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Systematic review

Respiratory training improved ventilatory function and respiratory muscle strength in patients with multiple sclerosis and lateral amyotrophic sclerosis: systematic review and meta-analysis☆

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Abstract

Background Among neurodegenerative diseases, multiple sclerosis (MS) and amyotrophic lateral sclerosis (ALS) have a high rate of respiratory disability.
Objectives To analyze the effects of respiratory muscle training (RMT) on ventilatory function, muscle strength and functional capacity in patients with MS or ALS.
Data sources A systematic review and meta-analysis of randomized controlled trials (RCTs) was performed. The sources were MEDLINE, PEDro, Cochrane CENTRAL, EMBASE, and LILACS, from inception to January 2015.
Study selection/eligibility criteria The following were included: RCTs of patients with neurodegenerative diseases (MS or lateral ALS) who used the intervention as RMT (inspiratory/expiratory), comparison with controls who had not received RMT full time or were receiving training without load, and evaluations of ventilatory function (forced vital capacity – FVC, forced expiratory volume in one second – FEV_1, maximum voluntary ventilation – MVV), respiratory muscle strength (maximal expiratory pressure/maximum inspiratory pressure – MEP/MIP) and functional capacity (6-minute walk test – 6MWT).
Results The review included nine papers, and a total of 194 patients. It was observed that RMT significantly increased at MIP (23.50 cmH_2O; 95% CI: 7.82 to 39.19), MEP (12.03 cmH_2O; 95% CI: 5.50 to 18.57) and FEV_1 (0.27 L; 95% CI: 0.12 to 0.42) compared to the control group, but did not differ in FVC (0.48 L; 95% CI: −0.15 to 1.10) and distance in 6MWT (17.95 m; 95% CI: −4.54 to 40.44).
Conclusion RMT can be an adjunctive therapy in the rehabilitation of neurodegenerative diseases improving ventilatory function and respiratory strength.

Keywords: Multiple sclerosis; Amyotrophic lateral sclerosis; Breathing exercises; Systematic review; Meta-analysis

Introduction

Among neurodegenerative diseases, multiple sclerosis (MS) and amyotrophic lateral sclerosis (ALS) have a high incidence and high rate of disability [1]. Although they have different causes, these diseases affect the skeletal muscles, including the respiratory ones [1]. MS is a demyelinating,

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chronic, neurological disease with progressive degeneration in the nervous system. It is the second leading cause of disability in young adults [2,3]. ALS is also characterized by the degeneration of motor neurons, causing atrophy and loss of muscle mass with progressive difficulty in movements, including ventilatory ones [4,5].

The weakness of respiratory muscles, predominantly expiratory, is a characteristic of individuals with advanced neurodegenerative diseases and may result in pulmonary dysfunction, such as difficulty in clearing secretions, to repeated episodes of pneumonia, which is the main cause of death in this population [6,7]. Furthermore, the ventilatory function is diminished, leading to a restrictive feature [1], and possibly, these aspects also relate to lower functional capacity in this group of patients. Thus, training of respiratory muscles gives these patients a better quality of life [8–11].

In this way, physiotherapy appears to have an important role in multidisciplinary care of these patients. A well-structured exercise-training program may improve autonomic control, blood pressure, cardiorespiratory capacity and musculoskeletal function in patients with neurodegenerative diseases [3,12]. Additionally, physiotherapy also uses breathing exercise techniques to maintain adequate ventilatory function in people with impaired lung function, and to prevent pulmonary complications. Interventions with breathing exercises have already been reported as a possible benefit in neurological and cardiopulmonary diseases [13,14].

Studies linking respiratory muscle training (RMT) (inspiratory/expiratory muscle training – IMT/EMT) and neurodegenerative diseases are still scarce in the literature and have not confirmed the existing results, but offer hypotheses that RMT may be effective in increasing ventilatory muscle strength, decreasing pulmonary complications and hospitalizations in these patients [5,6,8]. Reyes *et al.* performed a systematic review of RMT in patients with MS and Parkinson's disease and concluded that there is evidence that training can improve respiratory muscle in patients with these disorders, but did not analyze the functional capacity of these patients [1]. Eidenberger *et al.* [15] and Martín-Valero *et al.* [16] reviewed RMT in ALS and MS, respectively, showing increased respiratory muscle strength in these populations, but they were not included under randomized controlled trials (RCTs).

Therefore, this systematic review aims to analyze the effects of RMT compared to controls, on ventilatory function, respiratory muscle strength and functional capacity in patients with neurodegenerative diseases such as MS and ALS.

Method

Design and search strategy

This systematic review was reported according to PRISMA Statement and the Cochrane Collaboration [17].

The search for papers was conducted in the following electronic databases: MEDLINE (PubMed), Cochrane Central Register of Controlled Trials (Cochrane CENTRAL), Physiotherapy Evidence Database (PEDro), EMBASE, LILACS and SciELO, from beginning of the bases until January 2015. The MeSH terms ("Multiple Sclerosis"; "Amyotrophic Lateral Sclerosis"; "Breathing Exercises") and their synonyms were used, as well as a list of sensitive terms to search for RCTs. The search strategy used in PubMed may be observed in Appendix.

Eligibility criteria, intervention and participants

RCTs that evaluated RMT (EMT or IMT or a combination of both types) in patients with neurodegenerative diseases (MS and ALS) compared to control group, who did not receive RMT full time or were receiving training without load were included in the study. Exclusion criteria were those RCTs in which there was addition of another intervention to RMT and data of variables were not informed.

Outcome measures

Ventilatory function (forced vital capacity – FVC, forced expiratory volume in one second – FEV_1, maximum voluntary ventilation – MVV); respiratory muscle strength (maximal expiratory pressure – MEP and maximum inspiratory pressure–MIP); and functional capacity (6-minute walk test – 6MWT).

Study selection and data extraction

Two independent reviewers assessed the titles and abstracts of all articles identified by the search strategy. Abstracts that did not provide sufficient information were selected for evaluation of full texts. Then, the same reviewers independently assessed the full text to perform the selection according to pre-specified eligibility criteria. Data extraction was done using a standardized form by two reviewers independently. Extracted outcomes were related to lung function and functional capacity.

Assessment of risk of bias

The assessment of methodological quality was analyzed descriptively, according to the method proposed by the Cochrane Collaboration [17], considering the following characteristics of the studies including generation of the random sequence, concealed allocation, blinding of investigators (professional who administered the training), blinding of outcome assessors, intention to treat analysis, and description of losses and exclusions. Intention to treat analysis was considered as all randomized patients were analyzed at the end of the study.