**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/week, 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=0.032), maximal expiratory (p=0.013) and inspiratory (p=0.007) pressures, and fatigue levels (p=0.009) after the short-term RRMT program, while the placebo control group had significant change in maximal inspiratory pressure (p=0.034) 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 shown 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.

**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. 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 (PImax) pressures.
- 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.

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

**Figure 2.** Maximal expiratory (PE) and inspiratory (PI) pressures.

**Figure 3.** Exercise duration for the submaximal (60% of max) endurance test. For RRMT, there was a significant increase (p=0.048) and for control there was no significant difference (p=0.86).

**Figure 4.** Modified Fatigue Impact Scale (MFIS) total scores. For RRMT, there was a significant decrease (p=0.013) and for control there was no significant difference (p=0.51).

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

**Figure 6.** RRMT device.