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Revision articles

Vocal phonotheraphy and respiratory physical therapy with healthy elderly people: literature review

Fonoterapia vocal e fisioterapia respiratória com idosos saudáveis: revisão de literatura

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ABSTRACT

This study is subject to vocal therapy and breathing physical therapy in the healthy elderly. The aim of this study was to review the literature on vocal therapy and respiratory therapy in healthy elderly. It was done a literature review of articles published between 2004 and 2014 in the databases Lilacs, Bireme, MedLine, PubMed and Scielo. Descriptors used: physical therapy specialty; breathing; speech therapy; aged; therapeutics and voice. The literature on vocal therapy with healthy elderly showed that the interventions have been made through vocal hygiene; traditional vocal therapy for the presbyphonia, regardless of the type of intervention; specific vocal exercises; and standardized treatment programs, there is evidence of improvement of the measures vocals perceptual-auditory, acoustic, self-assessment and laryngeal image. As for respiratory therapy, the literature showed that the techniques or procedures used whit healthy elderly were: used of Thershould machine, manual therapy techniques, incentive spirometry, respiratory exercises associated with the movement of the trunk and lower extremities and physical activity in general, with evidence of improvement in respiratory muscle strength, lung functional and functional autonomy of the elderly.

Keywords: Physiotherapy; Speech Therapy; Aged; Breathing; Therapeutics; Voice

RESUMO

Este estudo tem como tema a fonoterapia vocal e a fisioterapia respiratória no idoso saudável. O objetivo do presente estudo foi revisar a literatura sobre fonoterapia vocal e sobre fisioterapia respiratória com idosos saudáveis. Foi realizado um levantamento bibliográfico de artigos publicados entre 2004 e 2014 nas bases de dados Lilacs, Bireme, MedLine, PubMed e Scielo. Descritores utilizados: *physical therapy specialty; breathing; speech therapy; aged; therapeutics* e *voice.* A literatura sobre fonoterapia vocal com idosos saudáveis mostrou que as intervenções têm sido feitas por meio de orientação vocal; terapia vocal tradicional para presbifonia, independente do tipo de intervenção; exercícios vocais específicos; e programas terapêuticos padronizados, havendo evidências de melhora de medidas vocais perceptivoauditivas, acústicas, de autoavaliação vocal e de imagem laríngea. Quanto à fisioterapia respiratória, a literatura evidenciou que as técnicas ou procedimentos utilizados com idosos saudáveis foram: uso do aparelho *Threshold*, técnicas de terapia manual, espirometria de incentivo, exercícios respiratórios associados ao movimento do tronco e membros inferiores e atividade física em geral, apresentando evidências de melhora na força muscular respiratória, função pulmonar e autonomia funcional dos idosos.

Descritores: Fisioterapia; Fonoterapia; Idoso; Respiração; Terapêutica; Voz

INTRODUCTION

It is estimated that in 2025 about 14% of the population, more than 30 million people, will consist of elderly people[1], demonstrating the necessity and importance of research on the health and also on the quality of life of this population. The study on aging should enable the exchange among the several professionals (physicians, nurses, physiotherapists, speech therapists, psychologists, nutritionists, etc.), once this is a complex phase, which affects the entire body, thus contributing to the establishment of an interdisciplinary approach on senescence[2].

The larynx, the respiratory system and the orofacial organs are modified at this stage[1-11]. Some authors state that the period of voice occurs around 60 years, varying according to individual characteristics[3]. In laryngeal level, the resulting alterations of aging characterize presbylarynx, observing particular characteristics of this organ as laryngeal ptosis, glottal incompetence, as well as atrophy and reduced thickness, curving and irregularity in the vibration of the vocal folds (PPVV), the voice occurrence of ventricular bands, ossification and calcification of cartilage, fragility of blood vessels with tendency to submucosa hemorrhage[7,8]. Besides, the mucous-secreting glands are reduced in number and undergo atrophy, which causes the decrease of the laryngeal lubrication[8].

At senescence, there is an elasticity reduction in lung tissue, a reduction in respiratory structures and venules and arterioles compliance, increased capillary coating fibrosis related to alterations in the connective tissues of the lung, progressive reduction of pulmonary function parameters and breathing muscle strength[4-6,12], which may result in decreased air support for the production of voice[7]. The rib cage suffers progressive stiffening due to calcification of the ribs and vertebral joints, there is reduced elasticity and muscle mass, as well as atrophy of skeletal muscles of respiration accessories[12], being a result of a multifactorial process that includes physical inactivity, remodeling of motor units, decreased hormone levels and protein synthesis, named sarcopenia[13].

All laryngeal, respiratory and orofacial organs alterations, which were already mentioned, also force the voice to assume specific characteristics, such as reduction of TMF and speech rate, a decrease in the maximum phonation time, in the loudness and also in the vocal stability[7]; voice with crackling, breathiness, tension, hoarseness, fatigue[0], tremor[14]; acoustic vocal measures showing a decrease in the harmonic-noise ratio and an increase in the jitter, shimmer, soft phonation index (SPI), an increase in noise at spectrographies, and a decrease in the fundamental frequency (f0) in women and an increase in f0 in men[3,7,9,11,14].

Aging also promotes the decline in forced vital capacity (FVC), forced expiratory volume in the first second (FEV1) and forced expiratory flow (FEF) as well as an increase in functional residual capacity (FRC) and expiratory reserve volume (ERV) [5]. The values of maximal respiratory pressures (MIP and MEP) are significantly reduced over each decade, demonstrating that there is a strong negative relationship between age and respiratory muscle strength in this population[6]. Another relevant factor of senescence that shows strong influence on lung function is the postural change. The curvatures of the spine become more substantial, increasing the kyphosis of the thoracic region and, consequently, causing the shortening of inspiratory muscles[12].

Such alterations, associated with reduced muscle strength, can lead to a decrease in the peak expiratory flow (PEF), with less respiratory support and subglottic airway pressure, resulting in a reduction of sound pressure, pneumophonic incoordination and asthenic voice quality[7]. However, research has shown that trained voices show less effect regarding age[3,15]. Good habits in vocal health and performing exercises that improve the respiratory condition may result presbyphonia alterations in a more subtly form, not significantly interfering with daily life of elderly people[3,15], which reinforces the need for therapeutic work for optimizing the respiratory and phonation system[2,13,14].

As the aging process is characterized by biological and functional modifications, it is essential for Speech Therapy and Physiotherapy professional to know the characteristic vocal and respiratory parameters of the elderly population and the methodology that has been used to slow the effects of aging, so they can work efficiently in assessment strategies and rehabilitation[2].

Considering that, this study aimed to review the literature on vocal phonotherapy and also on respiratory physiotherapy with healthy elderly people.

METHODS

The research questions that supported the review were: “What are the publications on phonotherapy and respiratory physiotherapy with healthy elderly people about? What do they describe?”

We performed a search on the Lilacs (Latin American and Caribbean Health Sciences), Bireme (Regional

Library of Medicine), MedLine (Medical Literature Analysis and Retrieval System on Line), PubMed (Medical publications) and Scielo (Scientific Electronic Library Online) as a strategy of research, by selecting papers published from 2004 to 2014. Descriptors in Health Sciences (DeCS, 2013) selected for the search for articles were: physical therapy specialty; breathing; speech therapy; aged; therapeutics and voice, as well as the terms aging and elderly. The search was made by the associated descriptors.

The inclusion of the published studies were performed on the following criteria: selection of original research papers which were published in Portuguese or English with the previously mentioned associated descriptors (and/*e*), published in the period from January 2004 to December 2014 in these databases, complete available electronically, whose titles and abstracts were related to vocal phonotherapy theme and/or respiratory physiotherapy with healthy elderly people.

The exclusion criteria were in agreement with the classification of the level of scientific evidence: case study papers (evidence level 5), opinion of experts (evidence level 6), literature reviews, as well as abstracts in conference proceedings, books, dissertations and theses. We also excluded works on vocal phonotherapy and respiratory physiotherapy with unhealthy elderly who presented pathologies associated with the aging process or who used their voice professionally.

After applying the inclusion and exclusion criteria by searching and reading the titles and abstracts described above, 25 papers were selected for analysis. They were read in their entirety and grouped according to the themes that resulted in the subheadings of this work: vocal phonotherapy with elderly people and respiratory physiotherapy with elderly people, describing the methodological aspects and findings of each included work.

LITERATURE REVIEW

Phonotherapy with elderly people

In aging, the phonotherapy aims at compensating presbyphonia features, optimizing communicative aspects and slowing the process of deterioration caused by age, which may cause an improvement on the quality of life of the subject in their daily activities[3,15].

Therapy programs that consist of vocal exercises have been proposed for favoring the glottal closure, increasing subglottic and sound pressure, producing normotensive voice, as well as stabilizing vocal quality and f0, besides providing an improvement in pneumo-phono-articulatory coordination and vocal strength[3,10,11,15-18].

Studies show that trained voices can delay or reduce the effect of age on the larynx and orofacial organs[3,15]. In order to verify the program efficiency of vocal function exercises of Stemple, one study compared the auditory-perceptive and acoustic vocal parameters to the self-evaluation of 22 elderly people who were amateur singers of choirs, divided into control group (CG) and study group (SG). The SG went through vocal training, being the exercises exemplified in a large group, and then, executed in groups of three, overseen by the speech therapist, who also provided feedback on the performance. Two sets of each period were performed for five minutes, two times per day, preferably in the morning and in the evening, during five weeks. After the therapeutic program, the CG presented a significant reduction in vocal roughness, an increase of TMF, jitter and shimmer reductions, an increase of harmonic-noise ratio and it was noted positive effect of the therapeutic program on voice[17].

With the same therapeutic program, researchers carried out a study in order to determine the aerodynamic modifications and TMF elderly people after the implementation of the program to reduce the effects of age in their voice. The program was performed with 19 elderly people, twice a day, for a period of 12 weeks. We noticed an increase of TMF over the 12 weeks; in relation to the assessment after therapy we was also observed an improvement in terms of aerodynamic forces with increased subglottic pressure, but without increasing the vocal acoustic energy[16].

At this study, we aimed to assess the effectiveness in the short run and to check the differences in adherence and satisfaction with two types of treatment: vocal function exercises and the phonation resistance training exercise (PhoRTE) in the treatment of presbyphonia. 16 elderly people with presbyphonia participated, randomly divided between vocal function exercises, PhoRTE, and a control group without treatment. All elderly people achieved a score higher than 20 on the Mini Mental Examination, seeking to ensure the cognitive ability to understand the therapeutic methods. All participants were also asked about vocal health. Before and after a four-week intervention period, the subjects responded to the Voice-Related Quality of Life Protocol (V-RQOL), a questionnaire of perception of speech effort (PPE) and a post-treatment

satisfaction questionnaire. The intervention lasted four weekly sessions of 45 minutes.

The vocal function exercise program was, in addition to the four traditional exercises, composed by the learning of abdominal breathing and the use of the inverted megaphone resonance focus. The PhoRTE, adapted from Lee Silverman method, consisted of four exercises: Strong TMF of /a/; strong TMF, with upward and downward frequency /a/; specific functional phrases using a strong voice; and phrases with exercise in strong and weak voice. Participants also learned abdominal breathing and received feedback to remember to keep a "strong" voice, by keeping

the NPS between 80 and 90dB. And also, both intervention groups were instructed to practice their treatment twice a day, every day, to register their practice and they received written instructions and a CD on how to perform the exercises at home.

Preliminary data showed that the two therapy groups presented significant improvement in V-RQOL, scores, however, only the PhoRTE demonstrated a significant reduction in the perception of speech effort. The group of vocal function exercises showed greater adherence to home practice recommendations and PhoRTE presented higher satisfaction with treatment. The authors concluded that the results provide new evidence about the effectiveness of voice therapy exercises in the treatment of age-related dysphonia and suggest PhoRTE therapy as another treatment method for reducing the perceived vocal effort and improvement in quality of life in this population[19].

Authors examined the efficacy of the Lee Silverman method in two elderly people, a woman and a man, aged 61 and 88 years respectively, with diagnosis of presbyphonia. Laryngological examinations, phonation measures, acoustic and auditory-perceptive analysis of voice, pre and post-application of the method were performed. The sound pressure, TMF and f0 were also obtained. Subjects received 16 sessions of 60 minutes of Lee Silvermann method comprising a period of four weeks, individually. The first 30 minutes of each treatment session consisted of exercises to increase TMF and f0 and practice a set of sentences with the use of strong vocal loudness. The next 30 minutes focused on the use of breathing and the increase in vocal loudness in several speech tasks. Individuals should also practice the exercises at home every day in order to integrate and strengthen the skills which were acquired. After the end of the program, the subjects were also instructed to continue the practice at home. We observed that both subjects presented significant improvements in glottal closure, phonation (sound pressure and tuning), acoustic characteristics (f0, jitter, shimmer and harmonic/noise ratio), and auditory-perceptive characteristics of voice (general degree, roughness, breathiness and asthenia) after the treatment. The significant alterations in phonation measures were noted relatively early and remained stable throughout treatment. The authors concluded that the method is effective in the treatment of subjects with presbyphonia[20].

This study aimed to verify the feasibility of a Vocal Cognitive Program for presbyphonia, prepared with theoretical basis in genetic epistemology of Jean Piaget, associated with vocal techniques based on literature. The study included three elderly people with an average of 67 years, who performed before and after the larynx examination program, auditory-perceptive evaluation (CAPE-V) and dysphonia Risk Screening Protocol. The Vocal Cognitive Program consisted of six sessions, each one focusing on different aspects of vocal production. The program is divided into six sessions: first session of introduction and breathing (videos and guidance on physiology of speech and vocal health, cervical relaxation/stretching exercises and breathing in costo-diafragmatico-abdominal standard with air extension exercises in one, two three times with the sound /f/); second session of breathing (videos and guidance on breathing, cervical relaxation/stretching exercises, breathing in costo-diafragmatico-abdominal standard with air extension exercises in one, two and three times with the sound /f/, breathing in costo-diafragmatico-abdominal standard and pneumophonoarticulatory coordination with fricatives and high front and mid vowels in TMF); third session of glottal source (video and guidance on source; cervical relaxation/stretching exercises, exercises with emphasis on breathing and vibrant sounds of language); fourth session on source (video and guidance on source; relaxation exercises/cervical stretching, breathing with an emphasis on exercise and glottal firmness); fifth session on resonance /joint (video and guidance on joint; relaxation exercises/cervical stretching, exercises with an emphasis on breathing, vibrant sounds, glottal firmness and humming); sixth session, the one with the conclusion (resumption of the worked aspects, relaxation exercises/cervical stretching, exercises on emphasis on breathing, vibrant sounds of the language, glottal firmness and humming, conversation on the alteration which were observed

during therapy). In all sessions, exercises for practicing at home were asked and they would be taken up at the beginning of the next sessions. The results showed that after the program the loudness, pneumo-phono-articulatory coordination, articulation clear, jitter, harmonic-noise ratio, voice quality and TMF were improved, and there was an increase of f0. In two participants, there was tension associated to the increase in loudness and better score of Dysphonia Risk Screening Protocol. There was also observed a reduction of presbylarynx signs at laryngoscopy, with improved glottal closure and movement of mucosal wave[21].

The promotion work on vocal health is also carried out with the elderly people, mostly through speech guidance on vocal hygiene, trying to educate the elderly people about the importance of keeping themselves physically active, to adopt healthy habits of daily living, such as good nutrition, serene sleeping and adequate hydration, avoiding the incorrect vocal uses[9]. In order to analyze the presence of inadequate habits, forms of prevention and vocal symptoms, a study compared two groups of elderly people, one without vocal knowledge and another which had received guidance on the care of the voice given by a speech therapist in the year preceding the survey. The researchers found that the group that received guidance presented significantly lower rates of inadequate habits and vocal symptoms, showing that the guidance on vocal health in elderly groups is effective[9].

There are studies that analyzed the immediate and prolonged effect of vocal exercises on the voice of the elderly subjects[15,18,22]. A voice therapy program for elderly people with presbyphonic voice was performed once a day for six weeks.

The self-assessment of voice, the voice handicap (Voice Handicap Index), the auditory-perceptive and acoustic vocal analysis of the voice were performed pre and post-therapy. The exercises were the support the TMF of vowels and musical scales with vowels and words. After therapy, it was observed a decrease of the vocal effort, an improvement in resonance, in respiration and also in phonation, reducing the severity of voice disorders as well as reducing the voice handicap index[18].

The vocal immediate effect of the completion of Semi-occluded vocal tract exercise (SOVTE) of sounded blowing was evaluated in 33 elderly subjects without voice complaints and hearing disorder and self-reported good general health. A recording of the vowel / ɛ / sustained at three different times was performed: the first, named habitual (H), from the regular emission of the subject; the second, use (U), after one minute of spontaneous speech; the third, exercise (E), performed one minute of execution of the sounded blowing. After the exercise, a self-assessment of the elderly person about the perceived alterations in voice was requested. The exercise was performed for one minute, which consisted of the emission of a breath associated to the emission of strengthen sounds with the vowel /u/. The recordings were edited and paired randomly, considering two moments of the same subject: H/U; H/E and U/E, for further auditory-perceptual assessment of the best emission, carried out by three speech therapists expert in voice. The authors observed that there were no difference between H/U and U/E, however, the emission E was considered better than H. In relation to the vocal self-assessment, 75.8% of the elderly people did not notice alterations in their voice after performing the exercise. It was concluded that the sounded blowing produced immediate positive effect on the vocal quality of the elderly subjects, observed only in the auditory-perceptual evaluation[15].

A current study tried to verify the effectiveness of using the Finnish method of resonance tubes in a group of 42 elderly subjects, 30 of whom were female, aged from 62 to 93 years, residents of a long-stay institution, with complaints of vocal and respiratory alterations. The sample was equally divided between Research Group (G1) and Control Group (G2). A sociodemographic inventory followed by spirometry and auditory-perceptual evaluation of voice before and after the intervention was applied. Six sessions of phonotherapy were performed once a week, lasting an hour. G1 participated in six sessions with the technical resonance tubes and G2 participated in six workshops of vocal health.

All therapeutic sessions of G1 with the technique of resonance tubes used one liter plastic containers, with side marking of the water level in 6cm, depth adjustment of the tube to 5cm from the surface and glass tubes (8mm to 9mm internal diameter and 24cm to 25 cm in length). The height of the tube was adjusted according to the individual in order to promote the proper phonation position, without effort. The elderly people were seated and instructed to keep the recipient with water in the table, and also hold the tube between finger and thumb, about 1 mm from the teeth and keeping the rounded lip to the adequate seal lip around the tube, being necessary to perform emissions of continuous sounds like strengthen /b/ and “u”, sounds

or meaningless words such as "jjjuu", "jjjiibbuu", jjiibbiiuu" and also the emission of the "Happy Birthday" song melody. The sounds produced water bubbles during the emission and the therapist demonstrated to the elderly subject the exercise in order that he/she could imitate.

Alterations in intonation and sounds were inserted individually, as the patient feel the easiness to phonation. The limit of all subjects was respected with regard to fatigue, allowing up to two minutes for breaks between emissions. The vocal health guidance interventions with the G2 group were carried out through play activities such as games and music and addressed themes on the vocal aging process and care of the voice, as laryngeal hydration, coffee, alcohol, cigarettes and medicines for voice, physical exercise, food effects on the voice, the sleeping and the influence of the rest in the voice, the voice development from childhood to old age, ending with the testimony of each participant on the acquisition of these learnings. The results showed that the G1 obtained significant improvement post-therapy in the overall degree of dysphonia, roughness, asthenia, tension and instability and vital capacity parameters, while G2 received no significant vocal alteration and presented worsened in vital capacity. The authors concluded that the Finnish technical resonance of tubes showed efficacy in therapy with elderly individuals with symptoms of presbyphonia, helping the improvement of vocal quality and vital capacity[22].

Other SOVTE as vibrating lips and tongue, sounded blowing, fricative sounds, prolonged /b/, humming, glottis firmness, finger kazoo, lip constriction, Lessac Y-Buzz and phonation tubes, can also be used in elderly people, focused on a more balanced vocal production. Such exercises are considered normotensions by promoting the reduction of compression and glottal supraglottic constriction and the expansion of the vocal tract, stimulating the resonance and improving pneumo-phono-articulatory coordination[15].

A study aimed to show the effectiveness of the treatment of presbyphonia in elderly people by reviewing charts of patients cared at a school clinic. From 54 charts of patients with dysphonia by presbylarynx not associated with other pathologies, 25 which had complete data were selected. From these, 19 underwent therapy (RG) and six did not (CG). The effectiveness of therapy was measured by the total scores of pre and post-therapy V-RQOL, protocol responded by the RG individuals who attended at least two months of treatment. Considering that these were cases of individual therapies records held during three years in a center for specialized care in voice, it was not possible to specify the objectives and techniques performed during the therapeutic sessions. It was observed that the RG attended therapy for an average of 4.1 sessions and showed a significant increase in quality of life after the process[23]. Another study that carried out a review of 77 medical records of elderly people during a period of three years on a voice center showed that the main complaint of patients was the hoarseness, the videostroboscopy examination showed the presence of vocal folds atrophy even in absence of the larynx or neurological conditions, and that 85% of patients improved with voice therapy, regardless of sex or age[24].

Respiratory Physiotherapy with Elderly people

The respiratory physiotherapy includes various techniques and exercises to prevent and/or delay the alterations that come with the aging process, and the most used and researched ones are: strengthening the respiratory muscles (Threshold), increased lung and chest expansion (incentive spirometry, deep breaths associated with movements of the upper limbs, manual therapy techniques), in addition to physical activity in general.

The physical activity can be used as a resource to prevent and/or delay the alterations and complications resulting from aging, once a sedentary lifestyle, very common in senescence, is considered an important risk factor for disease. One study described the respiratory parameters of elderly women dance practitioners when compared to sedentary ones and the influence of the regular practice of dancing on anxiety. It was observed that the dance practitioners showed adequate values of respiratory pressures and greater value in cirtometry in baseline level, leading to better airflow dynamics and indicating positive clinical effect in respiratory quality and emotional well-being of these elderly women[25].

Another similar study showed that elderly women who practiced hiking twice a week showed a significant increase in MIP and MEP when compared to sedentary ones, concluding that regular physical activity can also reverse or lessen the normal deterioration of respiratory function[6]. Researchers[26] evaluated 77 individuals over the age of 64, classified as active and inactive, concluding that the assets had MIP and MEP, respectively, 14 and 25% higher than the inactive ones.

Researchers analyzed the difference in respiratory muscle strength among sedentary elderly people and

active ones, being observed higher MIP and MEP in active elderly people[4], concluding that physically active elderly people have MIP and MEP higher than those sedentary ones.

In addition, the activities conducted by the elderly individual, routinely, can positively influence the MIP and MEP. Thus, including more complex activities in daily routine life is so important as maintaining regular physical activity[5]. Although many studies have proven that the general physical activity promotes an increase in respiratory muscle strength, it is possible to note that this association with specific exercises for respiratory muscles is more effective, once the strengthening of this musculature can be considered an additional physical therapy resource, aiding the prevention of pathologies[27].

In relation to the respiratory physiotherapy, one of the equipment used is the Threshold-IMT (Respironics USA - 2004), commercially available in the form of a transparent plastic cylinder and applied to strengthening inspiratory muscles. It consists of a linear load pressure which produces resistance to inspiration by a spring system with one-way valve, requiring also the use of a nose clip. During exhalation, the one-way valve opens and there is no resistance during the expiratory act; the inspiration, the valve closes, creating resistance and strengthening the inspiratory muscles[28].

The measurements of MIP and MEP and peak expiratory flow (PEF) of 30 healthy elderly people were analyzed before and after using the Threshold machine. It was concluded that the device is effective, being noticed an increase in MIP and more relevant increase in MEP and PFE[29]. Another study evaluated the effect of inspiratory muscle strengthening on MIP and the functional autonomy of institutionalized elderly people. The strengthening was carried out with the Threshold IMT-apparatus with installed gradually workload (50% -100%) sessions lasting 20 minutes with seven strengthening series (two minutes each) and break of one minute between the series three times per week, in a total of ten weeks. The authors defined that the isolated strengthening inspiratory muscles caused an increase in MIP and functional autonomy of the subjects[30].

In contrast, a clinical randomized study[31] evaluated the respiratory muscle strength in elderly people who were submitted to two types of training: Group 1 trained respiratory muscle strength with Threshold and Group 2 trained strength of the accessory muscles of respiration with elastic band of intermediate resistance and concluded that they were ineffective. Strength training of the upper limbs and breathing muscles of accessories is also a recommended method for maintenance and/or improvement of respiratory pressures, however, little explored in the literature.

The manual therapy techniques (massages, pompage and muscle energy techniques) are widely used in clinical practice of physical therapists, which contributes particularly to improve the elasticity of the joint capsule and the surrounding muscles. A study[32] verified the use of intervention by manual techniques of mobilization, directed the respiratory system and applied preventively, could modify the mobility of the rib cage, the respiratory muscle strength and hence the functional capacity of healthy elderly people. Significant differences for the maximum pressure and chest mobility variables were found, having influence only on functional capacity, however, with no statistical difference between the control group and the study group.

Studies[28,29] concluded that the increase in muscle strength has an association with an increase in respiratory muscle fatigue threshold, reflecting the decreased dyspnea and improved ventilatory efficiency, contributing to the better performance of activities of everyday living.

The incentive spirometry consists of using equipment designed to stimulate patients to perform deep and slow breaths through visual stimuli, followed by sustained respiration, aiming at lung and chest expansion. The incentive spirometers are portable and easy to handle and can be categorized into: oriented by volume (Voldyne) or flow (Respiron/Triflo) [33].

The maximum inspiratory support technique by using the spirometer determines an increase in transpulmonary pressure, which, associated to the inspiratory pause, promotes alveolar recruitment and inflation, helping to stabilize the alveoli, which improves compliance and lung ventilation[34].

A study[35] evaluated the respiratory muscle strength and the peak of expiratory flow before and after the application of the six-week treatment program, consisting of three weekly sessions of 15 minutes each. The 16 elderly participants were divided into four groups: training inspiratory incentive (Respiron); expansive training manual techniques (diaphragmatic breathing and compression/decompression); training techniques associated with both; and a control group. It was concluded that all the groups who received the intervention presented an increase in respiratory variables. There are few studies in this area, especially

because the Respiron is indicated for volume gain and not for increasing respiratory muscle strength.

The incentive spirometry requires work on the respiratory muscles, generating greater motor unit recruitment and thus muscle strengthening[36]. So, even not having the improvement of respiratory muscle strength as specific therapeutic aim, the incentive spirometry can influence on ventilatory muscle performance and it can be used as an aid in the treatment of subjects with respiratory muscle weakness.

Another study[37] compared the effects of incentive spirometry flow (RESPIRON®) and volume (Voldyne®) on lung volumes, thoracoabdominal mobility and inspiratory muscle activity in the elderly people and in healthy adults, evaluated by plethysmography and electromyography, concluding that both the spirometers have similar effects in lung volumes and thoracoabdominal mobility, however, the spirometer flow requires greater respiratory muscle activity. A current study[38] with 48 healthy elderly subjects randomized into group therapy with RESPIRON® and the other therapy group with Voldyne® presented an increase in some variables, such as: respiratory muscle strength, lung function (spirometry values) and thoracoabdominal mobility in both groups by approving these devices as good allies of respiratory therapy.

Authors found that during the use of spirometry oriented by volume, it occurs greater mobility of the abdominal compartment, lower recruitment of accessory muscles of respiration and greater tidal volume, when compared to the use of flow spirometers. The volume spirometer seems to be superior to flow spirometers, once they promote more effective breathing pattern, i.e., predominantly abdominal, with inspiratory time greater than that obtained with the flow spirometers, associated with a lower burden of the muscles of the rib cage, which indicates a greater comfort and safety to patients[39].

Other exercises widely used for respiratory therapy do not require devices; they consist of trunk and upper limbs movements associated with breathing inhalations and exhalations and aim at lung and chest expansion. One study evaluated the effects of a respiratory exercise program in chest expansion in healthy elderly people by checking the effects of the means of production (water or no water) on it. The program consisted of trunk and upper limbs exercises associated to inhalation and exhalation, performed three times a week for an hour each session, for ten successive weeks. The researchers concluded that the proposed respiratory exercise program presented better results when developed in aquatic environment, however, they could not affirm that it significantly improve chest expansion independent of the means of production[27].

DISCUSSION

Aging is a heterogeneous and universal process, which is influenced by biopsychosocial, constitutional, racial, hereditary, food and environmental aspects - including lifestyle and physical activity – as well as the life story of each subject[3]. The inter-subject differences occur and they are influenced by several factors, but independently from them, with time, biological and functional modifications occur to a lesser or greater extent in the body of all individuals, characteristics of the aging process. The larynx, the respiratory system and the orofacial organs also pass through changes during this fase[1-11].

Currently, health professionals are improving and investing in therapeutic methods aimed at health promotion, prevention and/or maintenance of the characteristics acquired by the elderly people in the aging process. Research suggests the need for interdisciplinary work with this population[2]. It is supposed that the vocal phonotherapy work and respiratory physiotherapy might optimize the treatment and provide more benefits to patients, especially if they can occur in an associated way[2].

The literature that was consulted during the period from 2004 to 2014 showed only 11 research on vocal phonotherapy in healthy elderly people: one through vocal orientation[9]; three with specific vocal exercises, such as, TMF support of vowels and musical scales with vowels and words[18], sounded blowing[5] and the Finnish method of resonance tubes[22]; two carried out a review of medical records of elderly who underwent voice therapy for presbyphonia, regardless of the kind of intervention [23,24]; five of them applied therapeutic programs: the Lee Silverman[20] method, the Vocal Cognitive Program[21], the program of vocal function exercises of Stemple[16,17], and the comparison between the vocal function method and the PhoRTE[19].

The results of speech therapy with elderly people showed an improvement in voice quality in relation to the aspects of roughness[17,22], breathiness[20,22], asthenia [20,22], instability[22], tension[22], loudness[20,21] and the general level of the vocal disorder[15,18,20,21,22,24]; a decrease in effort phonation[18], an improvement in resonance[18] and articulation clarity[21]. There was also verified an improvement of acoustic measures, reducing jitter[17,20,21]

e shimmer[17,20], an improvement in harmonic-noise ratio[17,20,21] and f0[20,21]. In the medical examination of laryngeal image, there was verified an improvement in coaptation[21] and greater movement of mucosal wave[21].

There was also noticed an improvement in respiratory patterns[18], aerodynamic forces[16], the vital capacity[22], pneumo-phono-articulatory coordination[21] and maximum phonation times[17,21].

In relation to the self-evaluation, it was noticed a significant improvement in V-RQOL, scores [19,23], in the Dysphonia Risk Screening Protocol [21], a decrease in Vocal Handicap Index scores, self-reported positive effect of the therapeutic program on voice[17,19], significant reduction in perception of the phonation effort[19], a decrease in inadequate habits and vocal symptoms[9].

In physical therapy, it is observed that the literature of the period from 2004 to 2014 showed only 11 research on respiratory therapy in healthy elderly subjects: three using the Threshold machine, two with incentive spirometry, with a manual therapy, with the use of breathing exercises associated with the trunk and upper limb movement in soil and aquatic environment and four involving physical activity.

The results of physical therapy intervention with elderly people showed, in general, the increase in MIP and MEP, increase in PEF and functional autonomy of the elderly subjects, in addition to an increase in respiratory muscle fatigue threshold, which reverberated in reducing dyspnea and improved ventilatory efficiency, which contributes to a better performance of activities of daily living. However, besides scarce, some studies are controversial, which requires further research in this area. It is also noteworthy that several studies highlight the positive influence of physical activity on the respiratory function of the elderly people.

It is observed that the studies in speech therapy area present as a focus the issues related to breathing, considering that it is essential for the maintenance of pneumo-phono-articulatory coordination, loudness, sound pressure, respiratory aerodynamic forces, vital capacity, maximum phonation time and stability of vocal quality, among other features. However, there are no studies that investigate the speech therapy and respiratory physiotherapy in healthy elderly people in an integrated way.

Nevertheless, research states that when the rehabilitation of vocal production is associated with respiratory rehabilitation, there may be a reduction in the therapy time[2]. Thus, it is suggested to conduct clinical, controlled, randomized and interdisciplinary studies, aiming at the integration of respiratory physiotherapy and vocal speech therapy work on improvement of vocal and respiratory characteristics as well as on quality of life of healthy elderly subjects.

CONCLUSION

The literature on vocal phonotherapy with healthy elderly people showed that interventions have been made through voice guidance; traditional vocal therapy for presbyphonia, regardless of the type of intervention; specific vocal exercises; and standardized treatment programs, being possible to notice the improvement in auditory-perceptive and acoustic vocal measures, as well as in vocal self-assessment and laryngeal image.

By means of respiratory physiotherapy, literature showed that the techniques or procedures used with healthy elderly subjects were: the use of Threshold machine, manual therapy techniques, incentive spirometry, respiratory exercises associated with the movement of the trunk and lower extremities and physical activity in general, with evidence of improvement in respiratory muscle strength, lung function and functional autonomy of the elderly people.

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