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Review articles

Voice therapy with a respiratory approach in older people: an integrative literature review

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ABSTRACT

Purpose: to characterize voice therapy with a respiratory approach in dysphonic older people.

Methods: a search made in PubMed, VHL, Scopus, Web of Science, and EMBASE. Original studies in English, Spanish, and Portuguese, addressing voice therapy in combination with a respiratory approach in the older population, were included. The analysis encompassed sex, age, associated etiology, session frequency and duration, exercise dosage, intervention, and benefits.

Results: altogether, 1,425 articles were found, of which only nine were included in the review. In voice therapy for older people, the following strategies stood out: Vocal Function Exercises, Lee Silverman Voice Treatment®, ParkinSong, and tubes immersed in water. These approaches change the laryngeal muscle function and respiratory impulse and support and increase vocal intensity. The main therapeutic findings included improved auditory-perceptual, acoustic, and aerodynamic parameters, maximum phonation time, phonatory effort level, and voice quality.

Conclusion: voice therapy with a respiratory approach characteristically used strategies aimed at both the general older population and those with neurological dysphonia. Their results showed improvement in frequency, resonance, intensity control, and breathing/phonation coordination.

Keywords: Aged; Voice; Training Voice; Respiration; Voice Disorders

INTRODUCTION

The older population has been growing in many countries, particularly fast in Brazil[1]. Aging is a natural phase in every person's development when we go through progressive physiological changes[2,3].

Anatomical and functional changes in the vocal tract are part of this process and depend on individual aspects (such as genetic, social, occupational, and overall health issues) and whether there had been previous voice training[4]. Laryngeal aging, called presbylarynx, may cause various voice symptoms, like tremors, decreased vocal intensity, changed frequency, instability, and vocal fatigue[4,5].

Voice changes in this public may appear over the years without being necessarily related to presbylarynx. This would be the case of presbyphonia, which is the natural aging of voice, associated with complaints such as hoarseness, voice quality changes, problems speaking or singing, difficulties projecting the voice, dry throat, and constant phlegm[6,7]. Age-related voice changes are often caused by changes in the respiratory system, due to chest stiffness and loss of pulmonary elasticity[5,8].

A healthily produced and sustained voice knowingly requires interacted phonation, articulation, and breathing, with coordinated respiratory and stomatognathic systems. Phonation depends on adequate glottal closure and air pressure, which allow the efficient vibration of the vocal folds[4]. Hence, the main objective of speech therapy for older people's voices is to attenuate the characteristics of presbyphonia (including aspects of breathing), optimize communicative aspects, and slow the deterioration process caused by aging, thus improving the subject's quality of life in their activities of daily living[4,6].

The literature demonstrates that in voice therapy for older people, speech-language-hearing therapists can use Vocal Function Exercise (VFE), Voice Therapy for the Elderly (VTE), Phonation Resistance Training Exercise (PhoRTE), and the Lee Silverman Voice Treatment® (LSVT®) – which, despite being developed for patients with dysphonia caused by Parkinson's disease (PD), has positive results in cases of presbyphonia as well[9-12].

Semi-occluded vocal tract exercises (SOVTE) use hard and flexible tubes immersed in water[13] and respiratory instruments (e.g., incentive spirometers and respiratory devices). These resources have been increasingly used in speech-language-hearing practice as they improve breathing and phonation, decreasing the degree of voice changes and the score in the vocal disadvantage index[13,14]. Moreover, speech therapy with high-intensity vocal exercises in combination with Expiratory Muscle Strength Training (EMST) can have an important role in improving results in the voice of patients with presbyphonia[15].

Hence, this integrative review aimed to characterize voice therapy with a respiratory approach in dysphonic older people. Its important applicability in voice and breathing therapy was considered, as older people have specific needs related to respiratory system functioning. Therefore, speech-language-hearing therapists must understand the effects of such strategies to optimize their clinical practice and implement these therapeutic resources in the attention to the said population.

METHODS

The methodological process of the integrative review had the following stages: identification of the topic; development of the research question and definition of descriptors; definition of the inclusion and exclusion criteria; categorization; assessment; interpretation of results; and presentation of the integrative review, with the synthesis of knowledge[16].

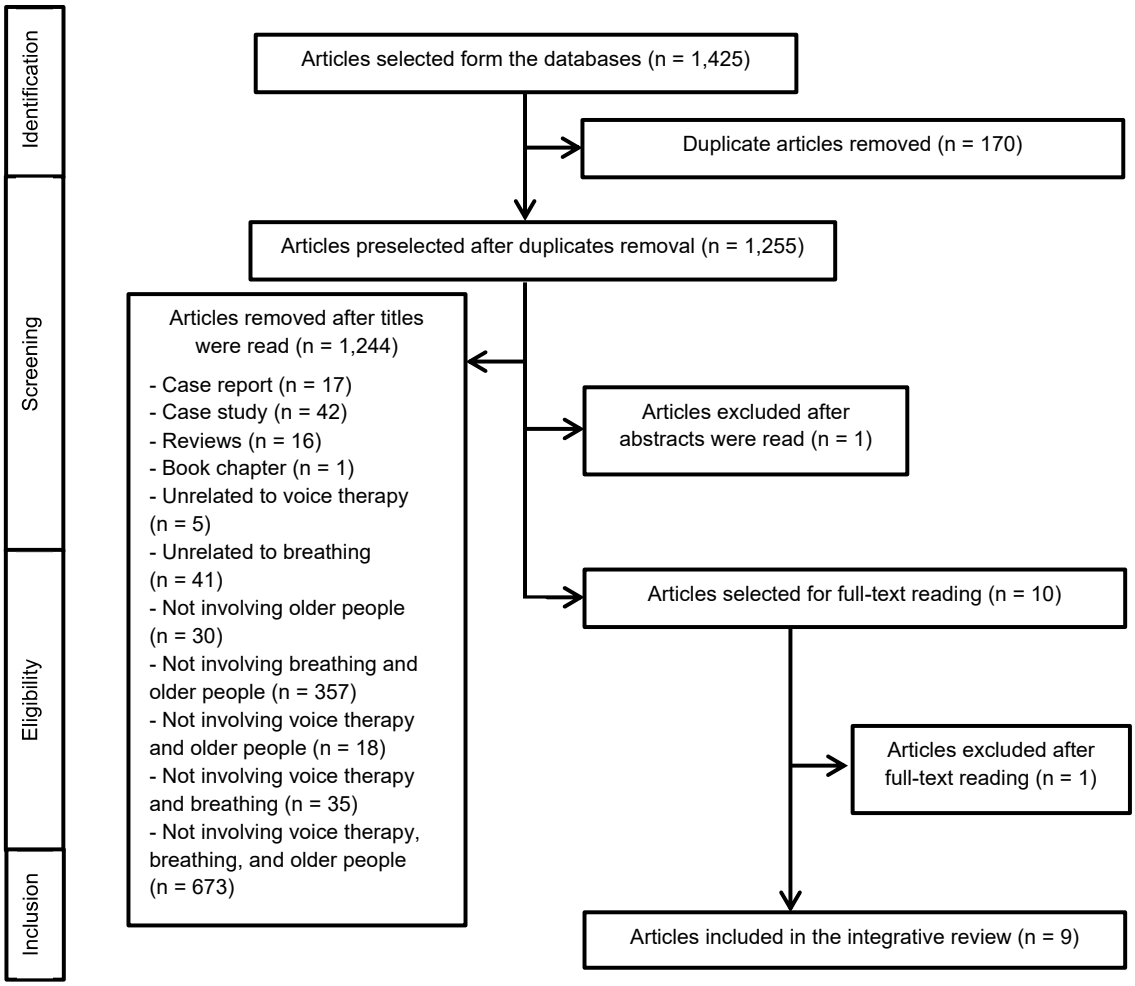
The research question for the review was developed with the PICO strategy, in which P (Population) was older people with voice complaints; I (Intervention) was voice therapy with a respiratory approach; C (Comparison) was older people without voice complaints; and O (Outcome) was the auditory-perceptual, acoustic, and aerodynamic measures and self-perception of the voice. The research question was as follows: "What are the characteristics of voice therapy with a respiratory approach in dysphonic older people?".

Articles were searched between December 29, 2020, and January 10, 2021, in the following databases, virtual libraries, and bibliographic repositories: Web of Science, Scopus, EMBASE, and those accessed via PubMed and Virtual Health Library (VHL) portals, using descriptors from DeCS (Health Sciences Descriptors), MeSH (Medical Subject Headings), and Emtree (Embase Subject Headings), in the three main languages of the American continent: English, Portuguese, and Spanish. The following terms were used: aged, *idoso*, and *anciano*; voice training, *treinamento da voz*, and *entrenamiento de la voz*; respiration and/or breathing, *respiração*, and *respiración*. The strategies are described in Chart 1.

Chart 1. Search strategies in the databases

Databases	Search strategies
PubMed	(Aged) AND (“Voice training”) AND (Respiration OR Breathing)
VHL in English	(Aged) AND (“Voice training”) AND (Respiration OR Breathing)
VHL in Spanish	(Anciano) AND ("Entrenamiento de la Voz") AND (Respiración)
VHL in Portuguese	(Idoso) AND ("Treinamento da Voz") AND (Respiração)
Scopus	(Aged) AND (“Voice training”) AND (Respiration OR Breathing)
Web of Science	Aged AND "Voice training" AND Respiration
EMBASE	Aged AND 'Voice training' AND 'Breathing'

The initial sample in this study comprised 1,425 scientific articles, distributed as follows: PubMed: n = 66 (4.63%); VHL in English: n = 1,262 (88.56%); VHL in Portuguese: n = 9 (0.63%); VHL in Spanish: n = 7 (0.49%); Scopus: n = 77 (5.40%); Web of Science: n = 3 (0.21%); and EMBASE: n = 1 (0.007%). The 170 duplicate articles were removed, leaving 1,255 preselected articles. Through the methodological process, 11 articles were selected based on their title, 10 of which were read in their full-text. Nine of these articles were selected for the review (Figure 1). Their methodology was assessed with Joanna Briggs Institute (JBI) protocols[15], all of which were approved and included in the study.



Caption: n = number

Figure 1. Flowchart of the number of articles found and selected after applying the inclusion and exclusion criteria

Selection criteria

The selection criteria for this review were as follows: original articles published in any year, whose topic addressed the voice, with emphasis on voice therapy associated with respiratory aspects in the older population. The exclusion criteria were as follows: repeated publications, letters to the editor, theses, dissertations, monographs, books, book chapters, manuals, abstracts, case studies, experience reports, and systematic, narrative, and integrative reviews.

Data analysis

The review was divided into two stages for data analysis: data extraction and methodological assessment. Both phases were conducted by two independent reviewers. Since there were no divergences between the reviewers, the appraisal of a third reviewer was not necessary at any moment.

In the extraction, the two reviewers first read the titles and abstracts, then the full texts of the articles, following the preestablished inclusion and exclusion criteria. Afterward, the following variables were entered into an Excel spreadsheet: year of publication, place of study, type of study, objective, sample (sex, age, and etiology), approaches, therapeutic resources, and main results, as shown in Chart 2.

Chart 2. Summary of studies included in the integrative review

Authors (Year)	Place of study	Type of study	Objectives	Sample/Age range	Therapeutic resource	Results
Tamplin et al. (2019)[18]	Australia	Controlled clinical trial	To explore the effects of an interdisciplinary therapeutic intervention based on singing (ParkinSong) on the voice and communication in people with PD.	71 older people – 61% men; with a mean age of 74 years, age range from 51 to 93 years.	ParkinSong	Increased vocal intensity, MEP, and voice-related quality of life.
Guzman et al. (2018)[19]	Chile	Quasi-experimental	To observe the influence of tube phonation in water on older people's voices.	30 older people (20 women, 10 men). Mean age of 73 years, ranging from 70 to 77 years, with presbyphonia.	Phonation exercises with flexible tubes immersed in water	Improved older people's voices by increasing vocal fold adduction and subglottal pressure in deep immersion.
Kaneko et al. (2015)[9]	Japan	Quasi-experimental	To make a multidimensional assessment of vocal function exercises regarding the results in the voice of older people with atrophy.	16 patients with vocal fold atrophy, aged 65 to 81 years, and 6 patients with vocal fold atrophy aged 65 to 85 years.	VFE	Improvements in older people with vocal fold atrophy, improving the amplitude of the mucosa, glottal insufficiency, jitter, MPT, VHI-10, and GBRAS
Tay et al. (2012)[20]	Australia	Quasi-experimental	To investigate the effectiveness of a 5-week vocal function exercise program on vocal function measures in a sample of older singers from community choirs.	22 older choir singers (8 men, 14 women). Mean age of 76.41 years, ranging from 68 to 83 years.	VFE	Improved roughness before and after the therapy; MPT increased only in the VFE group after the therapy; there was a difference in shimmer between before and after the therapy, only in the experimental group.
Sauder et al. (2010)[10]	United States	Quasi-experimental	To examine the effects of vocal function exercises as a primary treatment for presbylarynx.	9 older people (2 men, 7 women) with presbylarynx, aged 67 to 90 years, with a mean age of 76 years.	VFE	Improved functional disability, severity of voice problem, effort level, breathiness, and strain after VFE in patients with presbylarynx.
Gorman et al. (2008)[21]	United States	Quasi-experimental	To measure the results of vocal function exercises in vocal aerodynamics regarding the glottis in older men.	19 older men aged 60 to 78 years with laryngeal myasthenia and/or presbylarynx in laryngeal examinations.	VFE	Improved MPT before and after the treatment; full glottal closure, diminishing breathiness; increased subglottal pressure; improved resonance.

Authors (Year)	Place of study	Type of study	Objectives	Sample/Age range	Therapeutic resource	Results
Sapir et al. (2002)[22]	United States	Quasi-experimental	To assess the long-term perceptive effects of two treatment methods.	35 older adults with PD, distributed into groups that received either LSVT® (mean age of 63.23) or RET (mean age of 65.31).	LSVT® and RET	The results revealed long-term perceptual evidence with positive effects for LSVT® in speech volume and quality in people with PD.
Ramig et al. (2001)[23]	United States	Quasi-experimental	To assess the impact of LSVT® on vocal functions after 2 years of treatment.	33 older people with a mean age of 61.3 years in the LSVT® group and 63.3 years in the RET group.	LSVT® and RET	Patients with idiopathic PD treated with LSVT® improved vocal function for up to 2 years after the treatment. Patients treated with RET did not have long-term effects.
Ramig et al. (2001)[24]	United States	Quasi-experimental	To assess the impact of LSVT® on vocal intensity in a group of dysarthric people with idiopathic Parkinson's disease.	43 older people, divided into 3 groups: one group received LSVT® (7 men, 7 women, with a mean age of 67.9 years); one group with PD that was not submitted to voice therapy (7 men, 8 women, with a mean age of 71.2 years); and a group of neurologically normal older people with no voice disorders (7 men, 7 women, with a mean age of 69.8 years).	LSVT®	LSVT® increased the voice SPL from the baseline to post-treatment, statistically significant and audibly noticeable for voice and speech.

Captions: PD = Parkinson's disease; MEP = maximum expiratory pressure; MPT = maximum phonation time; VHI-10 = Voice Handicap Index - 10; GBRAS = Perceptual assessment scale of the glottal source; VFE = Vocal function exercise; LSVT® = Lee Silverman Voice Treatment®; RET = Respiratory Effort Training Program; SPL = sound pressure level.

The critical analysis involved the methodological assessment of articles read in full text selected according to JBI protocols[17]. Only articles with at least 60% positive answers in JBI protocols[17] were included in the integrative review.

LITERATURE REVIEW

The study aimed to characterize voice therapy with a respiratory approach in dysphonic older adults. The analysis of the articles revealed that voice therapy is permeated by respiratory approaches with evidence of benefits to older people's voices, regardless of the different therapeutic approaches used in each study.

The years of publication of the articles ranged from 2001 to 2019. No Brazilian studies were found with the search strategies and databases used by the authors. The country with the most publications was the United States (55.55%)[10,18-21]. Studies may have predominated in this country because LSVT®[12] (used in older people and PD patients) and VFE are originally North American[22].

As for study designs, eight articles were quasi-experimental[9,10,18-21,23,24]. The explanation for this may be that it is not always possible to randomly distribute people or groups based on the same experimental conditions.

The predominating mean age in the samples was 70 years old, indicating an increase in life expectancy worldwide, as this age group has higher population growth rates[25]. The greater participation of males in the selected studies also stands out[18,21,26], contrary to others that demonstrate a greater presence of women in health self-care than men[10,23,24]. Given the constant deconstruction of gender roles in society and the changing definitions of masculinity, the greater participation of men in these studies is worth noting[26]. It is increasingly necessary to change the idea of invulnerability because it hinders men from seeking their well-being and disease prevention[27,28].

Four of the selected studies addressed subjects whose voice changes had a neurological origin, involving participants with PD[19-21,26]. Others approached subjects with changes inherent to senescence (such as presbyphonia[23], presbylarynx[10], laryngeal myasthenia and/or presbylarynx[18], and vocal fold atrophy[9]), while one article analyzed a group of older people who participated in a university choir, without any voice and/

or laryngeal changes[24]. The studies used assessment processes common to speech-language-hearing practice, namely: auditory-perceptual, aerodynamic, and acoustic measures and self-assessment of the voice[29-31].

Some points stood out in the interventions. There were variations in therapy and/or exercise frequency (once a week[26], four times a week[19-21], twice a day[9,10,18,24]) and session duration (30 min, 1 h of singing, and another 30 min in social interaction[26]; 50 min[19], 1 h[10,20,21,24]; 3 h[23]), as well as in instructions to perform the therapy outside the therapeutic environment[9,10,18,20,24].

The following therapeutic approaches in combination with respiratory support were found: four studies on VFE; one on LSVT® (alone and intensive); two on LSVT® and the Respiratory Effort Training Program (RET); one using flexible phonation tubes immersed in water; and one with ParkinSong. The activities required and employed in this last one were musical notes[18]; musical scales (ascending and descending glissandos)[10,23]; sustained phonatory tasks[9,10,19-21,23]; maximum phonatory effort[19-21]; maximum respiratory effort[19-21]; respiratory self-perception[10,19,20]; respiratory control; and popular singing[26].

Generally, VFE[9] benefitted the older population with the following results: improved glottal closure; improved resonance balance; decreased breathiness, roughness, and phonatory effort; and increased maximum phonation time (MPT)[9,10,18,24]. This result may be due to the fact that VFE changes laryngeal muscle function and respiratory support in voice production. This approach involves changes in the physiological activity with exercises that are focused on airflow and laryngeal muscle strength, balancing the voice production systems: phonation, breathing, and resonance[32,33].

As people grow old, they naturally lose 10% of muscle mass from 25 to 50 years old and about 40% from 50 to 80 years old, which tends to cause voice changes[33]. Despite this situation, VFE improved various aspects of the voice in older adults with myasthenia[18] and vocal fold atrophy[9], as well as in singers[24], showing the potential to be used in various age ranges and voice profiles. VFE also had positive results in participants with presbylarynx[10,18] and presbyphonia[23].

LSVT®[12], the second most prevalent treatment approach, was present in three studies selected for this review. One study compared a PD group submitted to LSVT® with another PD group without therapy and a third, neurologically healthy group. In the other two studies, LSVT® was compared with RET[19,20], which directs the respiratory effort to increase respiratory and subglottal volumes and air pressure. The treatment tasks included maximum inspiration and expiration, maximum prolongation of /f/ and /s/ and sustained intraoral air pressure. Participants were also encouraged to maximize their respiratory effort in reading and speech tasks[19].

According to the studies surveyed in the review, RET results were not equivalent to LSVT®[19] results – i.e., they were neither as good nor as lasting. However, there is still much to learn about RET in Brazil, as it is seemingly not quite used or known in the country, besides the difficulty in finding articles on this program. LSVT® is an excellent method to treat the voice in PD patients[34]. Its main objective is to increase the respiratory impulse and adjust laryngeal muscles as it stimulates and trains the increase in voice volume[34,35].

Based on this principle, the three studies[19-21] reported improved glottal closure, increased sound pressure level (SPL)[19], and increased speech volume, furnishing audibly greater strength and quality to the voice of older adults with PD[19-21]. These results may have been obtained because the method is the only one based on a simple set of tasks designed to maximize the phonatory and respiratory functions. This is achieved by constantly instructing and stimulating patients to produce a strong voice, with maximum effort, in sustained phonation and various speech tasks. They are also constantly reminded to monitor the volume of their voice and the necessary effort to produce it[20].

Another relevant point is the maintenance of therapeutic results. Two studies presented positive effects maintained for 24 months (2 years)[19,20], while one reported results maintained for 6 months[21], agreeing with another research[34]. There is no exact explanation for such a prolonged effect. Nevertheless, it has been hypothesized that, by emphasizing vocal effort and strong phonation, LSVT® stimulates neural systems that help people overcome some deficits characteristic of PD[19].

Another therapeutic strategy used in the study in older people with PD was ParkinSong[26], an interdisciplinary intervention based on singing, voice, and communication. The result of the study demonstrated significant improvements in vocal intensity, maximum expiratory pressure (MEP), and voice-related quality of life, in contrast with the control group.

To explain such results, it was considered that the exercises are based on high-intensity music,

incorporating respiratory, vocal intensity, and tone variation control, as well as some vocal exercises aimed at phonatory efforts and self-monitoring. This strategy also approaches popular and traditional singing, focusing on voice projection and increased respiratory support. It also values social interaction, as participants are encouraged to engage in conversations to use high-intensity voice strategies, practiced during the sessions[26,36].

Singing is an important therapeutic modality, which requires greater respiratory support, more intense sustained phonation, and greater articulation and tone variations than speaking[36]. Moreover, it activates reward, excitation, and emotion networks in the brain, stimulating oxytocin, dopamine, serotonin, and endorphin release, thus decreasing cortisol[36,37]. It also stimulates the group context, enabling social connections and promoting well-being – which promotes cohesiveness, bond, and empathy among participants[37].

Tubes immersed in water were another resource used in voice intervention in older people[23]. Although only one study[23] using tubes focused on the topic of this research, this resource has been widely used in speech-language-hearing clinical practice[14,37]. The study pointed out positive gains in the older population, with striking results in electromyographic contact coefficient, increased glottal resistance and SPL, and improved airflow. In addition to these findings, the study suggests immersing the tube deeper into the water, as the effects take place when it is at least 8 cm deep. Shallower immersions may result in smaller or inexistent effects.

Other studies agree that the depth of the tube in the water is relevant to the result of the exercise[23,38]. It was verified that immersing it 1 to 2 cm into the water enlarges the vocal tract and reduces vocal fold collision force, whereas greater depths, such as 10 cm, activate the laryngeal muscles and induce compensation, as in an effort exercise, aiding glottal closure[38].

In general, SOVTE brings various benefits and can be done with tubes of different patterns, materials, and sizes[14,38]. However, investigations approaching the effects of vocal exercises and breathing in older people need to be more specifically explored.

Concerning the therapeutic dosages presented in the studies, the VFE approaches used different strategies. One used behavioral sessions, involving vocal hygiene, vocal education, and VFE for 8 weeks[9]. Another used four specific exercises, practiced twice each, twice a day, for 6 weeks[10]. Still another study used five to seven repetitions of the syllable /pa/ and vowel /a/ sustained for 5 s and three tones (habitual, high-pitched, and low-pitched) three times each, for 12 weeks[18]. Lastly, a piece of research conducted 1-hour training so they could understand the method and then practice it independently at home for 3 weeks, following a printed program; after this period, the participants' exercise technique was assessed, and they continued for another 2 weeks independently at home[24].

Regarding interventions with LSVT®, a piece of research used four 50-minute sessions per week, for 4 weeks[19]. Another approach used the method intensively, with four 1-hour sessions per week, for 12 weeks[21]. Yet another study used the same dosage, but for 24 months[20]. In the study that used ParkinSong – which, like LSVT®, is meant for patients with PD –, the sequence began with 30 minutes of music-based high-intensity vocal exercises, followed by 60 minutes of popular singing and 30 minutes of social interaction[26].

The study that used tubes immersed in water to verify the immediate effect of the technique on aerodynamic, electroglottographic, and acoustic measures conducted exercises in a sequence of three phonatory tasks: (1) sounds similar to the sustained vowel, (2) ascending and descending glissandos in comfortable vocal range and speed, and (3) intensity and pitch variations. Each participant performed 15 minutes of voice exercises with a plastic straw measuring 5 millimeters (inner diameter) by 25.8 cm (length) immersed in water in a container, 4 and 8 centimeters away from the bottom of the container[23].

Each therapeutic approach included in the review used a different dosage. When prescribing the training, it is important to understand and consider aspects such as the etiology, frequency, duration, intensity, and progression of the exercise to obtain the expected results. The exercises and duration used in voice intervention treatment lack standardization, as few studies combine these five components. Thus, most prescriptions for voice are based on the therapist's clinical experience[39].

Lastly, considering the laryngeal and voice aspects affected by aging (e.g., vocal fold atrophy, glottal gap, and mucosal wave changes – which cause asthenic, breathy, and rough voices)[4,11], the literature points to evidence of positive results from the methods and techniques applied to older people's speech and voice. Hence, new therapeutic resources, such as incentive spirometers and respiratory devices, should be included in speech-language-hearing therapy to

increase their use in clinical practice. These resources broaden the results and improve respiratory function, with important effects on voice quality and health[13,14].

A limitation of this study was the few pieces of research encompassing both voice therapy and breathing in the older population. Another limitation was that the studies demonstrated the effects of LSVT® on people with PD, which is neurological, even though the method is also suggested to treat people whose voice complaints are caused by the natural aging process.

Thus, vocal results with respiratory interventions comprise a field of study that needs a more in-depth approach in the speech-language-hearing sciences. Therefore, this topic requires further scientific investment and broadened use of therapeutic resources, such as instruments, incentive spirometers, and respiratory devices, in the older population.

CONCLUSION

This integrative review demonstrated that in voice therapy with a respiratory approach for older people, consolidated speech-language-hearing strategies, such as VFE, LSVT®, and SOVTE, stand out.

Regarding the session frequency and duration, the results varied in the number of sessions per week, time of treatment, and dosage of the exercises. In general, the patients' self-perception of the interventions with a respiratory approach was positive. The approaches were effective for older people's voices, with improved vocal emission (greater frequency intensity, variation, and control), resonance, breathing/phonation coordination, and improved aerodynamic and acoustic measures of the voice.

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