Original Article

Physiotherapy and Occupational Therapy Journal
Volume 13 Number 4, October- December 2020
DOI: http://dx.doi.org/10.21088/potj.0974.5777.13420.14

To Compare the Effectiveness of Inspiratory Muscle Training and Threshold Device (IMT) in Patients with COPD

Bhawana Dani [1], Vichitra Baliwan[2], Potsangbam Nandita[3], Niraj Kumar[4]

How to cite this article:
Bhawana Dani, Vichitra Baliwan, Potsangbam Nandita et al./To Compare the Effectiveness of Inspiratory Muscle Training and Threshold Device (IMT) in Patients with COPD. Physiotherapy and Occupational Therapy Journal. 2020;13(4):175-188

Abstract

Introduction: Chronic obstructive pulmonary disease (COPD) is a major cause of chronic morbidity and mortality worldwide. COPD is characterized by persistent expiratory flow limitation which is usually progressive. Dyspnea is the most prominent exercise-limiting symptom of the disease, which leads to chronic avoidance of physical activities.[1]

Inspiratory muscle training (IMT) has frequently been applied in patients with chronic obstructive pulmonary disease (COPD) to improve inspiratory muscle function, exertional dyspnea, and exercise tolerance. Results of the latest meta-analysis indicate that IMT as a stand-alone treatment yields clinically meaningful improvements in inspiratory muscle strength and endurance, functional exercise capacity, dyspnea, and quality of life.[8]

Aim of Study: "To Compare the Effectiveness of Inspiratory Muscle Training and Threshold device (IMT) in patients with Chronic Obstructive Pulmonary Disease"

Methodology: This is a comparativestudy and study done in OPD and IPD of SMIH Patel Nagar, Dehradun (UK). A total of 30 subjects of either gender, diagnosed to have mild, moderate and severe COPD were included in thestudy and randomly divided into 2 groups 15 in each i.e. (Group A) Inspiratory muscle training and Threshold group (IMT) (group B).

Limitation of Study: The study is conducted for a short duration and study shows only immediate effects and not the long term effects.

Proper follow up is not done with the patients due to COVID-19 Pandemic.

Total size of population group studied was small.

In this study, the effects of extrinsic factors such as administration of drugs like Bronchodilators, Beta blockers, Corticosteroids, etc. and intakes of caffeine in the diet are not considered while including patients in the study.

Future Research: Study can be done on largerpopulation. Further study can be done to check the combined effects of Inspiratoy muscle training and Threshold Devices. The exact mechanism behind the reduction of dyspnea following Inspiratory muscle training and the relationship between the reduction of dyspnea and Threshold Device can be studied in more detail. The duration of study can be increased.

Conclusion: Analyzing and comparing both groups pre and post data, although both group shows significant differences with in the groups and between the groups but group A (Exercise Group) shows slightly more significant improvement in both outcome measures.

Therefore, results suggest that after 4 week of Inspiratory muscle training and threshold device(IMT), both group shows improvement in Dyspnea but Inspiratory muscle training shows more improvement in Dyspnea in COPD patients.

Keywords: COPD, Dyspnoea, Inspiratory Muscle Training, Threshold device, forced expiratory volume, BDI/ TDI scale, mMRC.

Author Affiliation: [1]Student, [2]Assistant Professor, [3,4]Associate Professor, Department of Physiotherapy, Shri Guru Ram Rai University, Patel Nagar, Dehradun, Uttrakhand-248121, India.

Corresponding Author: Niraj Kumar, Associate Professor, Department of Physiotherapy, Shri Guru Ram Rai University, Patel Nagar, Dehradun, Uttrakhand-248121, India.

E-mail: drnirajkumar25@gmail.com

Introduction

Chronic obstructive pulmonary disease (COPD) is a major cause of chronic morbidity and mortality worldwide. COPD is characterized by persistent expiratory flow limitation which is usually

progressive. Dyspnea is the most prominent exercise-limiting symptom of the disease, which leads to chronic avoidance of physical activities.[1]

Chronic bronchitis and emphysema are the disease entities that may be present in varying combinations in individuals with COPD, with dyspnea and exercise intolerance being the most prevalent presenting complaints. The mechanisms for dyspnea and exercise intolerance are multifactorial and include increased resistance to airflow (especially during expiration), impaired gas exchange resulting in hypoxemia and hypercapnia, dynamic hyperinflation, and skeletal muscle dysfunction.[2]

McKenzie et al. in 2003 proposed that In COPD patients progression leads to dyspnoea that is from being present only during exertion to ultimately becoming an disabled feature during activities of daily living with decrease health related, quality of life .and also states that dyspnoea is insidious in onset and account incorrectly for ageing effect, Dyspnoea has been defined as "experience a subjective experience of breathing discomfort that consists of qualitatively distinct sensations that vary in intensity.[3]

Inspiratory pressure threshold loading device a device that is used to improve the worsening dyspnoea and increase the strength of respiratory muscles in COPD patients. inspiratory pressure threshold loading device which requires patients to produce an inspiratory pressure sufficient to overcome a negative pressure load and thereby initiate inhalation. Threshold loading allows a significant variable intensity by providing near flow independent resistance to inspiration. The threshold device include resistance in several ways that is with a weighted plunger, a solenoid valve, a constant negative pressure system or a spring – loaded poppet valve.[4]

Inspiratory muscle training (IMT) has frequently been applied in patients with chronic obstructive pulmonary disease (COPD) to improve inspiratory muscle function, exertional dyspnea, and exercise tolerance. Results of the latest meta-analysis indicate that IMT as a stand-alone treatment yields clinically meaningful improvements in inspiratory muscle strength and endurance, functional exercise capacity, dyspnea, and quality of life.[5]

Threshold device: Inspiratory muscle training with a pressure threshold resistive training device was the intervention. The IMT device is a commercially available lightweight clear plastic cylinder (weight, 36.4g; diameter, 4.06cm) that contains a spring-loaded valve at one end and a mouthpiece on the other. The valve blocks air flow until the patient generates sufficient inspiratory pressure to overcome the resistance provided by the spring-loaded valve. The threshold pressure is independent of airflow rate or breathing frequency.[6]

Aim of study

"To Compare the Effectiveness of Inspiratory Muscle Training and Threshold device (IMT) in patients with Chronic Obstructive Pulmonary Disease"

Need of study

Respiratory muscle weakness may contribute to dyspnea and poor exercise performance. Therefore, it is rational to try inspiratory muscle training in these patients, to enhance respiratory muscle function and potentially reduce the severity of breathlessness and improve exercise tolerance.

There is less study related to direct comparison of Insptarory muscle training and threshold device in COPD patients So the need arises to which therapy is more effective.

Another need is that The hospital stay of COPD patients is less than one week, so we can teach a home programe to the patient which will helpful to increase the quality of life and reduce the dyspnea. the pressure threshold device is expensive and economically weaker status Patients cannot afford it.

Purpose of Study

In COPD patients there is decreased strength and endurance of diaphragm muscle which is the main inspiratory muscle. The inspiratory muscles are placed at a suboptimal length for generation of muscle tension due to over inflation. Hence the diaphragm is susceptible to fatigue as a result of increased loading and diminished "capacity" to produce inspiratory force. So the purpose of the study is to improve dyspnoea, quality of life and improve exercise performance.

Hypothesis

Experimental Hypothesis

Inspiratory muscles training may be more effective than the threshold device (IMT) to improve dyspnoea in patients with COPD.

Null Hypothesis

Inspiratory muscles training may not be more effective than the threshold device (IMT) to improve dyspnoea in patients with COPD.

Review of Literature

Catharinne et al. 2019 did a study on Effects of different modalities of inspiratory muscle training as an add-on to conventional treatment of patients with chronic obstructive pulmonary disease (COPD): study protocol for a randomized controlled trial the best IMT modality may be included in conventional PR programs, thus optimizing the therapeutic management of COPD patients. We also hope that these findings endorse adjustments to the modalities used for respiratory muscle strengthening, as we believe that a well-implemented therapeutic program may reduce the morbidity/mortality rates for these individuals as well as improve their quality of life.[7]

A study done by Renata P Bosso –Vanelli et al2018reported that there is reduction of dyspnoea on exertion which is most common symptoms of COPD patients and the inspiratory muscles become strengthened, the capacity of performing physical exercise is increased after performing inspiratory muscle training and calisthenics –and-breathing exercises which are associated with physical training in COPD patients.[8]

Renata P. Basso Vanelliet al.2016 did a study on Reproducibility of inspiratory muscle endurance testing using Power Breathe for COPD patients. According to the reproducibility analysis, using PowerBreathe® can be recommended to carry out inspiratory muscle endurance testing using an incremental test.[9]

Langer et al 2015 find on their study that IMT test is short and largely home based IMT protocol, improve the inspiratory muscle function in both groups. And is an alternative to traditional IMT practice in both TRF and MTL group. the TFRL group tolerate higher training loads and shows improvement in inspiratory muscle function, then less in MTL group in COPD patients.[10]

Petrovic M et al2012 did a study to find the effect of Inspiratory muscle training (IMT) on hyperinflation in COPD patients and reported that IMT can improve respiratory muscle endurance, performance of physical activity and also IMT can reduce dynamic hyperinflation and breathlessness during exercise. So all this leads to a good performance of physical exercise.[11]

Rakhi Sharma, Niraj Kumar, Nishu Sharma (2019) et al. did a study to find the effect Of Buteyko Breathing Technique And Pursed Lip Breathing In COPD. In the present study both of the techniques are effective but the Buteyko breathing technique found more effective than pursed lip breathing. There was significant improvement in Pulmonary Function Test in COPD patients through Buteyko breathing exercise than Pursed Lip Breathing for 4 weeks in patients with COPD.There was significant improvement in Dyspnoea post Buteyko breathing exercise than pursed lip breathing for 4 weeks in patients with COPD.[12]

A study conduct by Geddes EL et al. 2008 states that inspiratory muscle training to determine its effect on inspiratory muscle strength and endurance, exercise capacity, dyspnoea and quality of life for adults with chronic obstructive pulmonary disease. Results indicate that targeted resistive or threshold IMT was associated with significant improvements in some outcomes of inspiratory muscle strength and endurance (Inspiratory Threshold Loading), exercise capacity (Borg Scale for Respiratory Effort (modified Borg scale), Work Rate maximum (Watts)), and dyspnea (Transition Dyspnea Index), whereas IMT without a target or not using threshold training did not show improvement in these variables.[13]

Crowe et al 2005 on Inspiratory Muscle Training Compared with Other Rehabilitation Interventions in Adults with Chronic Obstructive Pulmonary Disease: A Systematic Literature Review and Meta-Analysis reported that this systematic review of the evidence of IMT for adults with COPD demonstrated that IMT is effective in improving inspiratory muscle strength and endurance compared to education alone. Individual studies suggest the potential for benefits with IMT compared to other rehabilitation interventions such as general exercise, education or other breathing techniques.[14]

Gosselink 2004 conduct a study on Breathing techniques in patients with chronic obstructive pulmonary disease (COPD) concluded that exercise performance was enhanced in patients with inspiratory muscle weakness. Use of abdominal muscle contraction during expiration seems to be beneficial to diaphragm function, but the effects on dyspnea were not studied. The transfer effects of breathing techniques during resting conditions to exercise conditions are not well established.[15]

A study done by Shu-Fang Hsiao et al. 2003 concluded that the inspiratory muscle training with

target resisted TMT shows the similar effect like a more popular used pressure threshold. Inspiratory and also can be used in treatment of COPD patient. The availability of targeted resistive TMT and less expensive makes this device easily treatable of choice.[16]

Taniya Singh, Niraj Kumar, Nishu Sharma (2019) et al. conducted study on Chronic Bronchitis 30 Subjects and divided randomly into two groups; namely experimental group A and control group B. Group A was treated with Active cycle of breathing technique with postural drainage and Group B received autogenic drainage.We have shown that there is no significant result between active cycle of breathing technique along with postural drainage and autogenic drainage in clearance of secretions and oxygenation in clinically diagnosed patients with chronic bronchitis. In this study, Active cycle of breathing technique with postural drainage and autogenic drainage are effective individualy but comparatively there is no significant difference between 2 groups. [17]

3.3.12. Alba Ramı´rez-Sarmiento, et al.2002 did a study on Inspiratory Muscle Training in Patients with Chronic Obstructive Pulmonary Disease Increase in both the strength and endurance of the inspiratory muscles were observed in the inspiratory training group. This improvement is associated with increase in the proportion of type I fibers (by approximately 38%, $p< 0.05$) and in the size of type II fibers (by approximately 21%, $p < 0.05$) in the external intercostal muscles. No changes were observed in the control mucles. The study demonstrates that inspiratory training induces a specific functional improvement of the inspiratory muscles and adaptive changes in the structure of external intercostal muscles.[18]

Andrew harveret al.1989 a study on Targeted Inspiratory Muscle Training Improves Respiratory Muscle Function and Reduces Dyspnea in Patients with Chronic Obstructive Pulmonary Disease concluded that Targeted Inspiratory muscle training may enhance respiratory muscle function and reduce dyspnoea in symptomatic patients with moderate to severe chronic obstructive pulmonary disease.[19]

Jaya Negi, Niraj Kumar () et al. did study on effectiveness of Incentive Spirometer and Inspiratory Muscles trainer in patients with Chronic Obstructive Pulmonary Disease. Thirty subject were selected and randomly assigned into two group of 15 subjects each namely experimental Group A and control Group B. Group A was treated with Inspiratory muscles trainer and Group B with Incentive spirometer for a duration of 4 weeks. This study provided evidence to support the use of Incentive Spirometer and Resistive Inspiratory Devices to improve ventilatory muscle strength in patients with mild to severe dyspnea in COPD. In conclusion, both the treatment programs are inspiratory muscles trainer is more effective the incentive spirometer in improving Inspiratory Capacity and reducing dyspnea which could be due to improvement in ventilatory muscle strength.[20]

Meterial and Method

Sample

30 Patients with COPD who were willing to take treatment for four weeks session after a written consent were taken and divided into two groups, group A and group B. 15 patients were included in group first and 15 in group second.This study was an experimental design involving the comparative analysis of two group treated with exercise and inspiratory muscles trainer and assessed by dependent variables namely mMRC and Baseline dyspnea index.This study was conducted in SMIH Hospital, Department of Physiotherapy, Patel Nagar, Dehradun.A sample of 15 subjects each in 2 groups were selected according to inclusion and exclusion criteria.Inclusion criteria includes -COPD with acute /moderate/severe, No Age limitations, Both sex, Patient with an ability to perform inspiratory muscle training.Exclusion criteria includes-Musculoskeletal conditions i.e. barrel chest, Cardiovascular conditions and Restrictive disease. Outcome measures-MMRC (Modified Medical Research Dyspnoea Index) and Baseline Dyspnoea Index (BDI) and Transition dyspnoea index). Materials used Data collection sheet, Wrist watch, Timer. Equipments: Threshold inspiratory muscle training device (Philips Company)

Fig 4.1: Materials used in Study

Procedure

- The subjects will be informed regarding the purpose and procedure of the study.
- The subjects meeting up with the inclusion criteria will be recruited for the study after

obtaining a duly signed consent form for the same.

- After random sampling, subjects will be divided into two groups. each group consist of 15 patient of both male and female.

In Group A subjects will perform inspiratory muscle training. Each section is subdivided into exercises with 'Easy', 'Moderate' and 'Difficult' classifications. subjects perform these exercises 6 days a week and 2 session of 30 min per day. Subjects were positioned on a treatment couch in semi-fowler position with adequate back support. Or the position of patient was changed according to the exercise protocol.

Stretching and Mobilizing

Patient Position: The patients sits on couch in easy stage

Procedure: Patient Elevate and pull back the shoulders As slowly breathe in through nose, gradually elevate and pull back both shoulders. After taking a deep breath, slowly breathe out through mouth, relax and lower the shoulders.

- Stretching the upper chest: patient Place both hands on upper chest. Pull back elbows and pull down the chest while lifting chin and inhaling a deep breath through nose. And Expire slowly through mouth and relax.
- Stretching the back muscle: patient Hold hands in front of chest. As patient slowly breathe in through nose, hand moves frontwards and down, and stretch the back. After deep inspiration, slowly breathe out and resume the original position.
- Elevating the elbow: patient Hold one hand behind head. Then Take a deep breath through nose. While slowly exhaling through mouth, stretch the trunk by raising elbow as high as is easily possible. Return to the original position while breathing normally. Repeat the process using the alternate hand behind the head.21

Diaphragm Breathing

Patient position: patient is in semiflower's position.

Procedure

- Commence diaphragm breathing at the end of a normal exhalation.
- With palms placed lightly on the ribs with the fingers facing forwards and the tips of the fingers almost touching at the end of a normal exhalation.
- Patient Keep the abdomen, shoulders and chest relaxed, and take a deep, slow inhalation through nose.
- On inhalation, ask the patient to see and feel the abdomen bulge forwards and ribs move sideways and forwards.
- And Watch your finger tips and try to move them apart using your abdomen as you inhale.
- Guide the patient that if chest rises, the diaphragm is not being used properly – relax the shoulders and chest.
- Exhalation should be relaxed, with no muscle

Fig 4.2 Group A Patient Performing Diaphragmatic Exercise

activity – allow the air to 'fall out' of the chest as lungs and rib cage 'spring' back.

- Be careful not to hold the breath at the end of the inhalation – relax and let the air fall out.
- Diaphragm breathing training programmes have been shown to improve diaphragm mobility and exercise tolerance (Paulin et al, 2007; Yamaguti et al, 2012). [Fig 4.2]

Gluteal Bridge

Patient Position: Patient lies on his back.

Procedure

- The patient flexed his knees, hip and resting the both hands on the side of the body and then controlling the body weight using the gluteals and hamstrings.
- Once in position, brace the abdominal muscles (maximally) and breathe slowly and deeply at around 12 breaths per minute throughout the exercise. ensure maintenance of a completely straight bodyline.
- This is a good exercise for the gluteals and hamstrings, as well as the trunk and deep pelvic stabilizers. It challenges the ability to breathe effectively during hip extension. Fig 4.3

Leg Raise

Benefits

This exercise challenges the pelvic and low back stabilizers during hip flexion. As with other exercises in this sub-section, it challenges the ability to maintain lumbopelvic stability without suspending breathing.

Position of the patient: Patient lies on his back.

Procedure

- Push the back towards the floor, but concentrate on maintaining a neutral spine (it may help to place the fingers under the small of the back).
- With the feet lightly in contact with the floor, slide both heels towards the buttocks and return immediately to the start position with a controlled cadence. Inhale forcefully through the mouth as the heels are moved towards the buttocks and swap breathing phases between set.
- Once in position, brace the abdominal muscles (maximally) and breathe slowly and deeply at around 12 breaths per minute throughout the exercise.

Fig 4.3: Group A Patient Performing Bridging Exercise

- Push the back towards the floor, but concentrate on maintaining a neutral spine (it may help to place the fingers under the small of the back). For Moderate and Difficult versions, raise the feet about 15 to 20 cm (6 to 8 inches) off the floor and brace the abdominal corset muscles (maximally).
- This exercise challenges the pelvic and low back stabilizers during hip flexion. As with other exercises in this sub-section, it challenges the ability to maintain lumbopelvic stability without suspending breathing. [Fig 4.4].

Fig 4.4: GroupA Patient Performing Leg Raise

Reverse Curl

Patient Position: Patient lies on his back. The knees and hip are extended.

Procedure

- Ask the patient to Tilt the pelvis posteriorly, inhaling forcefully through the mouth with each posterior tilt (swap breathing phases between sets, exhaling during the tilt).
- Raise the hips off the floor far enough for the thighs to touch the hands (the hands should be a stationary target. inhaling forcefully through the nose with each lift (swap breathing phases between sets, exhaling during the tilt).
- Raise the hips and lower back off the floor, keeping the legs straight and inhaling forcefully through the mouth with each lift (swap breathing phases between sets, exhaling during the tilt).
- During this exercise, compressive (expiratory) forces are exerted on the rib cage and abdomen. The exercise therefore develops the ability to inhale under these conditions, which will enhance the ability to breathe in situations where the body movements and breathing are out of phase in terms of the actions required of the breathing muscles, i.e., inhaling during non-respiratory activation of expiratory muscles.

6. Easy Seated hip Extension

- Position of patient: patients sits on a chair, with back rested.
- Once in position, brace the abdominal muscles (moderately).
- Ensure that the hips are extended as far as is comfortable so that the shoulders are behind the hips. Rest the hands on the thighs, or fold the arms across the chest. Once in position inhale forcefully through the nose, completing the 30 repetitions continuously.
- This exercise requires activation of the trunk-stabilizing muscles to prevent toppling backwards. The muscles involved exert compressive forces on the chest wall and abdomen, which must be overcome during inhalation.

7. Easy Bag Pick Up

Position of patient: Patient stand with increase base of support.

Procedure

- Once in position, adopt a neutral spine alignment and brace the abdominal muscles (moderately).
- Standing upright with feet shoulder-width apart and arms at the sides of the body, squat down as if to pick-up a heavy bag. The hand should reach down to a typical height for a bag handle (30 to 45 cm, or 12 to 18 inches); pause briefly in the squat position before returning to the start position.
- Then reaching down on the opposite side for the next repetition. Inhale forcefully through the nose during the reach down phase (exhale

when standing up). Alternate this pattern between sets so that the exhalation occurs during the active phase.

- This exercise simulates the everyday demands of picking up and carrying a bag of shopping, challenging both trunk stabilization and postural control. The former compresses the trunk, whereas the latter necessitates feedforward activation of the diaphragm and transversusabdominis. Superimposing a controlled breathing demand upon these challenges facilitates the ability to meet them in daily life.

8. Easy Sit - Stand

Patient Position: Patients sits on a chair.

Procedure

- Begin in a seated position with the arms folded across the chest. Rise to the standing position as swiftly as possible, then return immediately to the seated position (under control) and repeat. Inhale through nose when rising; exhale when sitting (swap breathing phases between sets so that the exhalation occurs when rising)
- Sitting and standing doesn't just require adequate strength in the hip and knee extensors, it also requires good core stability and postural control. Typically, people inhale just before rising, and perform a weak Valsalva to produce stability and stiffness in the trunk and pelvis. This exercise will reduce the reliance upon this pneumatic pressure for stability, replacing it with good neuromuscular strength and coordination.[6]

In Group B, subjects will perform Threshold Devices. The patients were positioned on treatment couch in semi Fowler's position with adequate back rest. Then patients were given a mouth piece of Resistive Inspiratory Device fitted with a specific aperture opening disc, and nose clip was placed on the nose, so that breathing was done through the mouth. They were instructed to inhale through the mouth piece of Resistive Inspiratory Device, which was instructed to keep in the mouth for the period of 1-minute. The training was gradually increased in such way that they were able to perform twice a day for 10 to 15 minutes in each session. The progression was initially focus on increasing the duration to 30 minutes, then the intensity was increased by using a smaller aperture disc.[7] [Fig 4.5]

Fig 4.5: Training with Threshold Device

Data Analysis

Graph pad prism (Version 8.3.4) software was used for data analysis.

This chapter deals with the statistical analysis of the 2 Outcome measures that is mMRC and BDI/TDI of all individual which were analyzed on day one, before the start of the therapy and at the end of four weeks. Paired T-test used to compare Pre and Post treatment scores of (mMRC) modified medical research council dyspnea scale within group A and group B.

Unpaired t-test used to compare post treatment scores of (mMRC) modified medical research council dyspnea scale between the Group A and Group B.

2 WAY ANOVA test used to compare to baseline dyspnea index(BDI) and transition dyspnea index between Group A and Group B.

Result

This chapter deals with the result of data analysis of the data of two outcome measures that is mMRC and BDI/TDI, within group A and group B. The scores were analyzed and interpreted to determine which intervention is more effective in improving dyspnea in COPD patients.

Paired t-test was used to analyze and compare pre and post treatment scores within the group A and group B. Significant level of 0.05 was used for data analysis.

Unpaired t-test was used to analyze and compare post treatment score between group A and group B.

One -Way ANOVA (Non Parametric) Test was used to analyze and compare BDI/TDI scores of Group A and Group B.

Analyzing mMRC revealed significant difference in group A post treatment, Mean and standard error of mean (1.533 ± 0.2906) when compared to group A pre-treatment, Mean and standard error of mean (2.867 ± 0.3065) [Table &Fig 6.1]

Analyzing mMRC revealed slight significant difference in group B post treatment, Mean and standard error of mean (1.733 ± 0.2282) when compared to group B pre-treatment, Mean and standard error of mean (2.667± 0.2702) [Table &Fig 6.2]

Table 6.1: Within group comparison of pre and post treatment data of both outcome measure in group A

Outcome Measure	Pre (MEAN ± SEM)	Post (MEAN ± SEM)	P Value
mMRC	2.867 ± 0.3065	1.533 ± 0.2906	P<0.0001
	BDI	TDI	
BDI\TDI	2.667±0.6738	6.533 ±0.3634	P<0.0001

Table 6.2: Within group comparison of pre and post treatment data of both outcome measure in group B

Outcome Measure	Pre (MEAN ± SEM)	Post (MEAN ± SEM)	P Value
mMRC	2.667 ± 0.2702	1.733 ± 0.2282	P<0.0001
	BDI	TDI	
BDI\TDI	2.400±0.5327	4.067 ±0.3581	P<0.0003

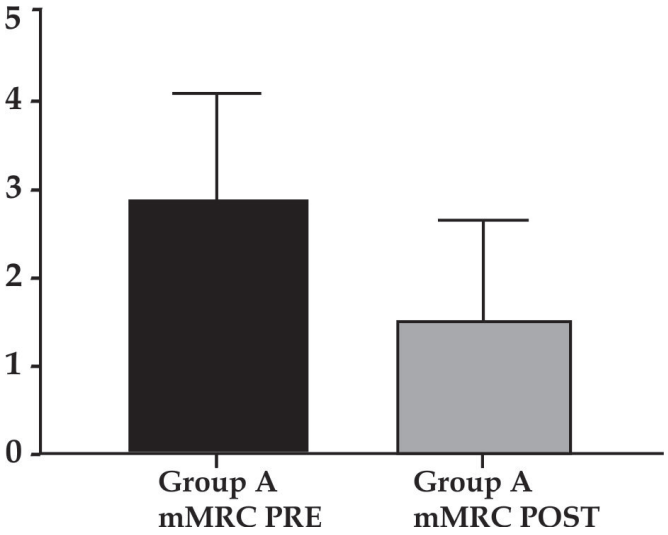

Fig 6.1: Comparison of mMRC pre and post treatment data of group A (Mean and SD)

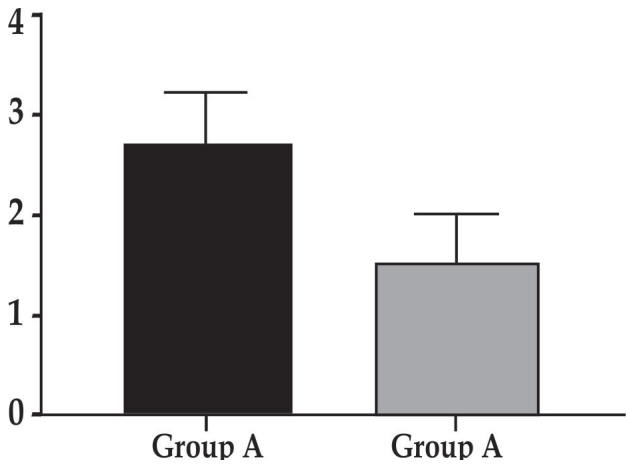

Fig 6.2: Comparison of mMRC pre and post treatment data of group A (Mean and SEM)

Analyzing BDI/TDI revealed significant difference in group A TDI focal score, Mean and standard error of mean (6.533±0.3634) when compared with group A BDI focal score, Mean and standard error of mean (2.667±0.6738)

Analyzing BDI/TDI revealed significant difference in group B TDI focal score, Mean and standard error of mean (4.067±0.3581) when compared with group B BDI focal score, Mean and standard error of mean (2.400±0.5327)

Analyzing TDI scores revealed significant difference between both groups. Group A shows more significant improvement Mean and Standard error of mean (6.533±0.3634) when compared to Group B TDI score Mean and Standard error of mean (4.067±0.3581) that means Group A shows more improvement in Dyspnoea after 4 weeks of intervention.

Analyzing and comparing both groups pre and post data, although both group shows significant differences with in the groups and between the groups but group A (Exercise Group) shows slightly more significant improvement in both outcome measures.

Therefore results suggest that after 4 week of Inspiratory muscle training and threshold device(IMT), both group shows improvement in dyspnoea but Inspiratory muscle training shows more improvement in Dyspnoea in COPD patients. [Table 6.1]

Table 6.3: Comparison between group A and group B post treatment data of both outcome measures

Outcome Measure	Group A Post Data (Mean ± Sem)	Group B Post Data (Mean ± Sem)	P Value
mMRC	1.533 ± 0.2906	1.733 ± 0.2283	P= 0.5926
TDI	6.533 ±0.3634	4.067±0.3581	P<0.0001

Discussion

In this study, efforts were made to compare the effects of Inspiratory muscle training and and Threshold devices as a treatment for improving ventilatory muscle strength in patients with mild to severe dyspnea in COPD.

A total of 30 patients with COPD were included in the study. The intervention was gave for a period of 4 weeks. The present study was done in Respiratory medicine ward of Indiresh Mahant Hospital. Patients diagnosed to have COPD were randomly allocated in both the groups. This study shows a comparison between group receiving

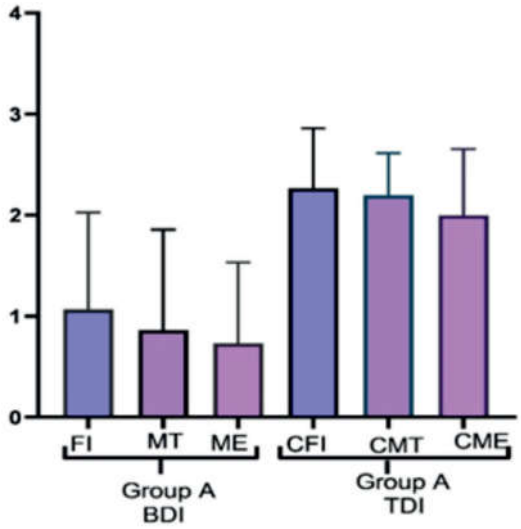

Fig 6.3: Comparison of BDI/TDI of group A (Mean and SD)

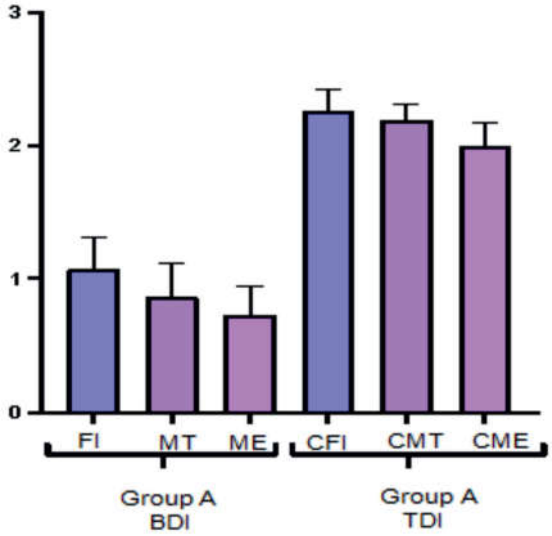

Fig 6.4: Comparison of BDI/TDI of group A (Mean and SEM)

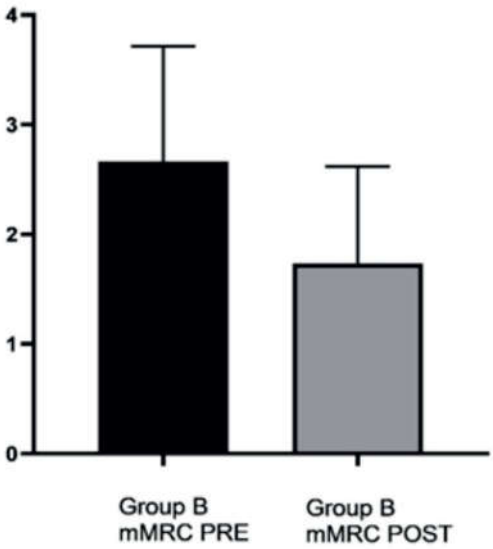

Fig 6.5: Comparison of mMRC pre and post data of group B (Mean and SD)

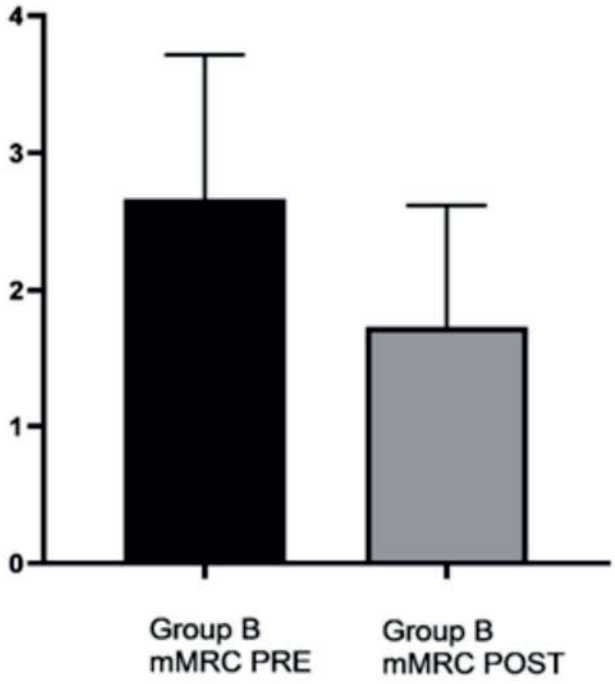

Fig 6.6: Comparison of mMRC pre and post data of group B (Mean and SEM)

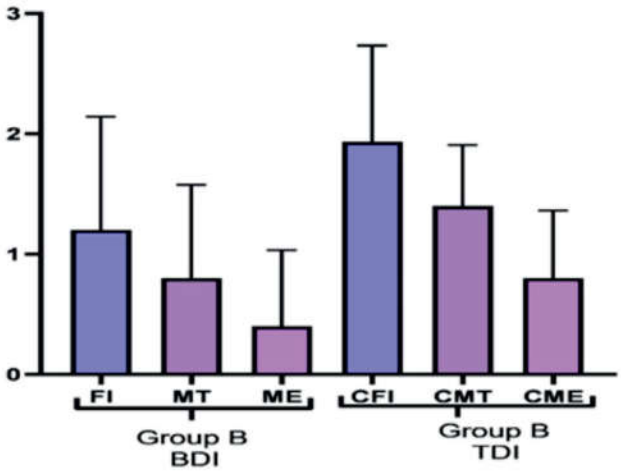

Fig 6.7: Comparison of BDI/TDI of group B (Mean and SD)

Inspiratory Muscle Training while the other group receiving Threshold Device(IMT) in patients with chronic obstructive pulmonary disease.

In the present study to aim to find the efficacy of which mode of treatment was better in the two group using two different evaluating outcome measures such as mMRC, BDI/TDI. The major findings of this study were that an inspiratory muscle training improves dyspnea scores in patients with COPD, however few variables maintained the state of improvement even after follow-up.

This study consisted of a total 15 subjects in each group with 10 male patients (66.66%) and 5 female patients (33.33%) in group A, while the other group had 11 male patients (73.33%) and 4 female patients (26.66%). The prevalence of COPD is generally higher in males than for female subjects.

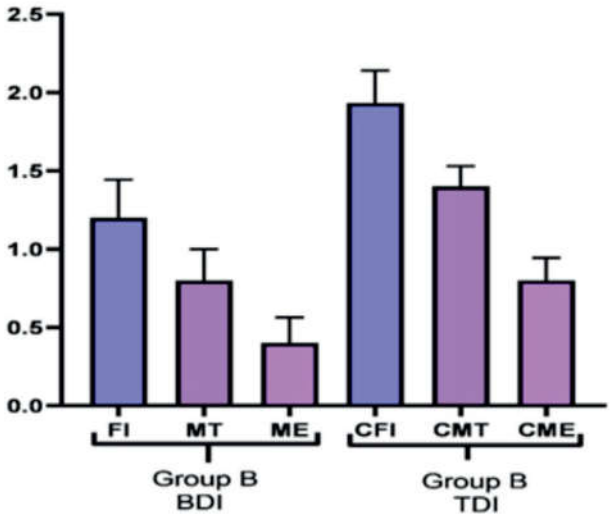

Fig 6.8: Comparison of BDI/TDI of group B (Mean and SEM)

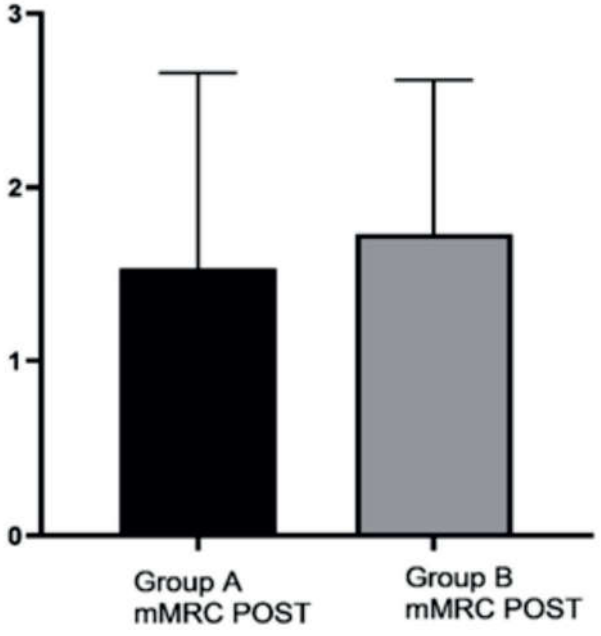

Fig 6.9: Comparison between group A and Group B mMRC post treatment data (Mean and SD)

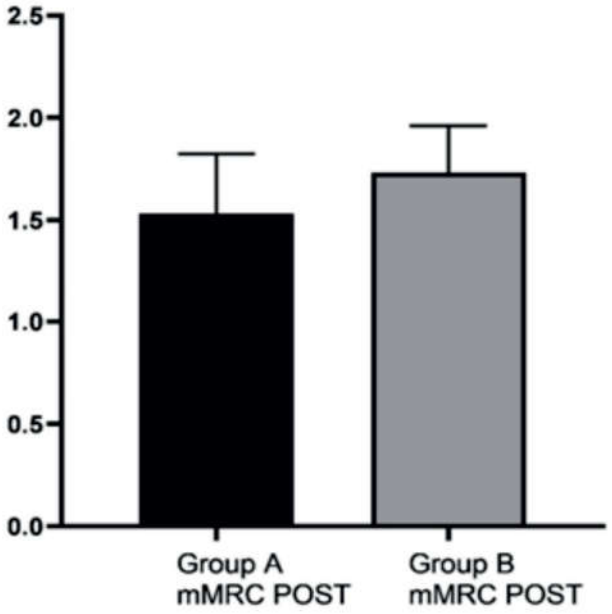

Fig 6.10: Comparison between group A and Group B mMRC post treatment data (Mean and SEM)

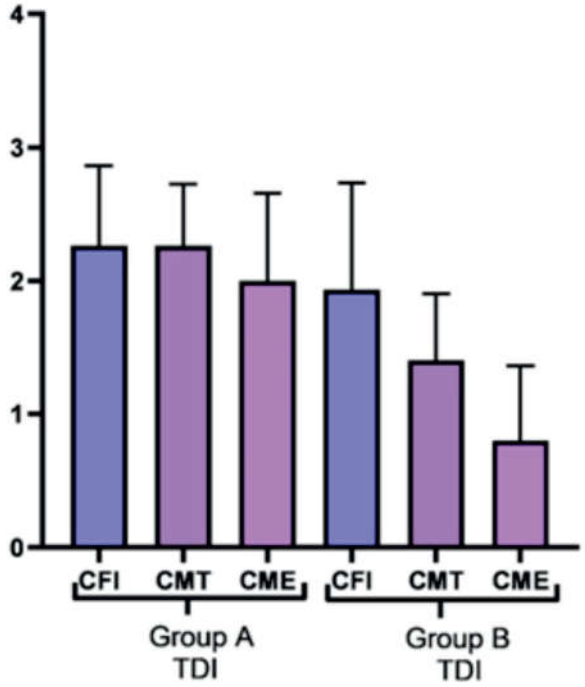

Fig 6.11: Comparison between group A and group B TDI post treatment data (Mean and SD

The "t" test and One -way ANOVA was done to find out the significant of the data between two groups. Overall 15 COPD patient receive inspiratory muscles training and 15 patients receive Threshold device . Who were selected based on the selection criteria. The results demonstrated that the patients treated with both the intervention were highly significant in improving ventilatory muscle strength and hence decreasing the exertional dyspnea.

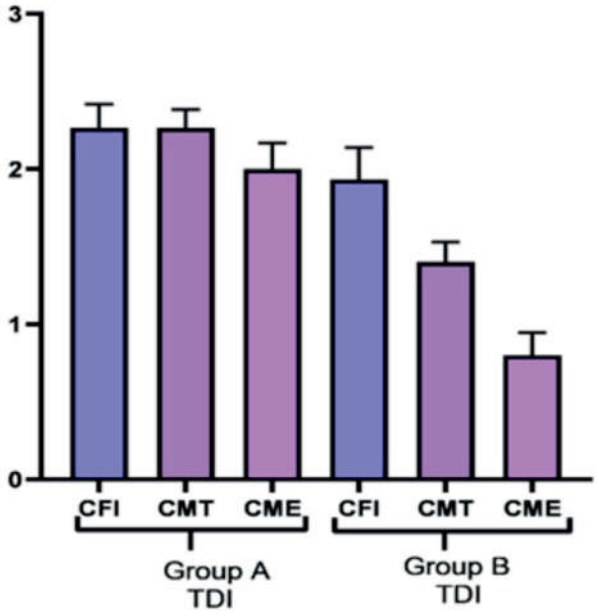

Fig 6.12: Comparison between group A and group B TDI post treatment data (Mean and SEM)

Based in this data we accept the experimental hypothesis and reject null Hypothesis. The study undertaken included patients who had COPD with mild to severe dyspnea.

In our study the mean flow of group A and group B varied between 2.57 and 1.05 I/s respectively. We have shown that inspiratory muscle training result in significant increase in respiratory muscles function and significant reduce in dyspnoea in clinically stable patients with mild to severe COPD.

Improvement occurs in both groups (these results may be due to treatment protocol which we have taken in this study). The drawback of this study is that inspiratory muscle training can be performed at home. whereas Threshold device is very expensive and low socio -economic status people can not afford it easily and not easily available in the market.

Limitation of Study: The study is conducted for a short duration and study shows only immediate effects and not the long term effects.

Proper follow up is not done with the patients due to COVID-19 Pandemic.

Total size of population group studied was small.

In this study, the effects of extrinsic factors such as administration of drugs like Bronchodilators, Beta blockers, Corticosteroids, etc. and intakes of caffeine in the diet are not considered while including patients in the study.

Future Research

Study can be done on largerpopulation.

Further study can be done to check the combined effects of Inspiratoy muscle training and Threshold Devices.

The exact mechanism behind the reduction of dyspnea following Inspiratory muscle training and the relationship between the reduction of dyspnea and Threshold Device can be studied in more detail.

The duration of study can be increased.

Conclusion

This study provided evidence to support the use Inspiratory Muscle Training and Threshold device (IMT) to improve ventilatory muscle strength in patients with mild to severe dyspnea in COPD. In conclusion, both the treatment programs the inspiratory muscles training is more effective than the Threshold Device(IMT) in improving Inspiratory Capacity and reducing dyspnea which could be due to improvement in ventilatory muscle strength after 4 week of study.

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