

Progressive resistance training in chronic musculoskeletal disorders

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ABSTRACT

Introduction: Progressive resistance training has been suggested as a therapeutic modality that attempts to promote the standardization of the prescription of physical exercises in physical therapy, besides optimizing the results of the treatment. **Objective:** To review studies that used progressive resistance training in chronic musculoskeletal diseases and to demonstrate the importance of including this type of training in the rehabilitation of those diseases. **Source of the data:** Pubmed, Medline, and Lilacs databases were reviewed without restrictions of date and/or language. **Review:** Due to the countless benefits attributed to this treatment modality, the importance of exercises in physical therapy has been well documented. Despite the proven efficacy, high-intensity exercises are not routinely prescribed, and this prescription is usually not standardized, which does not allow a consensus on the type of strengthening used, as well as load calculation and progression. Progressive resistance training implies the gradual increase in load during the training period. The number of repetitions that each individual can complete depends on the calculation of the maximal repetition. **Conclusion:** Based on the findings of this review, the use of progressive resistance training to complement traditional exercises used in rehabilitation of chronic musculoskeletal diseases is recommended in order to standardize treatment protocols, with adequate control of individual load, and to optimize training results. However, it should be emphasized that further studies are necessary for more reliable conclusions.

Keywords: physical therapy, exercises, musculoskeletal diseases.

INTRODUCTION

The importance of exercises in physical therapy, especially in patients with chronic diseases, is based on reliable evidence of the countless benefits of this therapeutic modality, mainly promoting quality of life and improving functional capacity. Exercises have become even more important, since many doubts on the use and efficacy of physical means, both due to the insufficient number of studies and their poor methodological quality, remain.¹⁻⁵

Despite their proven efficacy, the ideal regimen is still debatable. Several studies describing the importance of different types of exercises in chronic diseases can be found. Conventional and high-impact, such as aerobic and resistance exercises are among those mentioned more often.^{1,6,7}

Regarding high-intensity exercises, especially in patients with rheumatologic diseases, the opinions of patients and experts are divergent. A recent study evaluated the opinion of patients, rheumatologists, and physical therapists regarding the expectations of this group on the use of conventional

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therapeutic exercises *versus* high-intensity exercises in patients with rheumatoid arthritis. All three groups were more favorable to the use of conventional exercises, especially, and at a higher degree, the group of physical therapists.⁸

This demonstrates the difficulty of professionals in prescribing and using high-intensity exercises in patients with chronic diseases. On the other hand, some studies have demonstrated the benefits and importance of resistance training in the treatment of patients with chronic diseases, showing good results especially regarding pain, function, and quality of life.^{9,10}

MATERIAL AND METHODS

The search included Pubmed, Medline, and Lilacs databases, with no restrictions of dates and languages, using the following keywords: physical therapy, exercises, resistance exercise, progressive resistance exercise, resistance training, progressive resistance training, and musculoskeletal diseases. One hundred and eighty-six studies were found, but only 31 were included in this study. To be included, studies should have some type of exercise with external resistance, either manual, with the use of machines, ankle weights, or weights, among others.

Resistance Training

Resistance training is defined as an activity that develops and maintains strength, resistance, and muscle mass, and it has been practiced by a wide variety of individuals with and without chronic diseases, since it is associated with favorable changes in cardiovascular function, metabolism, coronary artery disease risk factors, and psycho-social well-being. Besides, those exercises stimulate muscle hypertrophy and coordination, showing functional improvement of activities of daily living.¹¹⁻¹³

The inclusion of this type of exercise in musculoskeletal rehabilitation had a great impulse and scientific recognition from the II World War on, when the importance of resistance training in improving the muscular strength of military personnel was demonstrated.¹²

Currently, studies have been emphasizing the potential benefits of resistance training in physical therapy, especially in the treatment of different rheumatologic disorders, since strength deficit is a common finding in most of those diseases, contributing for the incapacity to perform common activities.^{9,14}

Suetta *et al.* (2004) demonstrated that, contrary to conventional physical therapy, resistance training increases

muscle mass, maximal muscular strength, and neuronal stimuli in elderly individual with limb disuse after hip arthroplasty.¹⁵

Andersen *et al.* (2006) investigated muscular activation in conventional therapeutic exercises *versus* resistance exercises and concluded that neuromuscular activation in conventional exercises is below the 40-60% necessary to stimulate gain in muscle strength.¹⁶

Taylor *et al.* (2005) investigated systematic reviews on the use of resistance training in different specialties, with emphasis on cardiopulmonary, neuromuscular, gerontological, and musculoskeletal disorders. Regarding the last ones, the following studies were found.¹⁴

1. Two reviews of chronic back pain, with 18 studies, demonstrating an improvement of trunk extensor and flexor strength with reduction in pain and improved function;
2. One review of cervical neck pain, with four studies, demonstrating improvement in strength, amplitude of movements, function, and pain;
3. One review of hip and knee osteoarthritis, with two studies, demonstrating a reduction in pain;
4. One review of femur and ankle fracture, with three studies, demonstrating improvement in strength and function.

In reviews of lumbalgia and cervicgia, patients were instructed to perform one to four exercises using different resistances, which included machines, body weight, and exercises without any load. Participants completed one to three series of eight to 12 repetitions based on eight to 12 maximal repetitions (MR) two to three times a week for 12 weeks. According to the authors, the studies were difficult to evaluate because some of the parameters did not follow principles of progressive resistance training.¹⁴

Analyzing the studies on hip and knee osteoarthritis, the authors considered that they followed principles of progressive resistance training, applying two series of 12 repetitions, based on 12 MR, three times a week for 18 months, and progressive resistance after three consecutive days of training if the participant was able to finish the training easily. It was not clear, in those studies, how resistance was calculated and evaluated.¹⁴

On the review of fractures, only three studies, with a small number of participants, could be evaluated. They performed two to three series of eight to 12 repetitions with an intensity of 50 to 90% of MR, two to three times a week for 12 weeks. The authors did not describe if and how load progression was achieved.¹⁴

A systematic review of the Cochrane database evaluated the effects of progressive resistance exercises on physical

disability and function in the elderly. The review considered the methodological quality of the studies poor, but reported that training promoted a positive effect in some functional limitations. Neither the side effects of this intervention, nor the presence of periodic progression of the load, and how it was done, were reported.¹⁷

Although most of the studies reported positive results for some parameters, the heterogeneous methodologies do not allow a consensus on the interventions used, load calculation, if it was progressive, and how this progression was done.¹⁸⁻²⁴

Progressive Resistance Training

In view of what has been exposed, standardization and individualization of protocols are important to optimize treatment results and to allow the reproduction of those protocols in future studies.

The expression progressive resistance training it is not used often and studies mention the word strength more frequently, but it is very criticized because it is vague and it does not define the type of strengthening being done.^{14,17}

Discussions, and the consensus among the studies, hover around the need of progression of resistance training to achieve the desired results, especially regarding neuromuscular activation, increased strength, and muscular hypertrophy.^{14,17,25,26}

Progressive resistance training means a gradual increase in load during the training period and should always been monitored by a trained professional,^{6,17,25} The number of repetitions that each individual can tolerate depends on the external resistance, *i.e.*, the load imposed during the exercise, which is called MR in the studies published: for example, 1MR indicates the maximal load tolerated with one repetition.^{7,22}

The American College of Sports Medicine recommends that beginners or those with intermediate training use 60 to 70% of 1MR for two or three series of 8-12 repetitions, and that MR should be recalculated periodically. Any level above those mentioned can be considered a high load.^{22,25}

The resting period recommended for beginners or intermediate individuals is 1-2 minutes, respectively. Initially, non-trained individuals or beginners should perform the exercises at a slow or intermediate speed 2-3 times a week.^{22,25}

It is also recommended that eccentric and concentric exercises should be included in the training program, and both mono- and polyarticular exercises have been proven to be effective in increasing muscular strength.^{22,25}

Jan *et al.* (2008) investigated and compared the clinical effects of physical exercises with high (60% of 1MR) and low (10% of 1MR) resistance in patients with knee osteoarthritis.

The load was reevaluated every two weeks. The authors did not observe statistically different results regarding improvement in strength and in function.³

Beneka *et al.* (2005) investigated the gain in muscular strength in the elderly with exercises with high (90%), medium (70%), and low (50%) resistance. The load was evaluated every two weeks. The authors concluded that the group who performed high-resistance exercises had greater increase in strength.²¹

Alexanderson *et al.* (2007) evaluated the benefits and safety of high-intensity muscular training in patients with chronic myopathies. Patients trained three days a week for seven weeks with upper and lower limb exercises. They started the exercises with 50% of 10 MR and this load was increased progressively every two weeks. At the end of the training program, the authors observed gains in function without changes in the levels of muscular inflammation.²⁷

Rall *et al.* (1996) investigated the benefits of progressive resistance training in patients with non-active rheumatoid arthritis. Patients were instructed to perform the exercises for upper and lower limbs on exercise machines with three series of eight repetitions twice a week for 12 weeks, with a load of 80% of 1MR. Maximal repetitions were evaluated every two weeks. The authors concluded that this type of training is viable and safe for patients whose disease is under control, and they observed improvements in strength, pain, and fatigue, without exacerbating disease activity.²⁸

Studies following the principles of progressive resistance training regarding the calculation of the initial load and its progression in patients with ankylosing spondylitis and other rheumatic diseases, other than those mentioned here, were found.

In Brazil, very few studies on progressive resistance training in musculoskeletal rehabilitation were found. Among them, we can mention the study of Lombardi Júnior *et al.* (2008) who used progressive resistance training in a randomized controlled study, and evaluated pain, function, muscular strength, and quality of life of patients with impact syndrome. Patients performed two series of eight repetitions, the first series with 50% of 6MR and the 2nd series with 70% of 6MR, twice a week for eight weeks. Maximal resistance was reevaluated every two weeks. At the end of the study, pain, function, and quality of life of patients improved when compared to the control group.²⁹

Safety in progressive resistance training

Regarding the safety of this type of training, the studies found did not report any intercurrent that could

compromise the use of this type of training by sick people, but individuals with severe comorbidities were not included in the studies and, therefore, we cannot extrapolate those results for the general population. The main contraindications of progressive resistance training are the same for any other physical activity. Among them, we should mention: unstable coronary insufficiency, unstable heart failure, uncontrolled arrhythmia, recent acute myocardial infarction, blood pressure above 180x100 mmHg, severe hypertrophic cardiomyopathy, severe chronic obstructive pulmonary disease, acute thrombophlebitis, severe metabolic changes, acute infections, acute arthritis, and complicated pregnancy.^{10,13,14,26,30,31}

FINAL CONSIDERATIONS

Based on those findings, we should recognize the importance of progressive resistance training and recommend its use as complementary to traditional therapeutic physical exercises used in musculoskeletal rehabilitation to standardize and individualize the protocols used, controlling and adjusting the load, and try to induce enough levels of neuromuscular activation to stimulate hypertrophy and gain in muscular strength.

Despite the controversies among the studies on what is considered low, medium, and high loads, we believe that we can consider loads up to 30% of MR low, from 30 to 60% medium, and above 60% high. However, further studies should be stimulated to obtain stronger conclusions.

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