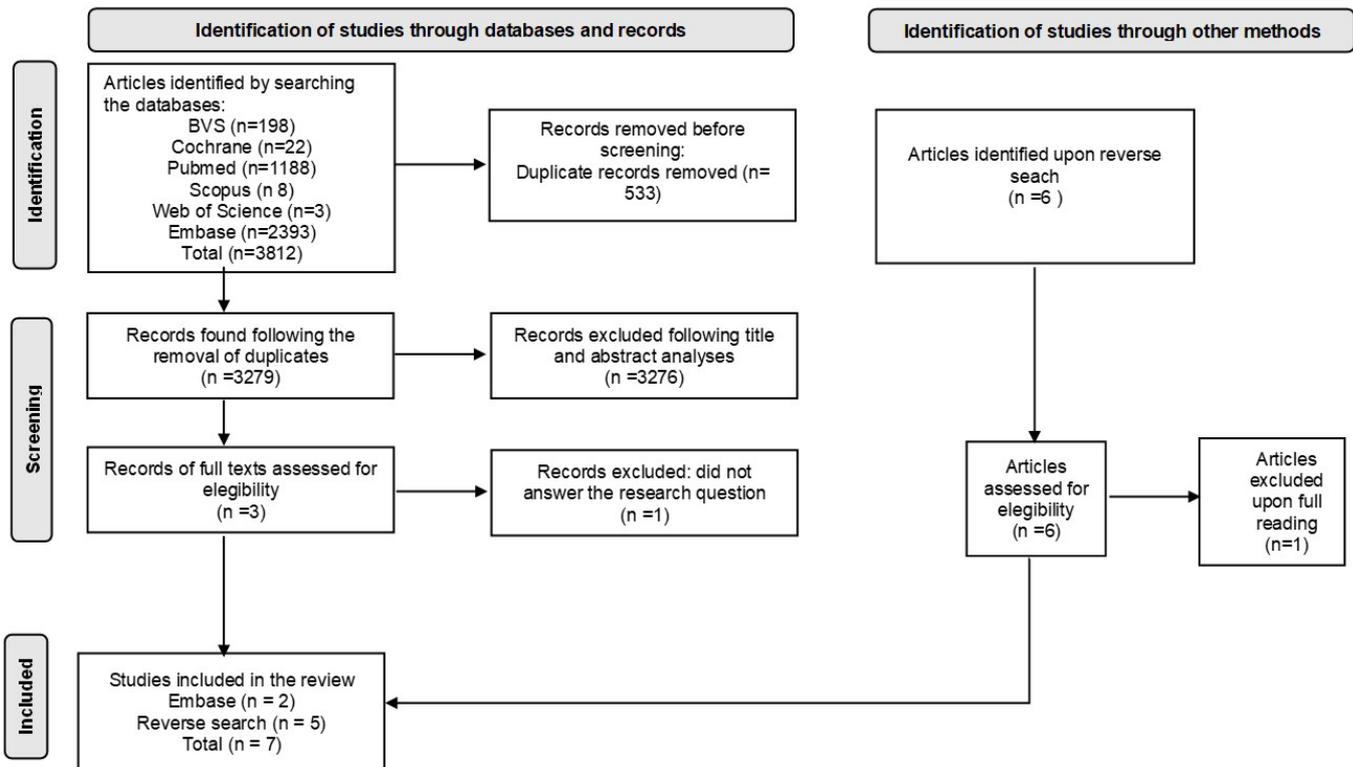


Figure 1. Article search flowchart adapted from Extension for Scoping Reviews (PRISMA-ScR)

Chart 2. Articles mapped in the scoping review

Authors	Year	Country of publication	Study design
Bassetto MR, Constantini AC <sup>(17)</sup>	2021	Brazil	Experimental
Paes SM, Behlau M <sup>(18)</sup>	2017	Brazil	Experimental
Ramos LA, Gama ACC <sup>(19)</sup>	2017	Brazil	Experimental
Moreira FS, Gama ACC <sup>(20)</sup>	2016	Brazil	Experimental
Menezes MHM, Ubrig-Zancanella MT, Cunha MGB, et al. <sup>(21)</sup>	2011	Brazil	Experimental
Azevedo LL, Passaglio KT, Rosseti MB, et al. <sup>(22)</sup>	2010	Brazil	Experimental
Menezes MH, De Campos Duprat A, Costa HO <sup>(23)</sup>	2005	Brazil	Experimental

in women<sup>(26)</sup> caused by the anatomical and physiological configuration of their larynx. Thus, the sample of six (85.71%) articles was composed of women, yielding results for the flexible latex tube, high-pitched murmur, rigid plastic tube, lip vibration, and sonorous tongue vibration exercises<sup>(17-23)</sup>.

Only two articles<sup>(17,23)</sup> investigated the subject in adult men without dysphonia: one using a flexible latex tube and the other using sonorous tongue vibration. The studies involving men showed different results from those involving women in terms of vocal technique execution time.

The study on male amateur singers using the flexible latex tube found no significant changes to the voice for this group, while for women there was an improvement in vocal quality<sup>(17)</sup>. As for the time taken to perform the vocal technique, the researchers found that longer times spent performing the exercise with the flexible latex tube in women generated negative self-perception effects, unlike the case for men. These differences could be due to the different sizes of the vocal tract between the groups, whereas the negative sensations may be less noticeable in men<sup>(17)</sup>. The recommended execution time

for the exercise ranged from three to five minutes for women, with no immediate effects on the parameters analyzed for men, up to seven minutes.

The study investigating the duration of the tongue vibration exercise in women and men without vocal complaints or laryngeal disorders also found an improvement in the perceptual-auditory analysis of women's voices in the third minute of the exercise, while, in general, the male group showed no changes. The researchers reported that some men showed differences in the parameters investigated after five minutes of performing the exercise<sup>(23)</sup>.

The type of dysphonia investigated in the four studies focused on the dysphonic population was behavioral dysphonia, which is related to inappropriate use of the voice and is more prevalent in individuals who use their voice as a work tool<sup>(27)</sup>. Of these, three<sup>(19-21)</sup> presented samples from populations diagnosed with vocal nodules, lesions that are more common in children<sup>(28)</sup>, women<sup>(29)</sup>, professionals with high vocal demand<sup>(30)</sup>, and individuals with specific personality traits<sup>(31)</sup>. The recommended time for dysphonic women to perform breath exercises sustaining the

**Table 1.** Results of dysphonic populations

Authors/Year of publication	Gender/Age group	Exercise	Repetition/Length of exercise	Frequency/ Length of treatment	Results
Moreira FS e Gama ACC (2017) <sup>(20)</sup>	Women / 18-55 years / vocal nodules	Breathing exercise, sustaining the vowel [u] in the high register	1, 3, 5, and 7 minutes	Single session	Exercise prescribed for 3 to 5 minutes, with improvement in vocal quality. Presence of vocal discomfort within 7 minutes.
Paes SM e Behlau M, (2017) <sup>(18)</sup>	Women / 20-50 years / behavioral dysphonia	SOVT: sturdy tube (rigid plastic tube 8.7 cm long and 1.5 mm in diameter); emitting [vu] at a pleasant frequency and intensity	1, 3, 5, and 7 minutes	Single session	Exercise was prescribed for 3 to 5 minutes. Positive changes were seen at 5 minutes, with better results at 3 minutes, with an increase in MPT and less effort in speech.
Ramos LA e Gama ACC (2017) <sup>(19)</sup>	Children / 5-10 years vocal nodules or epidermoid cyst	Hard plastic tube (8.7 cm long and 1.5 mm in diameter), associated with phonation exercises	1, 3, 5, and 7 minutes	Single session	Exercise prescribed for 3 to 5 minutes, with an improvement in vocal quality and a reduction in roughness and breathiness.
Menezes MHM, Ubrig-Zancanella MT, Cunha MGB, et al. (2011) <sup>(21)</sup>	Women / 18-48 years vocal nodules	Lip vibration	1, 3, 5, and 7 minutes	Single session	Exercise prescribed for 5 minutes with a reduction in noise, breathiness, and roughness and an increase in $f_0$ . At 7 minutes there was an increase in tension, greater instability, and an imbalance in resonance.

**Subtitle:** SOVT = Semi-occluded vocal tract; MPT = Maximum phonation time;  $f_0$  = Fundamental frequency

**Table 2.** Results of surveys with non-dysphonic population/no vocal complaints

Authors/Year	Gender/Age group	Exercise	Repetition/Length of exercise	Frequency/ Length of treatment	Results
Bassetto MR e Constantine AC (2021) <sup>(17)</sup>	Women / average age 22 Men / average age 25 / amateur singers	Flexible latex tube (35 cm long, 9 mm in diameter, immersed 2 cm below the surface of the water, in a 500 ml bottle containing 250 ml of water) producing the vowel [u], along with breathing comfortably, at the usual frequency and intensity	1, 2, 3, 5, and 7 minutes	Single session	Exercise prescribed for 3 to 5 minutes, with improvement in vocal quality and negative effects in 7 minutes. No difference was found in males.
Moreira FS e Gama ACC (2017) <sup>(20)</sup>	Women / 18-55 years / no vocal complaint	Breathing exercise, sustaining the vowel [u] in the high register	1, 3, 5, and 7 minutes	Single session	Exercise prescribed for 3 to 5 minutes, with an improvement in vocal quality.
Paes SM e Behlau M, (2017) <sup>(18)</sup>	Women / 20-50 years / no vocal complaints	SOVT: sturdy tube (rigid plastic tube 8.7 cm long and 1.5 mm in diameter; emitting [vu] at a pleasant frequency and intensity	1, 3, 5, and 7 minutes	Single session	Exercise prescribed for 1 minute, with improvement in MPT.
Azevedo LL, Passaglio KT, Rosseti MB, et al. (2010) <sup>(22)</sup>	Women/ 18-31 years / no vocal complaint	Sonorous tongue vibration	5 minutes, with intervals between 1 and 2 minutes	Single session	Exercise prescribed for 3 minutes, with an increase in $f_0$ and a decrease in noise.
Menezes MH, De Campos Duprat A, Costa HO (2005) <sup>(23)</sup>	Women / 20-42 years Men / 20-42 years speech therapy students, no vocal complaints	Sounded tongue vibration	3, 5, and 7 minutes	Single session	Exercise prescribed for women for 3 minutes and for men for 7 minutes. An improvement was seen in the perceptual-auditory analysis of the women's voices. Both men and women showed a gradual increase in undesirable sensations (discomfort) as the time taken to perform the exercise increased.

**Subtitle:** SOVT = Semi-occluded vocal tract; MPT = Maximum phonation time;  $f_0$  = Fundamental frequency

vowel [u] in the high register, uttering the syllable [vu] in a rigid plastic tube (8.7cm long and 1.5mm in diameter), and vibrating their lips was three to five minutes.

The adult population was the most investigated, present in six (85.71%) articles. Only one study involved male and female children diagnosed with vocal nodules and cysts<sup>(19)</sup>. This study<sup>(19)</sup> showed similar results to other studies carried out with women<sup>(18,20,21)</sup>. Although the samples were comprised of different populations and the exercises performed were also different (SOVT with blowing in the high register, rigid plastic tube, and lip vibration), in general, all studies achieved similar results in terms of the ideal time to perform the exercises. The prescribed time for performing the exercises ranged from three to five minutes for both samples, children, and women.

Based on this scoping review, there is a lack of studies investigating the ideal level of vocal techniques in the speech therapy of dysphonia for older adults. Studies aimed at this population must therefore be developed since older people have anatomical and functional differences compared to children and adults. The laryngeal structure ages along with the body and, with advancing age, this structure and the entire physiology responsible for phonation deteriorate<sup>(32)</sup>, affecting vocal quality.

Five articles<sup>(17,18,20,22,23)</sup> were found on the population without vocal complaints, with different exercises and similar results to the dysphonic population<sup>(18-21)</sup>, in terms of vocal technique execution time.

Both for women with behavioral dysphonia and for women without vocal complaints, the recommended time for performing the exercises of blowing the vowel [u] in the high register<sup>(20)</sup>, emitting the vowel [u] in the flexible latex tube<sup>(17)</sup> and sonorous tongue vibration<sup>(22,23)</sup> was three to five minutes. Vocally healthy women showed an increase in Maximum Phonation Time (MPT) after one minute of the [vu] syllable emission exercise in the rigid plastic tube<sup>(18)</sup>. The researchers found that this exercise generated positive vocal changes in women with behavioral dysphonia up to five minutes into the exercise, with a predominance of positive responses at three minutes (less phonatory effort, increased MPT, reduced Fundamental Frequency Variability), and worsening of vocal parameters as the exercise continued<sup>(18)</sup>.

In summary, the seven studies (100%) listed for analysis in this scoping review concluded that the ideal exercise time for the female and child population is three to five minutes<sup>(17-19,21-23)</sup> and six studies (85.71%) found a worsening of the vocal parameters investigated with seven minutes of exercise. It is worth mentioning that one of the studies, using the sonorous tongue vibration exercise on women with no vocal complaints, did not investigate the seven-minute time limit<sup>(22)</sup>.

The limitation of this study concerns that the articles included in the scoping review only investigated the immediate effects of vocal exercises on the voice, focusing on the time taken to perform the vocal techniques in a single session. Thus, no studies were identified that investigated the long-term effects of these exercises and their execution times.

## CONCLUSION

This scoping review allowed us to map out the synthesis for the ideal execution time of vocal techniques in speech therapy training in the vocal clinic.

Women and children showed better vocal results with a SOVT execution time of three to five minutes and worse with seven minutes. For the male population, the exercises should be performed for longer periods to achieve better vocal results.

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