Effects of Resistive Respiratory Muscle Training on Respiratory Function, Exercise Duration and Fatigue in Individuals with Multiple Sclerosis

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ABSTRACT

The goal of the study is to determine the effects of a 6-week resistive respiratory muscle training (RRMT) program on respiratory muscle strength, exercise duration and fatigue on Multiple Sclerosis (MS) patients. Eighteen individuals with mild-to-moderate MS were randomly assigned to RRMT (n=10) or placebo control (n=8) groups. Exclusion criteria were a relapse within past 4 weeks, smoker, wheelchair-bound, breathing/respiratory illness within past 6 weeks or contraindications for exercise. Both groups participated in breathing exercises for 6 weeks, 3x/wk, 30 min./session: RRMT with resistance breathing; control with no-load breathing. All participants were tested at baseline and after 6 weeks. The variables measured were maximal inspiratory and expiratory pressures, exercise duration during a submaximal endurance (60% of max) test, and perceived fatigue (Modified Fatigue Impact Scale (MFIS)). Results were analyzed using paired t-tests. The RRMT group significantly improved exercise duration (p=.032), maximal expiratory (p=.013) and inspiratory (p=.007) pressures, and fatigue levels (p=.009) after the short-term RRMT program, while the placebo control group had significant change in maximal inspiratory pressure (p=.034) only. This study will lead to a better understanding of MS fatigue and the potential for improving respiratory muscle strength and exercise endurance with a short-term respiratory rehabilitation program.

INTRODUCTION

Multiple Sclerosis (MS) is an inflammatory, demyelinating disease of the central nervous system. The symptoms of MS depend on the area affected by demyelination, which can occur in any part of the brain, optic nerve and spinal cord. The most common symptom of MS is fatigue which can interfere with an individual's function and can affect the respiratory muscles. Respiratory fatigue can lead to stealing of blood from other working muscles causing these muscles to further fatigue, which in turn contributes to exercise intolerance. Exercise training, when performed correctly, has been show to be safe and effective in reducing fatigue for patients with MS.

PURPOSE

The purpose of this study is to determine the effects of a 6-week resistive respiratory muscle training (RRMT) program of the inspiratory and expiratory muscles on respiratory muscle strength, exercise duration and fatigue on Multiple Sclerosis patients. The information represented in this poster is part of an ongoing study.

METHODS

Eighteen individuals with mild-to-moderate MS were randomly assigned to RRMT (n=10) or placebo control (n=8) groups. Inclusion criteria are a diagnosis of MS by a neurologist, an EDSS score of ≤ 6.0 (can walk with intermittent or constant unilateral support for 100 meters), ability to pedal an ergometer, and no contraindications for exercise. Exclusion criteria are current or past neurological conditions other than MS, a relapse within the past four weeks, lung pathology, breathlessness or recent respiratory infections, corticosteroid use in the past 6 weeks, smoking, wheelchair use, or contraindications for exercise.

Testing:

Subjects were tested on two separate days, 1 week apart, before and after the training program.

Day 1:

- Pulmonary Function Tests (PFT), including maximal expiratory (PEmax) and inspiratory pressures (PImax)
- Maximal graded cycling exercise test (GXT) (see Fig. 1)
- Assessment of perceived fatigue (MFIS). The MFIS form measures physical, cognitive, and psychosocial and a total fatigue score.

Day 2:

- Cycling endurance test at 60% of the maximal workload obtained during the GXT.

Training:

A 6-week RRMT or placebo control program was performed 3 days/week (1 day at UB, 2 days at home), 30 min/session. The subjects breath into a mouthpiece connected to an RRMT device (see Fig. 5 and 6). The mouthpiece has spring-loaded inlet and outlet valves set to specific resistances based on the subject's maximal values. Training pressures begin at 30%, and increase by 10% each week (up to 80%) based on the subject's baseline maximal PImax and PEmax values. The placebo control subjects perform no load breathing with the device for the 6 weeks.

Table 1. Physical Characteristics of Subjects

	RRMT	Control
n	10	8
Gender (M/F)	1/9	4/4
Age (yrs)	49.6 ±15	53.3 ±12
Height (cm)	163.5 ±7	170.4 ±9
Weight (kg)	78.1 ±22	80.6 ±17
EDSS score	3.3 ±2	2.7 ±2
Yrs since Diagnosis	11.3 ±7	13.1 ±11

Figure 1. Subject performing a GXT on a cycle ergometer using the metabolic cart.

RESULTS

Training and control groups were initially compared using independent t-tests. There were no significant differences between the two groups for all variables. The effects of the RRMT were analyzed using paired t-tests.

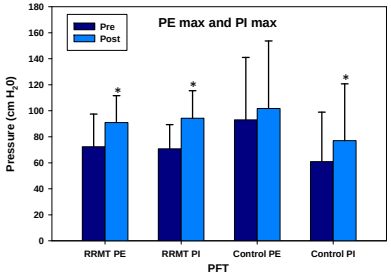

Figure 2. Maximal expiratory (PE) and inspiratory (PI) pressures. For RRMT, there was a significant increase for PE and PI (p_{PE}=.013, p_{PI}=.005). For Control, there was a significant increase only for PI (p_{PE}=.200, p_{PI}=.034).

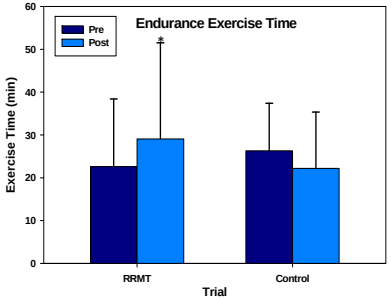

Figure 3. Exercise duration for the submaximal (60% of max) endurance test. For RRMT, there was a significant increase (p=.048) and for control there was no significant difference (p=.086).

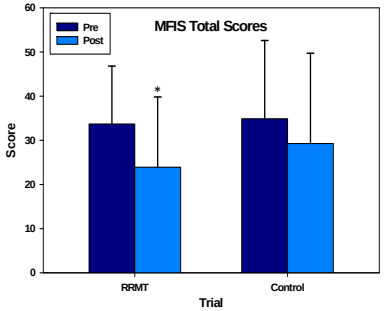

Figure 4. Modified Fatigue Impact Scale (MFIS) total scores. For RRMT, there was a significant decrease (p=.013) and for control there was no significant difference (p=.051).

Figure 5. Subject completing the RRMT program using the RRMT device.

Figure 6. RRMT device.

DISCUSSION

It has previously been shown that correctly performed exercise can reduce fatigue for patients with MS. This study assesses the effects of respiratory muscle exercise on an individual's fatigue levels and overall quality of life. As expected, the group participating in the respiratory training program had significant improvements in respiratory muscle strength, exercise performance, and fatigue levels. Surprisingly, the control group had significant improvement in inspiratory muscle strength and some aspects of fatigue, specifically cognitive and psychosocial fatigue. Since the individuals in the control group participated in similar breathing exercises as the RRMT group except with no resistance, it is possible that simply performing a controlled no load breathing can improve the quality of some aspects of life for MS patients.

CONCLUSIONS

The preliminary results of this experiment show that a short-term (6 weeks) respiratory resistive training program can be effective in improving respiratory muscle strength of both the inspiratory and expiratory muscles, increasing aerobic exercise endurance, and reducing perceived fatigue during activity.

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