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Efficacy of diaphragmatic breathing exercise among COPD patients: A randomised controlled trial

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Introduction

Chronic obstructive pulmonary disease (also known as COPD) is distinguished by a reduction in airflow as a result of airway obstruction. Because of the obstruction of the peripheral airways, a volume of air may become trapped within the lungs (i.e., hyperinflation). It is possible for the respiratory rate to increase as a result of inspiration, which takes place just before the lungs are completely evacuated of air. The adaptation to rapid, shallow breathing may lead to fatigue in the muscles of the respiratory system. The dome of the diaphragm can be reduced by hyperinflation, which also shortens the muscle fibres of the respiratory muscles and inhibits muscle contraction. In addition, there is a possibility that the gas exchange is ineffective. Because of this, people with COPD may feel like they can't get enough air, which is called dyspnea or shortness of breath.

The treatment of COPD with respiratory rehabilitation can include endurance exercise training, which helps people improve their physical fitness. Breathing techniques and ideas for living well with COPD are also included in these treatments.

The diaphragm is a dome-shaped sheet of muscle that is placed horizontally between the thoracic chamber and the abdominal cavity. Diaphragmatic breathing, also known as abdominal or deep breathing, is a method of breathing that involves contracting the diaphragm muscle. Other names for this method of breathing include deep breathing or abdominal breathing.

However, physiological studies on the effects of the individual components of pulmonary rehabilitation are lacking. It has been claimed, but not proven, that diaphragmatic breathing can correct abnormal chest wall motion, decrease work of breathing (WOB), alleviate dyspnea or shortness of breath (SOB), and improve ventilation. However, these claims have not been proven.

According to the findings of a number of studies, patients with COPD who breathe with their diaphragm experience a sizeable increase in their tidal volume, a reduction in their respiratory rate, as well as an improvement in their breathing pattern and their respiratory efficiency. The following is the perspective of a COPD patient regarding the usefulness of diaphragmatic breathing: "Breathing with my diaphragm has helped me a lot in my daily life and improved the quality of my personal, recreational, and professional life," she said.

However, there is some concern that the use of diaphragmatic breathing in patients with severe COPD and asynchronous thoraco-abdominal movements might make the patient's dyspnea worse and reduce the effectiveness of their mechanical breathing. Because of this, it is of the utmost importance to find out if the effect of diaphragmatic breathing changes depending on how bad the disease is in the people taking part.

Although there is ongoing debate regarding the utility of diaphragmatic breathing in the treatment of COPD patients, physiotherapists continue to employ the technique in their work. It is not clear whether abdominal movement is specific to diaphragmatic muscle activity; it is entirely possible to expand the abdomen with little or no involvement from the diaphragm at all. Some studies on the diaphragmatic breathing technique have measured abdominal expansion to determine the effect on diaphragmatic function. As a consequence of this, direct assessment of the activity of the diaphragmatic muscle may be a more appropriate outcome metric. It is not known how nutritional status influences the effects of positioning and diaphragmatic breathing; however, it is hypothesised that an increased body mass index (BMI), which may be associated with increased abdominal adipose tissue deposition, may have a negative impact on diaphragmatic activity and the capacity to recruit diaphragmatic activity while engaging in diaphragmatic breathing.

distribution have been shown to be beneficial for patients who suffer from chronic obstructive pulmonary disease (COPD) and demonstrated improvement in maximal exercise tolerance in mild COPD patients who underwent diaphragmatic breathing (DB) and pursed-lip breathing, but this was not the case in matched control patients. On the other hand, research that was not controlled found that doing DB led to a reduction in motion of the rib cage and an increase in motion of the abdominal region, even though pulmonary function and exercise capacity remained the same.

Recently, it was found that when patients with moderate to severe COPD who did not have respiratory insufficiency and had almost normal inspiratory muscle strength breathed with and without a load, DB had a negative effect on coordination of chest wall motion and mechanical efficiency, but the feeling of shortness of breath did not get better.

The investigators wanted to know what the effects of that method might be in people who had COPD that was more severe, specifically in people who were recovering from an episode of acute respiratory failure and had chronic respiratory insufficiency. As a consequence of this, the objective of this study was to investigate the effect of deep DB on blood gases, breathing pattern, and dyspnea in severe hypercapnic COPD patients recovering from a recent exacerbation of their condition who had impaired inspiratory muscular strength. As part of this study, we also looked at how DB affected the way some of the patients' lungs worked.

As a treatment for shortness of breath, breathing control exercises (also known as BCEs) and respiratory muscle training (also known as RMT) are utilized. Examples of body composition exercises (BCEs) include exercises such as diaphragmatic breathing (DB), pursed-lip breathing (PLB), relaxation techniques (RT), and body posture exercises (BPEs). BCEs are intended to reduce the amount of effort required for breathing while also assisting relaxation through deeper breathing. This could improve the way you breathe by slowing down your breathing and making it easier to breathe.

The goal of this study was to look at the short-term effects of deep diaphragmatic breathing on the activity of respiratory muscles (diaphragm and intercostal muscles) in COPD patients who were being treated at certain hospitals in Bangalore.

METHODOLOGY

The design of this investigation will be a randomised controlled trial.A total of thirty male participants will be screened, and fifteen participants from each group—the study group—will be selected to take part in the research. 1) Between the ages of forty and sixty in total Individuals who had a recorded medical history of COPD and were currently undergoing medical treatment with pulmonary medications were selected to take part in the study. 3) All of them were smokers or had been smokers in the past, but none of them displayed any of the clinical or physiological symptoms of bronchial asthma.

This is the criterion for excluding people. 1) having an age greater than 80 years 2) Obesity 3) A record of recent worsening symptoms 4) pulmonary hypertension that is not under control 5) The need for oxygen therapy to be performed at home.

Exercises targeting the diaphragm will be conducted solely for the group participating in the study. The only form of care that the control group received was medical. Taking readings of blood gases, including PaO2 and PaCO2 as well as PaO2 and FiO2,

OUTCOMES

Ninety-four patients were examined to determine their eligibility, and at random, they were assigned to one of three groups. As a result of a severe COPD exacerbation or other health problems, the CG experienced three protocol deviations. These patients were not dropped in order to maintain consistency with the analysis based on the intention to treat. There was no clear difference between the groups in terms of how bad the illness was at the start, how well they could work, how they looked, or any other baseline parameter.

The Movements of the Diaphragmatic and Thoracoabdominal Organs When compared to the CG, the TG exhibited higher abdominal mobility during NB immediately after the 4-week DBTP, as measured by a decrease in the RC/ABD ratio. This finding was supported by the fact that the TG had a larger RC than the CG (F8.66; P.001). In addition, the TG demonstrated greater abdominal mobility during voluntary DB after the operation in comparison to the CG (F 4.11; P.05). Every single patient with TG exhibited competent DB behaviour. At the end of the DBTP treatment period of four weeks, the TG demonstrated greater diaphragmatic mobility than the CG (F15.08; P.001). During both voluntary DB (d = –.69) and NB, the TG had a medium-to-large effect size on the RC/ABD ratio as well as diaphragmatic mobility (d = -.46) (d = -.96). Both the RC/ABD ratio and the mobility of the diaphragm were the same in people with CG.

Performativity potential Following the 4-week DBTP, there was significantly less dyspnea reported in the TG when compared to the CG (F5.1; P .05). A better HRQOL was indicated for the TG by a reduction of 10 points in the total SGRQ score (F9.7; P.001). When contrasted with the CG, the benefits offered by the TG in the various SGRQ domains (symptom and impact) were found to be statistically significant and clinically relevant. On the other hand, the TG for the activity domain did not change in any way. After a follow-up period of 4 weeks, the results of the 6MWT showed that the TG had a better performance than the CG (F4.9; P.05). Effect sizes ranging from small to medium were observed in favour of the TG with regard to the 6MWT (day 31), dyspnea (day 41), and HRQOL (day 64). The results of the spirometry and lung volume tests were the same for both groups.

Changes for the Better in the Characteristics of Abdominal Motion and Baseline Maintaining a Linear RelationshipThe improvement in abdominal motion (RC/ABD ratio) that occurred after DBTP had a negative correlation with both the baseline RC/ABD ratio (r = –0.8; P =.001) and the baseline diaphragmatic mobility (r =.58; P =.02). It can be seen in the bottom right corner that the majority of people who improved their abdominal motion had a costal breathing predominance (RC/ABD ratio of 0.5). After receiving DBTP, patients who started out with less diaphragmatic mobility saw the greatest improvements in their abdominal motion. There was no correlation found between changes in abdominal mobility in the TG and any other baseline outcomes. Following a four-week period of observation, the RC/ABD ratio was found to have no relationship with either the baseline RC/ABD ratio or diaphragmatic mobility in the CG (P.05).

DISCUSSION

The goal of this randomised controlled trial (RCT) was to find out how a short-term DBTP would affect COPD patients in different ways.During voluntary DB and NB, this indicated an improvement in abdominal motion as well as an increase in diaphragmatic mobility. Additionally, we found that DBTP helps improve symptoms of dyspnea, as well as HRQOL and exercise tolerance. These findings lend credence to the hypothesis that DBTP can modify patterns of habitual breathing and increase the diaphragmatic excursion of COPD patients, thereby reducing the severity of symptoms and improving their capacity for functional activity. According to the findings, patients were able to increase their abdominal motion while performing voluntary DB, which is in line with what was found in earlier research.

To begin, the duration of our training sessions was increased (12 sessions vs. 9). Second, in their research, the dynamic balance test was only completed in the seated and supine positions, whereas in our programme, the dynamic balance test was also completed in the lateral decubitus and standing positions. Third, in contrast to the patients examined by Gosselink, our patients demonstrated a lower degree of airflow obstruction (43 percent vs. 34 percent FEV1). In conclusion, after the intervention, each and every one of our patients was deemed capable of performing DB, in contrast to the other study, which did not provide any description of DB competency. The advantage we saw in our patients could have been caused by any of the differences that were seen between trials.

A significant and potentially life-threatening complication of COPD-related respiratory changes is dysfunction of the diaphragm. According to the findings of previous studies, patients whose diaphragmatic mobility is restricted (33.99 mm) have a lower exercise tolerance and a greater degree of dyspnea after engaging in physical activity. In the current study, both groups of patients had impaired diaphragmatic mobility at baseline, which was demonstrated by a smaller excursion than the critical criterion for diaphragmatic dysfunction (33.99 mm). However, only patients who participated in DBTP improved their diaphragmatic mobility to an extent that was beyond the limit of impairment. Based on these results, a hypothesis has been made that suggests that better diaphragmatic mobility will lead to fewer symptoms of dyspnea and a greater ability to function.

It has been discovered that an increase in the activity of the chest wall respiratory muscles as well as a decrease in the activity of the diaphragm are both related to an increase in the sensations of dyspnea. This demonstrates that treatments aimed at reversing the increased use of chest wall respiratory muscles and improving diaphragmatic function may help individuals with COPD who are experiencing dyspnea. According to the results of our research, patients who took part in the DBTP experienced a reduction in the severity of their dyspnea symptoms, as well as an increase in abdominal motion during NB and an increase in diaphragmatic mobility after the training. Based on these facts, we have reason to think that the decrease in shortness of breath may be caused in part by the diaphragm working harder and the chest wall breathing muscles working less.

CONCLUSIONS

The findings of this study led the researchers to the conclusion that DBTP increases functional capacity and abdominal mobility in COPD patients during NB. The researchers also found that patients who predominantly engaged in costal breathing and had limited diaphragmatic mobility demonstrated the greatest improvement in abdominal motion after receiving treatment. These patients are probably better candidates for DB training than other patients. Because of this, the results of our research show how important DB is as an additional treatment for COPD patients.

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