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Inspiratory Muscle Training (IMT) for Chronic Obstructive Pulmonary Disease (COPD) Patients

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Abstract

Chronic Obstructive Pulmonary Disease (COPD) characterized by airway limitation which is the irreversible and also preventable condition. The limitation of airflow usually progressive and also associated with inflammation occurs due to noxious particles or gases especially for cigarette smoking. COPD patients have significant respiratory and peripheral muscle weakness for this cause respiratory muscle weakness leads to dyspnea. It also reduced the performance of exercise tolerance of a patient. In worldwide COPD was one of the most common causes of morbidity and mortality. It was also responsible for global burden in medically and economically. Among all the population 5% were suffered by COPD. The prevalence of grade 2 COPD was more on male and it was 22.2% in Cape Town, South Africa. It was the largest one of respiratory diseases and also a common cause of death and it was about 8%. It reduced maximal inspiratory pressure and which was measured by diaphragmatic inspiratory muscle strength. Inspiratory muscle training (IMT) was used for a long time due to inspiratory muscle strength and endurance which helped to improve dyspnea & quality of life. The major aim of this study was to know about the effectiveness and the use of IMT. This study had done through a literature review from scholarly articles. Patients took a deep breath for 2 minutes & continued up to 7 cycles with a one-minute rest between each cycle for 21 minutes in each session. It was continued for 3 times per week & it continued for 8 weeks where the maximum threshold pressure sustained for 30 seconds. The study showed that IMT was effective to prevent further complications and also helped to improve functional capacity as well as increased peripheral muscle strength.

Keywords: Chronic obstructive pulmonary disease; Inspiratory muscle training; Respiratory muscle strength & endurance

Introduction

Chronic obstructive pulmonary disease was a preventable disease characterized by limitation of airflow and not fully reversible [1]. The airflow limitation was usually progressive and associated with an abnormal inflammatory response of the lungs to noxious particles or gases, primarily caused by cigarette smoking. COPD affects the lungs & produces significant systemic consequences [2]. Chronic Obstructive Pulmonary disease patients have significant respiratory and peripheral muscle weakness. Respiratory muscle weakness leads to breathlessness. It also reduced the performance of exercise tolerance [3]. In COPD patient's diaphragm was more work than other healthy persons. Due to this cause and overwork, respiratory muscles were more fatigue. In this time inspiratory muscle strength & endurance training helped to strengthen the respiratory muscles [4]. Inspiratory muscle strength and endurance training with ventilatory muscle training play a vital role to improve respiratory muscle functions and reduces breathlessness which helped to improve exercise tolerance [2]. Breathlessness, limitation on exercise and reduced quality of life were more common on obstructive pulmonary disease. Respiratory muscles training with fitness and sports training as well as to help for the improvement of performance [5]. A healthy person was breathing normally when they typically used 10 to 15 % of their total lung capacity. On the other hand, on Inspiratory muscle training, a person can typically increase the amount of lung capacity used [5]. COPD was also responsible for medical and economic burdens globally [1]. According to the WHO Global Burden of Disease Report in 2004 showed that about 5% were suffered by COPD. The prevalence of grade 2 COPD was more on males than females. It was 22.2% in males and 16.7% in females in Cape Town, South Africa [1]. It was the largest than other respiratory diseases and also a common cause of death which was about 8% [2]. In COPD reduced maximal inspiratory pressure (MIP) was measured by diaphragmatic inspiratory muscle strength. It was a risk factor for respiratory and also total mortality [6]. Therefore, the primary aim of this study was to know about the effectiveness of inspiratory muscle training in the case of COPD patients.

Methodology

The study had done through narrative review. This study wanted to know the effectiveness of inspiratory muscle training in COPD patients.

Information sources and search strategy: For this reason, researchers try to search for some evidence-based databases like Pubmed, Pedro, Google scholar, and specific journals.

Narrative review

Physiotherapy was effective to prevent further complication especially IMT was more effective. These double-blinded randomized controlled trial patients who were in the group of intervention inspiratory muscle training loaded with 50% maximum inspiratory

pressure two times daily for 4 weeks. In the IMT group, thirty-one patients were assigned and 34 was a group of sham inspiratory muscle training. It reduced to prolong the stay of hospitalization. Therapeutic effects were so positive in the case of COPD and reduced hospital staying [7]. Another RCT also said that IMT was not only effective for COPD but also effective for different post-operative conditions as well as lung cancer [8].

One Meta-analysis which included overall 32 RCT and analyzed the effectiveness of IMT. Patients were analysed with overall and also subgroup for strength and endurance training by IMT. In that analysis strength by IMT was a more significant effect. They also analysed endurance capacity as well as reduced breathlessness by using IMT. It was measured by 12 minutes' walk test where dyspnea and quality of life were measured. The group which was included IMT with general exercises were more significant. Exercise performance and also improved respiratory & peripheral muscle strength. So it defined that as a result, it reduced the symptom of dyspnea [4].

Another scholarly article discussed that 38 patients were selected for IMT for three months and followed for 1 year with a low load. The result showed that significant improvement of inspiratory muscle training group which statistically proved by a 6-minute walk test and significantly reduced dyspnea. Improved inspiratory muscle endurance training of inspiratory muscle was very much important and endurance devices were used in that time. The use of that device dependent on the valve of the device where patients inspired through the two-way valve and connected with a chamber and plunger where weights were used externally [3]. When this device used their inspiratory elastic work was increased by the progression and this progression should be dependent on the addition of 25–100 weights for 2 minutes' interval. This process was continued until the patients were exhausted and could no longer inspire. When this load was more than pressure were achieved larger and that time it was held for at least 60 seconds. This was known as the peak inspiratory pressure (PIP). When extra weight added than 2 minutes' interval needed and it was held for 1 minute for PIP. This training was performed using a threshold inspiratory muscle trainer six times a week and each session continued 30 minutes for 3 months [3].

It was discussed in another article that Patients were taken a breath for 2 minutes and in this way it continued up to 7 cycles which also followed by 1-minute rest within one cycle. As this consequence, it was taken for 21 minutes for each session. When this load would be Progressed than it needs to breathe against threshold loads which were increased per minute by 10%. In this time verbal instruction with encouragement was provided throughout the training. In sitting position patients wore a nose-clip & also allowed own breathing pattern. Patient's training sessions was 3 times per week & it continued for 8 weeks where the maximum threshold pressure sustained for 30 seconds [9]. IMT consisted of ten loaded breathing cycles against inspiratory resistance for 1 minute and which was also separated by 20 seconds intervals. This endurance training intensity was increased every 2 weeks. At first, it was started with strengthening training and lasted with endurance training which continued for 15 minutes. This treatment also performed on the sitting position and used a nose clip. IMT sessions for 1 time per day which continued for 7 days per week which lasted for 8 weeks [10].

This IMT training was continued by a threshold inspiratory trainer continued for three months. It also focused that at first resistance started with equal 15% of PI max for 3 days and increased gradually in each & every 2 days up to 60% maximum level. At last, it was continued for 2 weeks. Patients were trained per day six times a week and each session length for 30 minutes [11]. Another study focused that patients breathed slowly with an increased tidal volume which was performed by a threshold inspiratory device and supervised by a physiotherapist muscle trainer. It was conducted for 3 weeks and continued for 5 days per week. This was included aerobic exercise on a cycle ergometer and also on the treadmill for 30 minutes per day. Patients were trained in 2 sessions daily for 15 minutes. A total of 15 minutes were also divided into 5 times a week for 3 weeks [12]. Other RCT also said that breathing was started with resistance which maybe 15% of PI, maximum. After that load was increased by about 5–10% for each session, up to 60%. An exercise was done by the patient daily for 30 minutes and 6 times in a week which continued for 3 months (Table 1) [3].

Discussion

After a review of these articles, it helped to gain a clear conception and knowledge about the effectiveness of IMT. One study also reported that physiotherapy treatment including IMT was effective to prevent further complications among COPD patients [7]. IMT also helped to improve functional capacity as well as increased peripheral muscle strength. Other evidence also focused that IMT improved functional capacity with the improvement of respiratory & peripheral muscle strength [13].

Author and Year	Participants	Intervention	Outcome	Results
Gosselink et al., 2011 [4]	Thirty-two RCT The study was used.	All RCT was divided into two groups where one group was provided IMT with general exercises and another only general exercise. Repetition was continued until the patient exhausted. When extra weight added than 2 minutes interval needed and it was held for 1 minute for PIP.	Measured by using 12-minute walk test and also between & Within-group analysis.	IMT improved functional Capacity and improved respiratory & peripheral muscle strength which helped to reduce the symptom of dyspnea.
Weiner et al., 2004 [3]	Thirty-eight patient	IMT was continued for 3 months and Maintained for 1 year follow up. This	Using the 6-minute walk test	Improve and maintain inspiratory muscle strength.

		process was continued until the patients were exhausted and could no longer inspire for at least 60 seconds which was known as the peak inspiratory pressure or PIP. It was continued for 30 minutes and 3 months.		
Hill et al., 2006 [9]	Sixteen patients	Patients were taken a breath for 2 minutes and continued up to 7 cycles followed by 1-minute rest. Continued for 21 minutes increased per minute by 10%. This training continued at 3 times per week & 8 weeks where the maximum threshold pressure sustained for 30 seconds.	Chronic respiratory disease questionnaire (CRDQ)	Improve respiratory Muscle strength.
Beaumont et al., 2015 [12]	Thirty-two patients	Patients breathed slowly which Performed by a threshold inspiratory device and supervised by a physiotherapist muscle trainer. It was conducted for 3 weeks and continued for 5 days per week. This was included aerobic exercise on a cycle ergometer and also on the treadmill for 30 minutes per day. Patients were trained in 2 sessions daily for 15 minutes. Total 15 minutes were also divided into 5 times Weeks.	Borg scale and multidimensional dyspnea profile questionnaire & 6-minute walk test	Increased tidal volume
Shahin et al., 2008 [11]	Thirty patients were selected.	This training continued by a threshold inspiratory trainer for three months. First resistance started with equal 15% of PI max for 3 days and increased gradually in each & every 2 days up to 60% maximum level. At last, it was continued for 2 weeks and Patients were trained per day for six weeks.	6-minute walk test.	Improve inspiratory muscle strength & reduce breathlessness.
Petrovic et al., 2012 [10]	Patients were divided two groups and there were 20 patients.	It has consisted of ten loaded breathing cycles against inspiratory resistance for 1 minute and separated by 20 seconds intervals. It was increased every 2 weeks. At first, it started with strengthening training and lasted with endurance training & continued for 15 minutes. IMT sessions for 1 time per day which continued for 7 days per week which lasted for 8 weeks.	Borg scale, 6-minute walk test.	Improve Inspiratory muscle strength.

Table 1: Summary of evidence-based IMT treatment for COPD patients.

The main symptom and complain of COPD was dyspnoea and exacerbation where IMT strength and endurance training helped to maintain muscle strength and improve functional capacity which helped to reduce the symptom of dyspnea. Evidence also discussed that if IMT consisted of ten loaded breathing cycles against inspiratory resistance for 1 minute and which was also separated by 20 seconds intervals were more effective [10]. Evidence also said that breathing was started with a resistance which maybe 15% of maximum PI. Gradually that load was increased in each session 60% [3]. But most of the time in our country COPD patients also came for a few days, as well as they, were not continued physiotherapy treatment properly and hospital-based physiotherapy treatment system was less. Physiotherapists also face a dilemma that how much time they treat, which types of treatment they applied and also about treatment repetition. They also face trouble that how many weeks they will continue. This evidence-based treatment protocol was more effective and had a positive effect on a patient's health status and reduced the symptom. In our country, most of the patients visited a physiotherapist at later stages. So it is difficult to improve their conditions and maintains a healthy life.

Conclusion & Recommendations

COPD reduces physical activity as well as physical fitness. Physiotherapy may reduce the symptoms which help to maintain a maximal potential healthy life. Most of the evidence supported the positive effects of physiotherapy in the management of COPD including IMT. This physiotherapy treatment technique should focus on the specific physiotherapy treatment with appropriate repetition and its positive effects. It also helped a patient to lead a healthy better quality life. To establish more specific physiotherapy treatment with specific accurate dosage it needs to do more evidence-based information. For this reason, further RCT should be done in this area.

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