Effects of Deep Breathing Exercises On Oxygen Saturation and Functional Capacity in Hospitalized Patients with Chronic Obstructive and Pulmonary Disease

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ABSTRACT

Objective: The study aimed to examine the effect of deep breathing exercises on oxygen saturation and functional capacity in hospitalized patients with Chronic Obstructive and Pulmonary Disease (COPD).

Methods: This quasi-experimental study included 37 male patients aged between 60-75 years. This study was conducted from 25th November 2022 to March 2023 at Arif Memorial Teaching Hospital, Mayo Hospital, and Gulab Devi Hospital. There were 6 sessions, 3 sessions per week. Each session was of 15-20 min. Deep breathing exercises were performed on each patient. Patients included in the study were hospitalized for exacerbated COPD without the use of NIV (non-invasive ventilation). The measuring parameters were pulse Oximetry for oxygen saturation and dyspnea index for functional capacity respectively. Using SPSS version 25the qualitative variables were shown in frequency and Paired samples T-test was used to measure the mean score of the group for pre-test protest comparison and P value less than 0.05 was taken as significant.

Results: The study comprised of 37 participants with mean age of 66.51± 4.65. The sample t-showed there was a significant difference between oxygen saturation of COPD patients post-intervention with a mean value of -1.972±1.301 with a p-value of 0.05. Similarly the dyspnea index showed a significant difference between pre (23.18±4.77) and post-mean score (16.86±1.11) with p-value < 0.05.

Conclusion: The findings of the current study showed that deep breathing exercises were effective in improving oxygen saturation and functional capacity among hospitalized COPD patients.

Keywords: COPD. Deep breathing exercises, Hospitalized patients, oxygen saturation, functional capacity,

Original Research Article

Introduction:

COPD (Chronic Obstructive and Pulmonary Disease) is a chronic inflammatory lung disease that extremely affects human health [(1)]. It is characterized by restrictions in airflow brought on by an abnormally persistent inflammatory response to noxious or toxic gas particles in the lungs and airways [(2)]. Patients with COPD who experience progressive airway restrictions run the risk of developing major medical problems like immobility, muscular atrophy, and various psychological conditions over an extended period, and positioning managers can facilitate it [(3, 4)] Major symptoms are classified as (dyspnoea, sputum purulence, and increased sputum volume) and minor were (nasal discharge, wheezing, sore throat, and cough). [(5)] Dyspnoea, ventilatory restriction, and exhaustion are symptoms of peripheral and respiratory muscle dysfunction, which lowers functional ability and quality of life. [(6)] Alterations in lung function, alveolar destruction, and damage to the terminal bronchiole walls that may clog the terminal bronchioles are what cause the most significant changes in COPD patients. [(7)] The most severe cases of COPD also cause increased labor of breathing and dyspnoea, as well as an increase in the paradoxical movement of the chest wall. [(8)] The number of COPD fatalities increased by 17.5% between 2007 and 2017 as a result of continued exposure to risk factors like smoking and the aging population. [(9)] As air pollution increases COPD has become one of the leading causes of fatality worldwide. [(10)] According to WHO, it will be the third leading cause of death by 2030. [(11)] Pulmonary rehabilitation is a wide-ranging intervention that can effectively enhance the physical and psychological condition of patients with COPD [(1, 12)]. Patients with COPD are advised to avoid becoming physically unfit. [(13)] Pulmonary rehabilitation (PR) has been shown to improve symptoms, exercise tolerance, and health-related quality of life as well as reduce hospitalizations[(14, 15)] . A maximal inspiration during diaphragmatic breathing. (DB) is designed to assist in breathing correctly while strengthening the diaphragm, reducing labor required for breathing by slowing breathing rate, and reducing oxygen demand. [(16)] Pursed lip breathing (PLB) also causes an increase in inspiratory capacity (IC) in COPD patients at rest while performing PLB, indicating

a reduction in pulmonary hyperinflation.[17] This study aimed to investigate the effect of deep breathing exercises on oxygen saturation and functional capacity which may lead to the improvement of gaseous exchange among patients with COPD. The study also examined the effect of combining diaphragmatic, pursed lips breathing, and segmental breathing exercises on the clinical outcomes of patients with COPD.

Material and Methods:

This was a quasi-experimental study and non-probability purposive sampling. The ethical approval of the study was taken from the Ethical Committee of Rashid Latif Medical College. The study was conducted from 25th November 2022 to March 2023. Sample size n=37 was calculated by this formula N= (Zα)2 S2 / d2. The study was held in Arif Memorial Teaching Hospital, Mayo Hospital, and Gulab Devi Hospital. Before the start of their participation in the study, all participants were informed about the study and its purpose. The inclusion criteria included male patients aged between 60-75 with a confirmed diagnosis of COPD (mild to moderate) and having exacerbations or hospitalization in the past 4 weeks.[2] However, exclusion criteria included patients with a pulmonary disease comorbid with COPD and congestive heart failure. It also included patients with orthopedic problems (especially on the back) / muscle-joint disease. Before giving an intervention plan demographic data was noted. The report files of each patient were checked for any comorbidities and surgical history. Demographic data for each respondent was acquired through a self-designed questionnaire. Pretest measurements were taken at the start of treatment and post-test measurements were taken after two weeks of treatment. Deep breathing exercises were performed by each patient according to the instructions by the researcher over two weeks (alternate days in each week) which included pursed lip breathing, diaphragmatic breathing, and segmental breathing. After each breath, there was a pause of 1-2 seconds. There were 6 sessions, 3 sessions per week. Each session ranged from 15-20 mins. Pulse Oximetry was used to estimate the oxygen saturation and dyspnoea index was used to measure the functional capacity of each patient respectively before applying the intervention and again measured after two weeks and the results were noted. Patients were assured that their data would remain confidential. Informed consent was taken from each patient. All ethical considerations were taken into consideration including confidentiality, respect for patient identity, and disclosure of information. The data was first collected, and it was then analysed in SPSS for Windows software version 25. All qualitative variables were shown in frequency tables and percentages. Paired samples T-test was used to measure the mean score of the group for pre-test protest comparison. Quantitative variables were presented as mean ± standard deviation. P value less than 0.05 was taken as significant.

Results:

Demographics	Frequency (%age)
Smoker	30 (81.1)
Non-Smoker	7 (18.9)
Mean Age	66.51± 4.65

Table 1: Smoking history and Age of respondents

Out of 37 participants, 30 were smokers and 7 were non-smokers. The results showed that the mean score of the age of respondents is 66.51±4.659

Outcomes	Evaluation	N	Mean ±SD	Std. Error Mean	Mean Differences	t	P-value
Oxygen saturation	Pre-test	37	90.297±0.292	0.292	1.97±1.301	-9.222	0.000
	Post-test	37	92.270±0.341	0.3414			
Dyspnea Index	Pre-test	37	23.189±4.777	0.785	6.324± 3.979	9.667	0.000
	Post-test	37	16.864±1.115	1.115			

Table 2. Pre-test Post-test Comparison of O2 Saturation and Dyspnea Index (n=37)

There is a significant difference between pre mean values of 90.2±1.77and post mean value of 92.27±2.07 of oxygen saturation with a significant p-value of 0.05. There is a difference between pre (23.18±4.77) and post mean score (16.86±1.115) of the dyspnoea index with a significant p-value of 0.00.

Discussion:

The present clinical trial was conducted to study the impact of deep breathing exercises on COPD patient's oxygen saturation and functional ability. The improvement in oxygen saturation was assessed using a pulse Oximetry, and the dyspnoea score was utilized to gauge functional capacity. The combined effect of deep breathing exercises was checked. Deep breathing exercises showed significant improvement among COPD patients. A study was conducted to use the six-minute walk test and the dyspnea score to assess the impact of active cycle breathing as an airway clearance approach on functional capacity in people with productive bronchiectasis[18]. Therefore, in individuals with bronchiectasis, an active cycle breathing technique is a useful way to clear the airways and enhance functional ability. However, this clinical study is a short-term study that included COPD patients instead of bronchiectasis patients and deep breathing exercises were performed to check the functional capacity. The previous study was conducted to analyse how exacerbations affect the course of COPD or whether the usage of inhaled corticosteroids (ICS) and blood eosinophil counts (BEC) have an impact on the disease's progression. [19] As a result, COPD patients who experience exacerbations experience a faster decline in lung function. The difference between the previous studies from this study is that they examine the influence of exacerbations on COPD progression but in my study, deep breathing was conducted on COPD patients to reduce the exacerbations, and that reveals substantial differences. Another study was conducted to observe the effects of pursed-lips breathing versus diaphragmatic breathing in COPD individuals. Both diaphragmatic and diaphragmatic with pursed lips breathing significantly increased the tidal volume and its compartments in the chest wall and decreased the frequency of breathing.[14] In the current study they compared the different breathing exercises but the difference in my study was to determine the combined impact of deep breathing exercises among COPD patients. Among many other studies, there this study to assess the level-one pulmonary rehabilitation physiotherapy intervention. [20] It is conceivable that high-frequency chest wall oscillation (HFCWO) on the chest, soothing massage, vigorous exercise, electrical stimulation via electro-acupuncture, and an incentive spirometer were among the physiotherapy approaches employed in patients hospitalized for COPD exacerbation. [21] However, my study doesn't include many interventions, only deep breathing exercises were used to improve chest condition, oxygen saturation, and functional

capacity. In previous studies, there was no literature available in which the combined effect of deep breathing exercises was seen on oxygen saturation and functional capacity. These studies only included different interventions that differ my study from these clinical trials.

This study included only male patients, female patients were not included in this study. Not a single patient who engaged in exercise was placed in the experimental or control groups. The study had a brief duration. Only three settings were used to conduct the study. It is advised that bigger sample sizes be used in future research, with the experimental group and the control group included. Future researchers should also take samples from other cities. Female patients should also be included in the study to check the effectiveness in females. The study should be of long duration to get better results of the interventions.

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