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Effects of Inspiratory Muscle Training on Dyspnea and Pulmonary Function Test in Asthmatic Patients

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ABSTRACT

Asthma is a heterogeneous disorder with coughing, wheezing, shortness of breath, and chest tightness. **Objective:** To find the effects of inspiratory muscle training on dyspnea and pulmonary function test in asthmatic patients. **Methods:** A quasi-experimental study was conducted on twenty four patients of asthma. Patients were assigned into either Inspiratory Muscle Training group or Conventional asthmatic rehabilitation group, both groups were treated for 6 weeks with 3 sessions per weeks. Borg's scale and Functional pulmonary assessment were used for analyzing the effects of treatment. Data was analyzed by SPSS. 25. **Results**: The mean age of patients in group A and B was as respectively, 30.75 ± 7.26 and 30.25 ± 6.21 years. There was statistically significant difference between two groups with p value <0.05 on Borg scale. Dyspnea was decreased to greater extent in Group B with mean value 2.76 ± 0.58 as compared to Group A with mean 2.11 ± 0.86. Fatigue was decreased to greater extent in Group B with mean value 2.76 ± 0.58 as compared to Group A with mean 2.00 ± 0.80. The mean differences on pulmonary function test in inspiratory muscle group was greater as compared to other group. **Conclusion:** The study concluded that Inspiratory Muscle Training was more effective as compare to Conventional asthmatic rehabilitation in reducing dyspnea and improving pulmonary functional capacity.

INTRODUCTION

Asthma is a heterogeneous disorder characterized with the aid of episodes of hyper responsiveness or airway narrowing, obstruction, infection and production of mucous. Asthma has coughing, wheezing, shortness of breath, and chest tightness [1, 2]. The word asthma comes from the Greek asuma, asumatos that means a "hard breathing, death rattle, or short-drawn breath," and consequently, represented multiple breathing maladies rather than a single ailment [3]. Initially asthma is involved in the bronchial tree with its main aim to spread air all over the course of the lungs up to attaining the alveolar sacs. The bronchi stem from the end of the trachea, which distributes into a right and left bronchi. The size of left bronchus is small and extra horizontal whereas the right bronchus has a larger in diameter and lies extra vertical. Primary bronchi then distribute into secondary then tertiary bronchi. The bronchi comprise of elastic fibers and smooth musculature to keep the integrity of wall, which change primarily based on the relaxation and contraction of smooth musculature by inflammatory mediators, bronchodilators, or else Broncho constrictors [4]. There are much more smooth muscle fiber are involved as progresses further from the bronchi to alveoli [5]. Severity level of asthma can be analyzed by means of the frequency of the symptoms, functioning of lungs, degree of the sensitivity of airways and the infection in airway, it also runs within families, which indicates that if an individual has a positive family history of severe asthma, that individual has much more chances to develop severe asthma later in his life [6]. Excitingly, it is observed that dysfunctionality

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related to skin barrier no longer most effective complements sensitivity to allergens but can also cause general allergic responses, i.e. extended level of IgE and hyper-responsiveness of airway, showing that absorption of allergens through the skin of those patients who have atopic dermatitis, is a precondition for the occurrences of different allergic situations, along with hay fever and asthma [7, 8]. In patients with mild-to-moderate asthma exacerbation frequency can be decreased by maintenance controller treatment plans (ICS) [9, 10]. According to WHO, there were 417,918 deaths due to asthma world wide and 24.8 million DALYS due to Asthma in 2016. It was calculated about that more than 339 million individuals had Asthma worldwide in 2016 [11]. According to Centers for Disease Control and Prevention (CDC), one in every thirteen individuals have asthmatic problem [12]. Asthmatic patients can be treated with both non-medical and medical intervention, the main purpose of the treatment being to avoid recurring asthma attacks, optimum lung function and regular breathing pattern and well tolerated exercise capacity. Increased inspiratory muscle work lead to bronchoconstriction in people with asthma, therefore strengthening the muscle of inspiratory among asthma could improve exercise tolerance level and decrease dyspnea. [13] Inspiratory muscle training (IMT) is physical therapy approach that enhance asthma control. It is easy in application, low price, safe, and considered one of the essential considered adjuncts for asthma treatment [14]. It positively affect respiratory muscle strength, pulmonary function, physical activity, levels of functional capacity and health-related as well as reduce the use of medications, emotional and inflammatory disorders [15, 16]. IMT is a form of resistance training to strengthen inspiratory muscles by means of a resistance during inspiratory phase of breathing. Effects are generated through the inspiratory muscles adapting to overcome the resistance applied through incentive spirometer. The anticipated function is to produce results in patients with asthma in terms of enhancement in diaphragm strength and thickness and a decrease work of breathing and exertional dyspnea [17]. It also gives benefits such as respiratory muscle strength and endurance, pulmonary and physical function and capacity [18]. Previous researches have displayed that IMT encourages diaphragm changes in healthy persons and some specific diseased population [19, 20]. Inspiratory muscle training is a method planned to enhance the strength and power of the diaphragm and additional accessory muscles of respiration [20]. Until now, its consequences in clinical effects in sufferers with asthma are unclear, it is dire need to find the effects of IMT in asthma people and to establish enhancements in pulmonary function, inspiratory muscle power/strength, and a reduce symptoms of asthma. The aim is to find the effects of inspiratory muscle training on dyspnea and pulmonary function test in asthmatic patients.

METHODS

It was a quasi-experimental study which was conducted at private hospital set up. Sample size of 24 was measured by using G. power analysis Software, Version (3.1.9.2) with 0.80 power of study, with 0.05 margin of error and 95% confidence interval [21]. After taking written consent, patients were recruited through convenient sampling technique by defined inclusion and exclusion criteria. Only those patients were recruited who were between the age group of 20-40years and having moderate COPD from last 6 to 12 months. Those patients were excluded who were having any acute asthma attack in last one month, history of weight loss, pneumothorax, unstable cardiovascular symptoms and any other red flag signs [22]. Patients were selected and then divided into two group. Group A was treated with is conventional asthmatic rehabilitation protocol and group B was treated conventional asthmatic rehabilitation along with inspiratory muscle training. In group A, patients were educated regarding medication, deep breathing and precautionary measures to precautionary measures. While the group B was treated by conventional treatment along with inspiratory muscle training for 6 weeks. Patients were advised to sit straight and breathe in slowly through incentive spirometer after 10 inspiration. It was repeated with few seconds of rest. The cycle of 10 inspiration was repeated 3 times. The inspiratory muscle training was performed using an incentive spirometer, three times in a week with – 3 sets of 10 repetitions, 2 sets per session per day. Pre- treatment and post treatment was measured through dyspnea through Borg scale and Functional pulmonary assessment to measure pulmonary functions like FEV1, FVC, FEV1/FVC Ratio, PEFR.

RESULTS

Data analysis was done by using IBM-SPSS 25. Descriptive statistics was done for age and BMI to obtain means and standard deviations. To compare mean changes between groups, independent t-test was used. Significance level was set at p=0.05 for Borg scale and PFTs. Table 1 summarized the comparison of socio-demographic variable like age, and Body Mass Index (BMI) across both groups. In group A, mean age of participants was 30.75±7.26 years and in group B mean was 30.25±6.21 years. Body Mass Index (BMI) in group A was 25.41±4.56 kg/m2 and in group B was 25.25±3.41 kg/m2. Parametric tests were applied to compare the two population at pre-treatment and post-treatment level. In table 2, results show that there was statistically significant difference between two groups

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with p value <0.05 on Borg scale. The results of PFTs were not statistically significant between two groups with p value > 0.05, but there was greater mean difference in inspiratory muscle group as compared to conventional group. FEV1, FVC, FEV1 /FVC, and PEFR in group A 2.29±0.67, 3.17±0.84, 72.50±7.01 % and 6.68±0.37 and Group B are 2.40±0.68, 3.10±0.69, 76.41±7.72 and 7.14±0.46, respectively.

Study Group		Mean	Std. Deviation
Group A	Age of Participants	30.75	7.26
	Body Mass Index of Participants	25.41	4.56
Group B	Age of Participants	30.25	6.21
	Body Mass Index (BMI) of Participants.	25.25	3.41

Table 1: Comparison of Socio-Demographic Variables of two Groups

Variables		Treatment groups		p-value
		Group A (N=12)	Group B (N=12)	
Dyspnea	Pre-treatment (Mean ±SD)	6.76 ± 1.17	7.30 ± 0.97	0.383
	Post-treatment (Mean ± SD)	2.76 ± 0.58	2.11 ± 0.86	0.002
Fatigue	Pre-treatment (Mean ±SD)	6.80 ± 1.32	7.15 ± 1.08	0.264
	Post-treatment (Mean ± SD)	2.76 ± 0.58	2.00 ± 0.80	0.000

Table 2. Between Group Comparison on Borg Scale

DISCUSSION

The study was about the comparison of conventional approach to asthma to inspiratory muscle training. It was given for 6 week through incentive spirometer along with education, medication and general breathing exercises. The results of current study showed that there are significant effects of inspiratory muscle training with statistical significance of <0.05 as compared to conventional group. The objective was to find out the effects of inspiratory muscle training on dyspnea and pulmonary function test in asthmatic patients. In current study results showed that there was significant statistically difference between two groups with p value < 0.05. Dyspnea reduction is significant with p value< 0.05 but more change in IMT group. PFTs improved more in Inspiratory Muscle Training with mean values 2.40±0.68, 3.10±0.69, 76.41±7.72 and 7.14±0.46 as compared to Conventional asthmatic rehabilitation group with mean values2.29±0.67, 3.17±0.84, 72.50±7.01 %.6.68±0.37. This result is similar with a pervious study which shows difference in improvement in physiotherapy group as compared to conventional therapy on the basis of dyspnea and pulmonary function tests [18]. The results of current study are consistent with RCT done over asthmatic patients by Neslihan Duruturk et al. supported our results. Study compared the effects of inspiratory muscle training and control among 2 groups of randomly allocated 20 and 18 patients in each group respectively. There was statistically significant p value 0.01 for LCADL on daily living activity improvement and marked improvement in Functional pulmonary assessment with p value <0.01. So the results are consistent with the PFTs of this study [20]. A recent study was conducted on to determine the role of pulmonary rehabilitation role in asthmatic patients and COPD patients. The conclusion of study was that 5 time sit to stand and dyspnea was a satisfied consequence measure of pulmonary rehabilitation in asthma patient. After pulmonary rehabilitation, the 5 time sit to stand enhanced significantly in both populations (by a median value of −1.7 s) and (by a median value of −1.1 s) in subjects with COPD and asthma, respectively; p = .17 between groups, p < .001 for both and there was reduction in dyspnea from (7 to 4) and (8 to 5) in both groups respectively. So, physiotherapy treatment must be first priority in asthma. The current study is on two physiotherapy treatments with statistically significant results of both interventions [22].

CONCLUSION

The study concluded that Inspiratory Muscle Training was more effective as compare to Conventional asthmatic rehabilitation in reducing dyspnea and improving pulmonary functional capacity in asthma.

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