Literature Review

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Effects of vocal exercises on the treatment of dysphagia: integrative review

Efeitos dos exercícios vocais no tratamento da disfagia: revisão integrativa

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ABSTRACT

Purpose: To verify the available evidence on the effect of vocal exercises on the treatment of dysphagia. **Research strategy:** A bibliographic survey was carried out in the PubMed, LILACS, SciELO and MEDLINE databases, with no restrictions on the publication period. **Selection criteria:** Original articles, case studies and/or literature reviews published in Portuguese and/or English, available electronically in full and addressing clinical treatment with vocal exercises in adults and elderly with dysphagia. Publications repeated by the databases, with a population of children, individuals who did not present the diagnosis of dysphagia, with vocal exercises without specification, with exclusive swallowing exercises, articles and/or abstracts without the possibility of access by institutional platforms, and studies with animal model were excluded. **Results**: A total of 2,356 articles were found, of which, after the eligibility criteria were applied, 08 were selected for the final sample. To evaluate the effects of vocal exercises, the studies used clinical evaluation, videofluoroscopy, videoendoscopy and electromyography. Regarding the effects of vocal exercises on swallowing, it was observed that the techniques of plosive sound, buoyancy, semi-occluded vocal tract, basal sound, vocal modulation, overarticulation, the Lee Silverman Voice Treatment method® and the use of expiratory muscle strength training exercises showed positive effects in the rehabilitation of dysphagia. **Conclusion**: It was observed that studies with expiratory muscle strength training (EMST), Lee Silverman method (LSVT®) and traditional vocal exercises demonstrated positive effects in the treatment of dysphagia. However, it has not yet been possible to prove the level of evidence in all studies.

Keywords: Voice Training; Dysphagia; Speech therapy; Swallowing; Swallowing disorders

RESUMO

Objetivo: verificar as evidências disponíveis sobre o efeito dos exercícios vocais no tratamento da disfagia. **Estratégia de pesquisa**: foi realizado levantamento bibliográfico nas bases de dados PubMed, LILACS, SciELO e MEDLINE, sem restrições quanto ao período de publicação. **Critérios de seleção:** artigos originais, estudos de caso e/ou revisões de literatura publicados nos idiomas português e/ou inglês, disponíveis eletronicamente na íntegra e que abordassem o tratamento clínico com exercícios vocais em adultos e idosos com disfagia. Foram excluídas publicações repetidas nas bases de dados, com população de crianças, com indivíduos que não apresentassem o diagnóstico de disfagia, com exercícios vocais sem especificação, com exercícios exclusivos de deglutição, artigos e/ou resumos sem possibilidade de acesso pelas plataformas institucionais e estudos com modelo animal. **Resultados**: foram encontrados 2.356 artigos, dos quais, após aplicados os critérios de elegibilidade, foram selecionados 8 para a amostra final. Para avaliar os efeitos dos exercícios vocais, os estudos utilizaram avaliação clínica, videofluoroscopia, videoendoscopia e eletromiografia. Quanto aos efeitos dos exercícios vocais na deglutição, observou-se que as técnicas de som plosivo, empuxo, trato vocal semiocluído, som basal, modulação vocal, sobrearticulação, o método *Lee Silverman Voice Treatment*® e o uso de exercícios de treino de força muscular expiratória apresentaram efeitos positivos na reabilitação da disfagia. **Conclusão**: os estudos com treino de força muscular expiratória, o método Lee Silverman e os exercícios vocais tradicionais demonstraram efeitos positivos no tratamento da disfagia. No entanto, ainda não foi possível comprovar o nível de evidências de todos os estudos.

Palavras-chave: Treinamento da Voz; Disfagia; Fonoterapia; Deglutição; Transtornos da deglutição

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INTRODUCTION

Dysphagia is defined as a disorder or difficulty in deglutition when transporting the bolus from the mouth to the stomach, whose different phases may involve distinct consistencies[1]. This disorder can cause food to enter the airway, resulting in coughing, suffocation/asphyxia, and aspiration pneumonia. In general, dysphagia reflects problems in the oral cavity, pharynx, larynx, esophagus, or esophagogastric transition[2-4].

The strategies used for dysphagia treatment range from increased patient awareness and dietary changes to the adoption of postural techniques and voice exercises[3,5]. Therefore, adapting to the deglutition mechanism also requires changes to muscle strength, range of motion, and coordination of events involving the structures of oral cavity, pharynx and larynx, and pharyngoesophageal segment[3,6]

The pharynx performs two important functions: respiratory and digestive. During deglutition, the pharyngeal phase is influenced by the dynamics of the hyolaryngeal and pharyngeal complexes, acting in a contracted manner towards airway protection[7]. This complex presents vertical and horizontal motions of structures that work in the deglutition biomechanics[8].

In this sense, the morpho functional bases of the speech and swallowing systems are interconnected so that their functioning depends on myoelastic, aerodynamic, and pressure strengths for satisfactory deglutition and vocal performance . Structures of the oral cavity, oropharynx, and larynx play an important role in these functions and demand motor activities coordinated with breathing to simultaneously promote better vocal performance and lower airway protection[7].

The literature shows evidence of excellent results from integrating the voice exercise physiology and oropharyngeal motricity exercises used in dysphagia treatments, generating improved oral ingestion and less stasis in the pharyngeal area and in the glottal gap by maximizing the muscles and the pressure involved in the deglutition process[3,9,10].

In addition to traditional voice and deglutition exercises, the Lee Silverman Voice Treatment method (LSVT®) has also provided effective results in the rehabilitation of patients with dysphagia, especially for the neuromuscular control of the entire aerodigestive tract and increase in the expiratory flow. Gains in deglutition are attributed to an improved lower airway (AW) protection resulting from motor adjustments to glottal adduction, elevation of the hyolaryngeal complex, and pressure dynamics of the pharyngoesophageal segment[11,12].

Another available approach is based on respiratory exercises through expiratory muscle strength training (Expiratory Muscle Strength Trainer – EMST) aimed at strengthening the electrical activity of the suprahyoid muscles to improve the elevation of the hyolaryngeal complex with consequent opening of the pharyngoesophageal transition. This physiological effect favors the emptying of pharyngeal residues and enhances glottal closing and airway protection during deglutition[13,14].

Additionally, respiratory devices potentialize expiratory air strength[14], thereby optimizing laryngeal efficiency in voice production, due to improved glottal coaptation, greater loudness, and enhanced coordination between the respiratory and laryngeal systems[13,15]. Conversely, lower expiratory muscle strength, in addition to a potential inefficiency of voice production, may also cause an ineffective cough and potential reduction in airway protection upon food entering the glottal area[13].

Using voice techniques combined with myofunctional therapy is a common practice for rehabilitation of patients with dysphagic conditions, promoting a significant decrease in the presence of clinical signs such as wet voice, multiple deglutition, coughing, choking, and cervical auscultation, with functional improvement of food deglutition[1,3,6,16,17].

Historically, dysphagia recovery used to concentrate on compensation techniques during the deglutition function; however, the practice of strengthening exercises of the associated muscles has changed this scenario[18]. Evidence based speech therapy requires research to test therapeutic techniques to produce an increasingly standardized methodology. Therefore, it is fundamental for the clinical practice to reflect current research, seeking evidence of the effectiveness of these techniques for dysphagia treatment[13,18].

The functional mechanism of the laryngeal organ is an important source of coordination, deglutition dynamics, and lower airway protection[7,17], in addition to improving the elevation of the hyolaryngeal complex, associated with muscular adjustments in the dynamics of glottal adduction and abduction. It may constitute an important factor for airway protection and broncho aspiration reduction in patients with dysphagia[19].

Therefore, it is important to consider the relationship between exercise physiology and the effect transference principle of an exercise on more than one function by neuromotor commands and the activated biochemical and hemodynamic systems[11] in the clinical treatment of voice and dysphagia[17]. In this sense, an integrative literature review to investigate the effects of voice exercises on deglutition dynamics may broaden the theoretical basis for speech therapists to select adequate techniques for deglutition therapy with dysphagic patients.

Additionally, such a theoretical grounding may improve treatment in patients with concurrent voice and deglutition alterations, or even prevent or delay the onset of vocal signs and symptoms in dysphagic patients, or the opposite, in patients with progressive diseases, for example.

OBJECTIVE

The objective of this study is to explore the evidence available regarding the effect of voice exercises in dysphagia treatment by means of an integrative review.

RESEARCH STRATEGY

This research is an integrative literature review of a descriptive and qualitative nature, involving six preparatory phases: 1) establishing the guiding question; 2) literature search or sampling; 3) data collection; 4) critical analysis of the studies; 5) discussion of results, and 6) integrative review submission[20].

The following guiding question supported our data survey and discussion: "What evidence is available regarding the effect of voice exercises on dysphagia treatment?" Subsequently, we selected and evaluated the papers by reading their respective abstracts and proposed goals, applying the inclusion and exclusion criteria, fully reading the content, and analyzing the material included in our research.

Our search strategy involved browsing for papers in scientific journals written in the Portuguese and English, published in

the databases Public Medicine Library (PubMed), *Literatura Latino-Americana e do Caribe em Ciências da Saúde* (LILACS), Scientific Electronic Library Online (SciELO), and Medical Literature Analysis and Retrievel System Online (MEDLINE), in July 2019.

We adapted our search strategy according to the searched database to encompass the largest number of studies possible based on the following keywords: "semioccluded voice tract AND voice"; "AND dysphagia"; "dysphagia rehabilitation AND voice", "therapy voice AND dysphagia"; "voice training AND deglutition disorders", extracted from the Medical Subject Headings (MeSH), as well as keywords in Health Sciences (DeCS), as in Chart 1.

SELECTION CRITERIA

The inclusion criteria were defined as original papers, case studies, and/or literature reviews published in Portuguese and/or English, fully available electronically and addressing clinical treatment with voice exercises in adults and the elderly with dysphagia. In turn, the exclusion criteria included repeated occurrences in the databases, a focus on children, inclusion of individuals without dysphagia, unspecified voice exercises, exclusively deglutition exercises, papers and/or abstracts without free access, or studies based on an animal model.

We analyzed the papers using the PCC strategy, where P corresponds to population (adults and the elderly), C is the concept (voice exercises), and the other C represents the context (dysphagia treatments).

DATA ANALYSIS

All texts selected were analyzed by two independent examiners, and a third examiner in cases of disagreement. The analysis considered the following items: casuistry (participants' age and gender and base disorder), objective, study design, techniques, main results, and conclusion.

In total, 2,356 papers were selected for abstract reading, out of which 2,326 were excluded for not meeting our eligibility criteria.

Thirty papers were selected for full reading, out of which 22 were excluded for not meeting our eligibility criteria. Only eight papers met all criteria and were selected for content analysis, as in the flowchart presented (Figure 1).

RESULTS

A total of 2,356 studies were detected in the initial search, and 2,326 were excluded after reading the titles and abstracts. Thirty papers were read in their entirety, according to the selection steps described (Figure 1). Finally, the last sample of this review consisted of 8 scientific papers, selected according to the previously established inclusion criteria, including 5 from the PubMed database and 3 from SciELO.

The analysis of all papers included in the integrative review identified three experimental studies[3, 11,12] – 1 randomized clinical test (evidence level 2)[3] and 2 non-randomized (evidence level 3)[11,12] –, 3 reviews[13,14,21] – 1 systematic (evidence level 1)[13] and 2 narrative[14,21] –, and 2 case studies (evidence level 5)[9,10], according to the classification considered[22]. All studies were produced between 2002 and 2019.

Chart 2 shows a synthesis of the 8 papers included in the study, by author, year of publication, paper title, casuistry, study objective, study design, techniques, main results, and conclusion.

In six of the papers[3,9,10,12,21], the use of voice techniques improved deglutition in dysphagic patients and three[12-14] reported better expiratory flow and/or cough reduction following the realization of voice exercises.

The search for voice exercises for use in dysphagia treatment found 2 studies[13,14] detailing expiratory muscle strength training, 3 studies[11,12,21] with Lee Silverman Voice Treatment or LSTV/LOUD methods, and another 3 [3,9,10] describing traditional voice exercises.

Therefore, according to the consulted literature, the training exercises of expiratory muscle strength (Expiratory Muscle Strength Training – EMST), the Lee Silverman Voice Treatment – LSTV® and the traditional voice exercises were the most

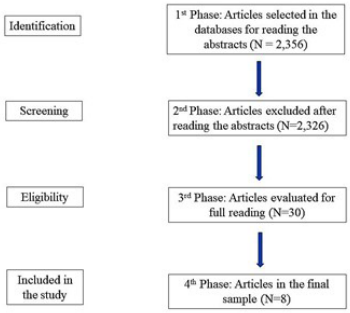

Figure 1. Flowchart do process de selection dos papers
Subtitle: N = number

Chart 1. Consulted keywords according to the databases

Keywords	PubMed	LILACS	SciELO	MEDLINE
Semioccluded voice tract AND voice	46	7	4	10
Voice training AND dysphagia	62	2	0	32
Dysphagia rehabilitation AND voice	266	10	2	278
Voice therapy AND dysphagia	921	19	6	610
Voice training AND deglutition disorders	51	4	0	26
Total	**1.346**	**42**	**12**	**956**

Chart 2. Synthesis of the eight papers analyzed

Author and Year	Title	Casuistry	Research goal	Study design	Techniques	Result measures	Main findings	Conclusion
Brooks et al.[13] (2019)	Expiratory muscle strength training improves swallowing and respiratory outcomes in people with dysphagia: a systematic review	Adults with communication and/or deglutition difficulties.	To investigate the effects of expiratory muscle strength training on communication and deglutition performance.	Systematic review on six databases: CINAHL, MEDLINE, Embase, SpeechBITE, AMED, and PubMed	EMST	Scale of penetration-aspiration; FOIS; EMGs of suprahyoid muscles; hyolaryngeal motion digitally analyzed by videofluoroscopy; VHI; Maximum speech time and s/z relation; questionnaire of life quality associated with deglutition.	Expiratory muscle strength training led to improved airway safety and strength of the expiratory muscles during swallowing.	Speech therapists should consider using expiratory muscle strength training to improve airway safety in adults with deglutition disorders.
Fraga et al.[3] (2018)	Efficacy of Myofunctional Therapy Associated with Voice Therapy in the Rehabilitation of Neurogenic Oropharyngeal Dysphagia: a pilot study	10 patients diagnosed with ischemic CVA and oropharyngeal dysphagia; average age of 73.2± 7.6 years; 6 male and 4 female individuals.	To verify whether the therapy of myofunctional exercises associated with voice exercises is more efficient in the recovery of deglutition in patients with cerebrovascular accident.	Study composed of two groups: control (myofunctional exercises) and experimental (myofunctional and voice exercises)	Voice therapy by means of plosive sound exercises, thrust, semi-occluded voice tract with glottal firmness or vibrating sound, maximum phonation time, and basal sound (voice fry).	Voice assessment through GRBASI scale, oral ingestion assessment through FOIS, and sensoriomotor-orofacial assessment through MBGR protocol.	The pre-therapy FOIS levels of the experimental group were 4 and increased to 7 after therapy. The combination of myofunctional exercises and voice was more effective in improving the levels of oral ingestion than the myofunctional exercises alone.	This pilot study showed evidence that the use of voice exercises in swallowing recovery in patients with CVA was able to provide a greater increase in the level of oral ingestion.
Miles et al.[12] (2017)	Effect of Lee Silverman Voice Treatment (LSVT LOUD®) on swallowing and cough in Parkinson's disease: A pilot study	20 participants (14 male and 6 female individuals) with Parkinson's disease.	To investigate the effects of LSVT LOUD® on deglutition by measuring quantitative parameters of deglutition and cough in patient group referred for voice treatment.	Programs applied in 16 sessions over four weeks.	LSVT®	Participants assessed by videofluoroscopy at three stages: before the program, a week into the program, and six months later.	All participants completed the program and there was significant improvement in the expiratory flow rate of involuntary cough and in the expiratory flow increase time. All participants reported eating a normal dietary food without modification of consistency. There were no cases of aspiration.	LSVT LOUD® demonstrates effects on swallowing function and involuntary cough efficiency in individuals with mild Parkinson's disease and voice complaints. This favors protection against respiratory and swallowing diseases, which are symptoms suffered by this population.
Laciuga et al.[14] (2014)	Functional outcomes associated with expiratory muscle strength training: narrative review	Individuals with Parkinson's disease, multiple sclerosis, and Lance-Adams syndrome; individuals with chronic obstructive pulmonary disease; healthy young adults and the elderly.	To classify evidence on expiratory muscle strength training using a pressure limiting device applied in multiple conditions or diseases.	Literature review on the databases: PubMed, Cochrane, Google Scholar, and two international publications on the Journal of Physical Therapy Science, and one on Respiratory Medicine.	EMST	Descriptive analysis.	The analyzed studies demonstrated promising results of expiratory muscle strength training for the protection of the airways in individuals with dysphagia secondary to neuromuscular deficiency.	Expiratory muscle strength training program was successfully applied to improve the components of speech, deglutition, and breathing. The program may be further applied as therapy in cases of dysphonia and dysphagia.

Subtitle: CVA = cerebrovascular accident; FOIS = Functional oral intake scale (Functional scale of oral ingestion); GRBASI = scale that assesses the degree of vocal deviation, in the auditory perceptual analysis, in which G – Grade; R – Roughness; B – Breathiness; A – Asteny; S – Strain; I – Instability; LSVT®: Lee Silverman Voice Treatment; EMST = Expiratory Muscle Strength Training (exercises of expiratory muscle strength); EMGs = surface electromyography; VHI = voice handicap index protocol; MBGR = orofacial myofunctional assessment

Chart 2. Continued...

Author and Year	Title	Casuistry	Research goal	Study design	Techniques	Result measures	Main findings	Conclusion
Rodrigues et al.[10] (2012)	Dysphagia associated to psychogenic dysphonia: case report	Female patient, 47 years old, with complaint of gradual difficulty deglutition of saliva and foods.	To report the evolution of a oropharyngeal dysphagia case associated with psychogenic dysphonia.	Patient subjected to weekly speech therapy (1 session a week). Exercises at a frequency of 3 series of 10 repetitions, with a total of 6 sessions. Each session lasted 30 minutes.	Scales with voice modulation; Over articulation exercises; isometric tongue base exercises.	Deglutition videofluoroscopy.	Fluoroscopy of the deglutition revealed normal results. The patient reported improvement in voice modulation scales, over articulation exercises, and stasis sensation in the pharyngeal area and in swallowing. However, the patient started to present aphonia condition, with present and audible cough, diagnosed as psychogenic dysphonia.	The speech therapy contributed to the patient's deglutition recovery.
Maffei et al.[9] (2007)	Pharyngeal cervical neurinoma: dysphonia and dysphagia	A patient with post-resection of neck and pharyngeal neuroma.	To analyze the effects of speech recovery, chewing, and deglutition on a case of neck and pharyngeal neuroma.	Clinical case of a 38-year-old patient with complaint of dysphonia, dysphagia, and chewing difficulty. Videolaryngoscopy indicated right hemilarynx paralysis and breathy tone. Electromyography showed a reduction in the electrical activity of the temporalis and masseter muscles on the right side. Speech therapy performed in 24 sessions.	Isotonic and isometric myofunctional exercises for the tongue, emission of sustained vowel / i / with hooked hands associated with neck flexion.	Vdeolaryngoscopy, videofluoroscopy and electromyography of the masticatory muscles.	Improvement in tongue strength, tonus, and mobility; decrease in food leakage; increased constriction of the pharynx muscles, with reduced residues in piriform sinuses; increased activity of temporal and masseter muscles on the right side, reduction in the glottal gap and decreased breathy tone.	The exercises promoted improvement in deglutition function and voice quality.

Subtitle: CVA = cerebrovascular accident; FOIS = Functional oral intake scale (Functional scale of oral ingestion); GRBASI = scale that assesses the degree of vocal deviation, in the auditory perceptual analysis, in which G – Grade; R – Roughness; B – Breathiness; A – Asteny; S – Strain; I – Instability; LSVT®: Lee Silverman Voice Treatment; EMST = Expiratory Muscle Strength Training (exercises of expiratory muscle strength); EMGs = surface electromyography; VHI = voice handicap index protocol; MBGR = orofacial myofunctional assessment

Chart 2. Continued...

Author and Year	Title	Casuistry	Research goal	Study design	Techniques	Result measures	Main findings	Conclusion
Fox et al.[21] (2006)	The science and practice of LSVT®/LOUD: neural plasticity-principled approach to treating individuals with Parkinson's disease and other neurological disorders	Individuals with Parkinson's disease, cerebrovascular accident, and cerebral palsy	To clarify the importance of a key-element as a recovery target for the improvement of various motor control systems.	Literature review.	LSVT®/LOUD	Descriptive analysis.	The studies demonstrated that the treatment with voice fold adduction and respiratory drive generated an effect on the voice sound pressure level, with improvement in speech (articulation), facial expression, and deglutition. The alterations in tongue function and base, prolonged oral and pharyngeal transit time, difficulty in bolus formation and lingual and pharyngeal stasis were resolved after the technique was applied.	Treatment focused on loudness (volume) is an effective tool for recovery, with results in disorders in oral communication and tract Vocal tract function in individuals with Parkinson's disease. Improvements in voice, speech and deglutition functions indicate a neural plasticity mechanism after LSVT®/LOUD technique.
Sharkawi et al.[11] (2002)	Swallowing and voice effects of Lee Silverman Voice Treatment (LSVT®): a pilot study	8 patients with Parkinson's disease: 6 male (aged between 57 and 77) and 2 female (aged between 48 and 57).	To define the effects of Lee Silverman Voice Treatment (LSVT®) on deglutition and voice.	Each patient received modified barium for swallowing and voice recording before and after a month of LSVT®.	LSVT®	Voice assessment with measurements of voice intensity, fundamental frequency, and the patient's perception of speech change.	Before LSVT, the deglutition disorders in the oral phase, tongue control and strength were reduced, and in the pharyngeal phase, tongue base retraction decreased, resulting in vallecula residues. Oral transit time and pharyngeal transit time were prolonged. After LSVT®, there was a reduction in the number of deglutition disorders and in the oral residue after swallowing liquids.	LSVT® improved neuromuscular control of the whole upper aerodigestive tract, improved tongue and tongue base function during the oral and pharyngeal phases of deglutition, and improved voice intensity.

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relevant techniques for the rehabilitation of individuals with dysphagia[23].

Half the studies analyzed included patients diagnosed with Parkinson's disease and with voice complaints and deglutition disorders[9,10,12,18]. Three of the papers analyzed were literature reviews[13,14,21].

In relation to the techniques applied, the LSVT® method affected the neuromuscular control of the upper aerodigestive tract and the efficiency of involuntary cough[11,12,21]. EMST improved airway protection[13,14], while the traditional voice exercises improved oral ingestion[3,9,10] and, in association with myofunctional exercises, resulted in greater strength, tonus, tongue mobility, better food ejection, and less oral and pharyngeal residues[9].

DISCUSSION

Although not speech function exercises per se, training exercises for expiratory muscle strength were considered in this study as also being part of clinical voice treatment [14,15].

Of the papers included in this research, two review studies addressed EMST for deglutition treatment – 1 narrative[14] and 1 systematic[13]. In the narrative review, the studies mentioned found promising results for EMST in the treatment of dysphonia and dysphagia, finding it to be non-specific training for airway protection in individuals with neuromuscular alterations. However, the authors acknowledge the need of more controlled studies to corroborate and generalize the findings reported[14], in line with another systematic review on dysphagia treatment in patients with Parkinson's disease[24].

It is worth mentioning that EMST therapy applied to deglutition function was found to be a potentially simple and cost-effective way to reduce penetration-aspiration in patients with Parkinson's disease, resulting in a substantial increase in the elevation and excursion of the hyolaryngeal complex during deglutition (19,25).

EMST is performed using a respiratory device that works as a respiratory stimulator aimed at exercising the suprahyoid muscles to improve the elevation of the hyolaryngeal complex. Strong evidence has been published in videofluoroscopic studies (gold standard in deglutition assessment). Improvement in the mobility and function of the hyolaryngeal complex promotes laryngeal elevation and anteriorization, directly favoring the opening of the faringolaryngeal segment through mechanical action. This process leads to less residue in the pharynx and pharyngoesophageal transition[19,25], leading to better airway protection during deglutition and a lower risk of penetration/aspiration in dysphagia rehabilitation for patients with Parkinson's[19].

These studies corroborate the findings of the systematic review paper that highlights that speech therapists should use expiratory muscle strength training (EMST) in clinical practice given its efficacy for the protection and safety of airways in adults with dysphagia[13].

Respiratory stimulators are useful in assisting lung re-expansion, increasing airway permeability, and respiratory muscle strengthening. The use of these devices associated with suction or breath interferes with the mobility of soft palate, hyolaryngeal complex, and pharyngeal transit[26].

Additionally, although not applicable to all cases, speech therapy with a blowing device is able to provide greater efficiency in glottal adduction and respiratory control, thus improving voice quality, speech stability, and voice intensity[27]. It can be recommended as a preventive measure to decrease the effect of sarcopenia on muscles used in deglutition and voice, as well as to alter the progression of senescence characteristics in voice and deglutition[28].

Of the papers included in this research, the only systematic review on the effects of EMST on deglutition and voice function recognized the need for further research with randomized clinical tests to generate more robust findings. However, the authors report preliminary evidence that this technique improves deglutition in individuals with dysphagia, afflicted by Parkinson's disease or cerebrovascular accident, in addition to compensating deficiencies in the treatment of individuals with motor-based communication alterations[13].

The LSVT® method (or LSVT LOUD®) is a program developed by American speech therapists to treat speech and voice alterations in patients with Parkinson's disease. The average duration of a session is one hour, with four sessions per week for one month. The therapy encompasses two approaches: daily tasks and hierarchical speech[11,21].

The daily tasks are aimed at increasing voice intensity with varied repetitions of the sustained vowel /a/, with tonal variations, emission time, and repetition variations, in addition to functional sentences chosen by the patients. In the hierarchical speech, patients progress with speech production (words, sentences, and conversation) to train the voice intensity achieved and enhance functional speech, since it improves laryngeal excursion and extends the vocal folds, with potential positive outcomes for patient prosody[3,11,12,18,21,23,29].

For our sample, we found that the physiological changes in speech recovery with LSVT® in patients with Parkinson's disease were able to trigger changes in the synergy and activity of the supraglottal and laryngeal muscles, also improving deglutition. We also found markedly shorter oral transit time during the pharyngeal phase, and less oral and pharyngeal residue, thus reducing the risk of post-deglutition aspiration, and promoting efficiency in oropharyngeal deglutition, in addition to improving expiratory flow and involuntary cough[11,12,21]

Positive effects of LSVT/LOUD® have been reported for other disorders in addition to Parkinson's disease, such as cerebrovascular accident and cerebral palsy. The results of applying this technique to deglutition showed a 51% reduction in the number of severe oropharyngeal dysphagia for liquids and solids. The findings indicated that the treatment extends to muscles of the aerodigestive tract, even when the focus is laryngo-respiratory[21].

These results corroborate another study with LSVT®, which indicated that the technique improved the activation of oropharyngeal and laryngeal muscles and glottal elevation[18]. Such a physiological effect directly improves oral food ejection, oral transit times, glottal adduction, and pharyngoesophageal transition opening, thereby leading to lower airway protection, as well as the elimination of pharyngeal residues and the risk of laryngo-tracheal penetration[11,12,18,21].

As for the voice exercises (plosive sound, thrust, semi-occluded tract voice with glottal firmness or vibrating sound, maximum phonation time, and voice fry), combined with myofunctional exercises (isotonic, isometric and counter-resistance exercises of lips, tongue and cheeks) in patients with oropharyngeal dysphagia, these were more efficient at levels of oral ingestion

assessed by the Functional Oral Intake Scale (FOIS) than the isolated myofunctional exercises[3].

The FOIS is used to assess oral ingestion capacity, which can be determined after clinical assessment with a validated standardized protocol. In a pilot study(3), FOIS was used as a marker to measure the efficiency of oropharyngeal dysphagia recovery[3,5].

Scaling voice exercises (with voice modulation) and myofunctional exercises (isometric exercises on the tongue base) applied to dysphagia recovery were also able to gradually improve the sensation of food stasis in the pharynx and the general deglutition performance[10].

Furthermore, improvements were also found in the glottal gap reduction, functional components of strength, tonus, and tongue mobility, food escape, and breathing pattern following the myofunctional exercises (isotonic and isometric of the tongue) and emission of sustained vowel / i / with hooked hands, associated with neck flexion[9].

These findings show that speech therapy intervention with voice exercises improves deglutition and associated life quality, as observed in a study with patients with vocal fold paralysis. The altered values observed during the pre-speech therapy assessment were found to have improved in the post-speech therapy assessment, leading us to conclude that the compensations were efficient for the voice and deglutition components[30].

Therefore, our study demonstrates the positive effects of the exercises used in voice therapy on dysphagic conditions with results that may support dysphagia therapy, especially in patients with associated voice alterations.

Nonetheless, it is worth noting specific research limitations in relation to methodology, given that it did not consider the quality of the studies included. Additionally, it only considered papers available for free (on institutional platforms) and the search strategy did not include technologies applied to voice treatment, such as electric neuromuscular stimulation or photobiomodulation. Thus, it may be assumed that the search keys and keywords may have limited the selection of the papers. In turn, the quality of evidence represents a limitation of the studies selected.

We suggest that prospective studies extend the research scope to other populations, like the elderly and cancer patients, and perform randomized and controlled tests investigating this topic for further scientific evidence.

CONCLUSION

The studies using expiratory muscle strength training (EMST), the Lee Silverman (LSVT®) method, and traditional voice exercises associated with myofunctional therapy observed positive effects on dysphagia rehabilitation. The parameters used were pre- and post-speech clinical therapy assessments as well as videofluoroscopy, videoendoscopy, and eletromyography tests. However, it was not possible to determine the evidence level of all studies.

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