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Original Research Article

Impact of Inspiratory and Peripheral Muscle Training in Cases with COPD: A Prospective Observational Study

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Abstract

Introduction: Chronic obstructive pulmonary disease (COPD) is characterized by continual respiratory symptoms and controlled airflow in the respiratory tracts. Breathing exercises can rehabilitate the lung function in COPD including continuous training of breathing patterns and exercises to respiratory muscles. The present study was designed to assess the role of inspiratory muscle training and peripheral muscle training in pulmonary function and exercises capacity progression in cases with COPD.

Materials and Methods: A source of 80 cases with symptoms and spirometry suggestive of moderate to severe COPD patients above 30 years were recruited. Participants were randomly divided into group IMT (n=40) undergone inspiratory muscle training and group PMT (n=40) undergone peripheral muscle training. At the baseline and end of the session quality of life by COPD assessment test score, mRC dyspnea scores, exercise capacity by 6 minutes walking distance and lung function by Forced Expiratory Volume in one second (FEV_1) were assessed.

Results: The COPD assessment test score was 24 and 17 in group IMT and 22 and 16 in group PMT at baseline and after sessions respectively ($p<0.05$). The mean 6 minutes walking distance showed increase from baseline to end of sessions. The mean FEV_1 was 50±8.98 and 51±9.18 in group IMT and 45.8±7.88 and 46.5±7.67 in group PMT.

Conclusion: IMT was an effective method to improve the inspiratory muscle strength, pulmonary function, quality of life and without changes in the dyspnea in cases with COPD. Similar outcome was found in terms of peripheral muscle training.

Keywords: COPD, Inspiratory Muscle Training, Lung Function, Quality Of Life.

Introduction

COPD is a major public health concern and becoming a leading cause of morbidity and mortality [1]. The severity and recurrence of exacerbation can influence the disease prognosis in COPD. Weakness of respiratory muscles is commonly associated and contributes to dyspnoea, hypercapnia, decreased SPO2 in sleep and reduced walking distance [2,3]. Dyspnoea is prominently limiting the body activity thus leads to non-adherence and chronic avoidance of physical exercises. Neglect

physical activities for prolonged duration contribute skeletal muscle deconditioning and reduced ability of exercise capacity which affect the quality of life [4,5].

Exercise and inspiratory muscle training are the management choices to reduce dyspnoea and improve inspiratory muscle strength (IMT), which enhances the quality of life [6]. IMT is effective in associated with pulmonary rehabilitation programs. However, there is literature lack in this context and its effect on dyspnoea [7]. Pulmonary rehabilitation consists of multiple components including cessation of smoking, education, psychosocial support, respiratory exercise practice, vaccination, oxygen support. Outcome can be assessed by measuring functional exercise capacity, severity of dyspnoea, and laboratory measures of exercise performance [8]. With above reference, the present was designed to assess the role of inspiratory muscle training and peripheral muscle training in pulmonary function and exercises capacity progression in cases with COPD.

Materials and Methods

The present Prospective study was conducted in the department of Pulmonary Medicine at MNR Medical College and Hospital from September 2021 to November 2022. A source of 80 cases with symptoms and spirometry suggestive of moderate to severe COPD patients were recruited. The cases symptoms of COPD including chronic cough, chronic sputum and progressive shortness of breath, history of risk factors of COPD including smoking, high exposure to dust and pollution, congenital abnormalities, predisposing genetic factors and spirometry findings including FEV1/FVC <0.7 and post bronchodilator FEV1 <80% and willing to participate were included. Cases with severe hypertension, respiratory failure, cardiovascular complication, unstable angina, hemoptysis and not willing to participate were excluded. Written informed consent was obtained from all the cases and study protocol was approved by institutional ethics committee.

Study participants were randomly divided into two groups. Group IMT consists 40 participants undergone inspiratory muscle training and group PMT consists 40 participants undergone peripheral muscle training. Detailed history was collected and study participants were subjected to detailed clinical examination. The inspiratory muscle training (IMT) was conducted by using inspiratory muscle device. Participants were advised to inspire and expire air for 2 min with one-minute intermittent rest over the period of 20 minutes for 20 sessions. The peripheral muscle training was conducted by using elastic resistance bands with progressive increase in force. Elastic band resistance exercises were conducted for 20 min in two sets with intermittent rest of two minutes for 20 sessions.

The quality of life of participants were assessed by measuring BMI, COPD assessment test score, mRC dyspnea scores. The exercise capacity was assessed by levels of SPO2 and 6 minutes walking distance. The lung function was assessed by Forced Expiratory Volume in one second (FEV_1). The scores of above parameters were measured at the beginning and at the end of the training session.

The collected data was analyzed by using SPSS version 23.0. Descriptive statistics was used to estimate the frequency and percentages of demographic data. Chi-square test was used to assess the association between study variables. The $p<0.05$ was considered as statistically significant.

Results

Table 1: Clinicodemographic data of study participants.

Demographic data	Group IMT (n=40)		Group PMT (n=40)	
	Frequency	Percentage	Frequency	Percentage
Age (In years)				
31-40	05	12.5%	03	7.5%
41-50	14	35%	15	37.5%
51-60	14	35%	14	35%
Above 60	07	17.5%	08	20%
Gender				
Male	28	70%	24	60%
Female	12	30%	16	40%
Smoking status				
Yes	30	75%	33	82.5%
No	10	25%	07	17.5%

Table 2: Comparison of study parameter among both study groups.

Parameters	Group IMT		p-value	Group PMT		p-value
	Baseline	After session		Baseline	After session	
	Mean±SD	Mean±SD		Mean±SD	Mean±SD	
BMI (kg/m^2)	24.4±1.9	24.3±1.9	0.001	22.9±2.3	22.6±2.1	0.001
mMRC dyspnea scores	2.2±1.0	1.7±0.8	0.001	2.1±0.8	1.5±0.6	0.001
COPDassessment test score	24±6	17±4	0.027	22±5	16±3	0.042
6minutes walking distance	418.6±64.2	439.2±67.1	0.982	427.5±66.1	467.2±65.17	0.528
SPO2	97.6±4.37	98.22±4.79	0.030	96.89±3.68	97.37±4.12	0.026
FEV_1	50±8.98	51±9.18	0.0547	45.8±7.88	46.5±7.67	0.027

Discussion

Majority study participants were between age group 41-50 years followed by 51-60 years. The male participants were commonly observed in both groups. 75% of cases in group IMT and 82.5% of cases in group PMT were smokers (Table 1). A study by Buran Cirak *et al*., found mean BMI 25.9 kg/m^2 and 26.4 kg/m^2 in IMT with MT and IMT only groups. Majority are male participants (80% in group IMT & MT and 83.3% in IMT only) [9]. Cheng *et al*., included cases with mean age of 67.23 years and BMI of 23.02 kg/m^2 [10].

The mean BMI was 24.4 kg/m^2 and 24.3 kg/m^2 in group IMT and 22.9 kg/m^2 and 22.6 kg/m^2 in group PMT at baseline and after sessions respectively. The mean difference was statistically significant ($p<0.05$). The mMRC dyspnea scores are 2.2 and 1.7 in group IMT and 2.1 and 1.5 in group PMT at baseline and after sessions respectively. The COPD assessment test score was 24 at baseline and 17 after session in group IMT. Whereas, scores were 22 and 16 in group PMT at baseline and after sessions respectively. The mean difference of mMRC

dyspnea scores and COPD assessment test scores were statistically significant between two study groups. The mean 6 minutes walking distance showed increase from baseline to end of sessions. However, the mean difference was statistically not significant ($p>0.05$). There was a significant improvement in the mean oxygen saturation levels in group IMT and PMT from baseline ($p<0.05$). The mean FEV_1 was 50±8.98 and 51±9.18 in group IMT and 45.8±7.88 and 46.5±7.67 in group PMT. The mean difference was statistically significant in group PMT ($p<0.05$) (Table 2). A Systemic review and meta-analysis by Figueiredo *et al.*, reported that the comparison between IMT and control groups showed an improvement in FEV_1. The 6 minutes walking distance showed significant improvement in the isolated IMT, especially in cases without respiratory muscle weakness. The quality of life and dyspnea was statistically not significant ($p<0.05$) [11]. Smart *et al.* (2013) and Charususin *et al.* (2013) reported that in addition to increasing respiratory muscle strength, inspiratory muscle training improved functional capacity, quality of life, dyspnoea and exercise capacity [12,13]. de Medeiros *et al.*, observed improvement in the functional capacity assessed by the six minutes' walk test (MD 80 m, 95% CI 41 to 119) and FVC (MD 0.70 litres, 95% CI 0.53 to 0.87). In addition, breathing exercise showed significant effect on FEV_1 [14]. Gosselink *et al.*, reported that IMT improves inspiratory muscle strength and endurance, functional exercise capacity, dyspnoea and quality of life [15].

A study by Buran Cirak *et al.*, found improvement in the FEV1 and FVC values were improved with the addition of MT to IMT [9]. Cheng *et al.*, reported that the mean FEV_1 was 40.05 and 43.75 before and after respiratory muscle training. The comparison of RMT training effect between severities of FEV_1 in patients with COPD showed improved FEV_1 (46.32 in IMT only and 41.43 in IMT with EMT), CAT score (7.75 in IMT only and 10.00 in IMT with EMT), mMRC score (1.20 in IMT only and 1.07 in IMT with EMT) and distance of 6MWT (321.75 in IMT only and 351.92 in IMT with EMT). The mean difference of FEV1 (%), CAT score, mMRC score and distance of 6MWT are statistically not significant ($p>0.05$) (10). The present study has limitations in terms of number of participants and lack of control group. The IMT and PMT were conducted and compared separately instead together.

Conclusion

In conclusion, the inspiratory muscle training and peripheral muscle training are similarly effective in progressing severity of dyspnea, exercise capacity, COPD assessment test score, and quality of life in cases with moderate to severe COPD. However, there was no significant progress in the lung function was apparent.

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