Research article

Effectiveness of upper limb endurance and resistance exercises on reducing dyspnoea and improving activities of daily living (ADL) in patients with COPD

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ABSTRACT

Introduction and Aim: Chronic Obstructive Pulmonary Disease (COPD) is preventable and treatable disease, presenting permanent airflow limitation accompanying an augmented chronic inflammatory response in the airway and the lungs to harmful elements or gases. Chronic bronchitis and emphysema are the two most common conditions that contribute to COPD, individuals with COPD often experience difficulty with performing upper limb exercise due to dyspnoea and arm fatigue. Consequently, upper limb exercise training is habitually included in lung rehabilitation programmes to advance upper limb exercise tolerance; yet the effects of this exercise on dyspnoea and activities of daily living remain unclear. The aim of this analysis is to determine the effects of upper limb endurance and resistance exercises on reducing dyspnoea and improving activities of daily living (ADL) in patients with COPD.

Methodology: This is an experimental study design and was conducted in a clinical set-up of Physiotherapy Department with a total number of 10 samples selected based on the Inclusion and Exclusion criteria. All the participants underwent endurance and resistance exercises to the upper limb for 20 Minutes session for 3 days per week for 4 weeks. Pre- and post-treatment assessments were done using the outcome measures Modified Borg Scale and London Chest Activity of Daily Living Scale.

Results: The findings of the study revealed improved clinical outcomes in the study group. Calculation of mean and median values and then performing a paired t test of within group between pre-test and post-test values, it shows highly significant difference with a p value of p < 0.001.

Conclusion: This study shows that there is a significant improvement in the COPD patients after the treatment implying that Upper Limb Endurance and Resistance Exercises were beneficial in improving ADL and reducing dyspnoea in COPD patients. Future research suggests recommendation of early COPD treatment in both genders.

Keywords: COPD; upper limb endurance and resistance exercise; dyspnoea; ADL.

INTRODUCTION

Chronic Obstructive Pulmonary Disease is a preventable and treatable disease, presenting permanent airflow limitation that is usually progressive and augmented with chronic inflammatory response in the airway and the lungs to harmful elements or gases(1). Chronic bronchitis and Emphysema are the two most common conditions that contribute to COPD. These two conditions often occur together and make up COPD(2). Chronic bronchitis is a disease characterized by cough productive of sputum on most days for at least three consecutive months of each year for at least two successive years(2). Emphysema leads to airway obstruction by atypical persistent enlargement of the airspaces distal to terminal bronchioles, accompanied by damage of their walls and without fibrosis (1). Chronic obstructive pulmonary disease (COPD) is presently the fourth leading cause of disability, hospital admission and mortality and considered to be ranked third in the overall burden of disease after heart disease and stroke (3). People with chronic obstructive pulmonary disease (COPD) undergo trouble with upper limb activities. This difficulty is primarily due to the changes in the mechanics of breathing, such that the muscles involved for arm activities are also involved breathing. Consequently, while performing daily routine activities, people with COPD experience dyspnoea. It is conceivable that arm exercise training could be a useful intervention to improve arm activities in people with COPD (4). Individuals with COPD often undergo difficulty with upper limb activity at a lower intensity than their healthy counterparts. Consequently, when doing activities using their arm, individuals with COPD can encounter dyspnoea and early cessation of the activity. Most daily living activities involve the use of the arms,
dyspnoea and the early cessation of upper limb activities execute a challenge to people with COPD. It is more common in males than females. Nearly 90% mortality in COPD occur in Low and Middle Income Countries (LMIC’s), where helpful strategies for prevention and control are not usually implemented or available. Chronic obstructive pulmonary disease is rudiment and usually becomes outward after the age 40 to 50. The main symptoms of COPD are dyspnoea, chronic cough with or without sputum production and even daily routine activities become very difficult. The Upper Limb Endurance and Resistance training for people with COPD has been shown to increase the upper limb strength and endurance capacity. They include physiological improvement in the muscle level and in COPD patients, it improves tolerance to the symptoms during arm activity (5).

MATERIALS AND METHODS

Subjects

Men are more prone to COPD and are selected in the study within the age group of 40-50 years old. Subjects undergoing stable respiratory medication with no exacerbations and slight to severe breathlessness cases were included in the study. Subjects with acute exacerbation, any other respiratory, cardiovascular and neurological conditions, previous lung surgery, musculoskeletal abnormalities, patients requiring oxygen supplementation. rib fracture non-cooperative patients were not included in the study.

Outcome measures

Modified Borg scale or rate of perceived exertion is a widely employed and reliable indicator to monitor and channel exercise intensity, allowing individuals to subjectively rate their level of exertion during exercise. The scale has the ability to obtain the perceived exertion from central cardiovascular, respiratory and central nervous system functions (Borg 1982). It is 0-10 scale used in clinical practice to measure perceived exertions and subjects were tested for slight to severe breathlessness for Pre and Post-test measurements.

London chest activity of daily living scale is valid and reliable to assess the functional limitation in patients with COPD due to dyspnoea. The scale has four domains divided into 15 items with each item scored 0-5 and higher scores mean greater functional limitation. Gulart et al., proposed 28% as cut off point for LCADL as sensitive and specific to enable discrimination of functional status of patients with COPD. Subjects with more than 28% of LCADL were taken for the study (5).

Exercise protocol

Upper limb endurance and resistance trainings using arm cycle, chair with back support and weights were used for duration of 4 weeks, 3 sessions/week for 20 minutes treatment protocol followed by 60 seconds of rest between each exercise.

Upper limb endurance training

The upper limb endurance exercise training consists of - supported arm endurance exercise and Unsupported arm endurance exercises. The supported arm endurance exercise includes arm cranking, arm cycle is an equipment which is like a bicycle that pedal with the arms. It results in improvement of muscle mass and strength. It was performed by the patient for 15 minutes (continuous or intermittent). When they were able to perform for 15 minutes without any symptoms, the duration was increased to 20 minutes.

The unsupported arm endurance exercises include arm raise and arm together. These are low weight high repetition exercises. High sitting in a chair with back support. The patients is instructed to hold a dumbbell of 0.5 Kg in each hand at knee level and lift it by doing shoulder flexion and then lower. The patient is instructed to breathe in while lifting the bar up and breathe out while lowering the bar. This exercise is to be performed for 3sets of 10 times repetition with a rest of 1 minute. When the patient can perform 3sets for 2weeks, the weight is increased by 0.5Kg.

Arm together

High sitting in a chair with back support, patient is instructed to hold two weights of 0.5Kg. Starting with arms by the sides, he is asked to lift the arms until they are at the shoulder level. He should breathe in while doing this. Then he is asked to move the arms medially to meet keeping the elbows extended. He should breathe out while doing this. Reverse the movement until the arms are horizontal at shoulder height (breathe in) and return to the sides again (breathe out). This exercise is to be performed for 3sets of 10 times repetition with a rest of 1 minute. When the patient can perform 3sets for 2weeks, the weight is increased by 0.5Kg.

Upper limb resistance training

The upper limb resistance exercises consist of shoulder press, biceps curls and wall press. These exercises were performed for 3sets of 10 times repetition with a rest of 1 minute. When the patient can perform 3sets for 2weeks, the weight is increased by 0.5Kg.
Devadarshini et al: Effectiveness of upper limb endurance and …… living (ADL) in patients with COPD

Shoulder press

High sitting in a chair with back support, patient is asked to hold a weight in each hand at shoulder height with one arm lifting the weight straight up and down. He is instructed to breathe in while lifting the weight up and breathe out while lowering the weight down.

Biceps curls

Stride standing, patient is instructed to hold a weight and start with the arms by his sides and then to do flexion and extension of the elbow. Repeat the exercise with the other arm. If the patient develops breathlessness during the exercise, this can be done in high sitting in a chair with back support.

Wall press

Stride standing facing a wall, patient is asked to lean towards the wall by placing the hands at shoulder height on it. From this position, he is instructed to bend the elbows moving his body forwards and then slowly push away from the wall and return to the starting position. Ensure to keep the body straight throughout the exercise.

Data collection and statistical analysis

Pre-test and post-test measurements were collected using outcome measures and mean, standard deviation, t value and p value were calculated. Statistical analysis was done using SPSS, paired t test was done for the given data.

Table 1: Modified Borg scale readings

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<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>t value</th>
<th>P value</th>
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<tbody>
<tr>
<td>Pre</td>
<td>3.6</td>
<td>0.966</td>
<td>8.1429</td>
<td>0.0000192</td>
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<tr>
<td>Post</td>
<td>1.7</td>
<td>0.674</td>
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Table 2: LCADL scale readings

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<th>SD</th>
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<td>8.871928</td>
<td>10.339</td>
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<td>Post</td>
<td>29.2</td>
<td>9.425733</td>
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RESULTS

A total of 10 men with COPD in the study had slight to severe breathlessness, 6 men were having severe breathlessness with mean age around 45± 3 and mean time of COPD for not less than 2 years. The mean modified Borg scale of pre and post-test was 3.6 and 1.7 respectively. The mean of LCADL of Pre and Post-test was 39.4 and 29.2 respectively. P value p< 0.0001 for Modified Borg Scale and p value P<0.0002 for LCADL scale was shown.

DISCUSSION

In this study, subjects were assessed thoroughly for physical examination along with the outcome measures and their smoking behaviours were also recorded. 2 subjects did not smoke but were continuously inhaling polluted air while travelling without wearing masks and also by being a passive smoker. Home exercises were prescribed to the subjects after each treatment sessions, smoking cessation education was provided to the smoking subjects and 5 subjects stopped smoking after the treatment. Main limitation of the study was there were no follow up with the subjects and also there were few subjects with narrow age group. Further recommendations include studies with larger subjects and regular follow up and to include subjects with various causes of COPD and not only smokers.

CONCLUSION

From the above results it was concluded that the upper limb endurance and resistance training was found to be helpful in reducing dyspnoea among COPD subjects and was highly significant statistically. Future research requires larger participant numbers to compare the differences between endurance upper limb training, resistance upper limb training, and combining endurance and resistance upper limb training on patient-relevant outcomes such as dyspnoea, HRQoL and arm activity levels.
CONFLICT OF INTEREST

No conflict of interest reported.

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