Physiotherapy and Occupational Therapy Journal **POTJ**

Indexing information: *NLM catalogue & locator plus, USA; Index Copernicus, Poland; Indian Citation Index (ICI), India; EBSCO Publishing's Electronic Databases, USA; Academic Search Complete, USA; Academic Search Research & Development, USA; ProQuest, USA; Genamics JournalSeek, OCLC World Cat.*

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Physiotherapy and Occupational Therapy Journal

POTJ

April - June 2019
Volume 12, Number 2

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Gastroenterology International	Semiannual	6000	5500	469	430
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Indian Journal of Anesthesia and Analgesia	Bi-monthly	7500	7000	586	547
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International Journal of Food, Nutrition & Dietetics	Triannual	5500	5000	430	391
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Original Article

Physiotherapy and Occupational Therapy Journal
Volume 12 Number 2, April - June 2019
DOI: http://dx.doi.org/10.21088/potj.0974.5777.12219.1

Effect of Heavy Backpack on Cardiovascular Parameters in Middle School Children

Neha Gupta[1], Simran Pandey[2]

How to cite this article:
Neha Gupta and Simran Pandey. Effect of Heavy Backpack on Cardiovascular Parameters in Middle School Children. Physiotherapy and Occupational Therapy Journal. 2019;12(2):76-80

Abstract

In this article we study the effect of heavy backpack on middle school children. This topic is of great concern among educational professionals and clinicals to investigate the health problems faced by school children. On the daily basis, school students spend a significant amount of time carrying stuffed and heavy backpack. Aim of this study was to find out the effect of heavy backpack on cardiovascular parameters in middle school children. We have assessed 100 middle school students (11-14 years old). Children were divided into 2 groups according to their body mass index (BMI) in the following categories like underweight (UG) and healthy weight (HG) BMI. A six- minute walk test (6MWT) was performed by the children in two ways with and without backpack and cardiovascular parameters (blood pressure and pulse rate) were measured before and after the 6MWT. Backpack loads were assigned according to the individual body weight. There was no significant effect seen on the pulse rate (PR) and diastolic blood pressure (DBP). Backpack carriage have a significant effect on the systolic blood pressure (SBP). We noted that the systolic blood pressure increases more in heathy weight children than in underweight children with heavy backpack. Our findings highlight that cardiovascular parameter (such as systolic blood pressure) is affected by carrying loads in the backpacks.

Keywords: Six- minute walk test, Systolic and diastolic blood pressure, Pulse rate, Backpack, Body mass index.

Introduction

External factor like backpack is a common cause for the problems related to posture and cardiovascular parameters in children. There have been numerous studies on backpack in which various authors reported the influence of backpack and its effect on cardiovascular parameters in school children. It has been proven by authors that the heavy load in the backpack cause deviation in the cardiovascular system parameter, posture, and gait [1].

According to the recent studies, they have suggested that the loads i.e. school bags must not be loaded too much. Backpack must be lighter and its weight must be 10 to 20% of total weight of the child. In the following year, a review given by Breckley and Stevenson stated that the major portion of work considered the loads have a severe negative impact on the body of the children [2]. Chansirinekor W, Wilson D, grimmer K and Dansie B (2001) reported that carrying a backpack weighing 15% of body weight of the child seems to be very heavy to maintain the correct standing posture for adolescents [3]. Maximum load that is prescribed from these studies can vary from 25 to 40% of body weight of the child (Haisman 1988) [3]. Hong Y, Li Jx reported that the if the child's backpack weight is 8% of the body weight of the child. It is considered to be normal and there will not be any significant effect on child body posture [4].

According to the study done by H. Daneshmandi in springer-Verlag (2008). It has been found that if the backpack load is more than 13% of the total body weight then it has a significant effect on SBP, DBP, and the frequency at which heart contracts. However, for a backpack load of 8% of body weight there will be not be any significant effect on the body. In this study they had performed the test on treadmill for 3 minutes. The study was carried out

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Received on: 25.05.2019, **Accepted on** 18.06.2019

on children of 12.5 years of age [5]. To the best of our knowledge there is paucity in published literature regarding the study that shows effect on 11-14 years of children, and the study will be conducted by doing 6MWT. Hence there is a need to determine the effect of the backpack load on cardiovascular parameters among this age group. The study is aimed to determine the impact of backpack loads particularly on cardiovascular parameters in both healthy and underweight school children.

Materials and Methods

The study design was cross – sectional. Data of 100 middle school children of NGO in Noida was taken with age group of 11-14 years in which 50 students are of UG (underweight) BMI (body mass index) and 50 of HG (healthy weight) BMI (12.5–25). children with any cardiorespiratory disease, any history of musculoskeletal injury were excluded. The independent and dependent variables of the study are weight of the backpack and cardiorespiratory parameters (BP, pulse rate) respectively. The group allocation was done according to the BMI calculated with the CDC calculator. student with UG BMI (12.5) and student with HG BMI [12.5-25]. With and without backpack baseline readings of BP and PR were taken before and after the six-minute walk test. Participants were asked to walk for six minutes with backpack load of 12-15% of child's body weight.

Data Analysis

Z- test was used to determine the effect of backpack on cardiovascular parameters in middle school children. To examine the sample. All scores from both groups group A and group B were calculated to determine the mean, standard deviation, variance, after findings these values Z test on excel sheet is applied in both intergroup and intragroup variables. The Z-critical value at p = 0.05 is 1.95.

Results

Demographic Data

Hundred students participated in this study in which male: female ratio is (51:49), the mean age of the group were (12 ± 0.98) years, the mean height of the group were (144 ± 10.5), the mean weight of the group were (29.2 ± 8.07), the mean BMI of children was (16.5 ± 12.4). Z- test analysis was done in both intergroup and intragroup to see the effect of backpack on both the groups. The result is shown in the tables 1-6 below.

Table 1: Shows Statistical analysis between with and without backpack of Group A

Blood Pressure	Mean ± SD		Variance		Observation	Z-stats	Significance
	Without backpack	With backpack	Without backpack	With backpack			
Systolic pre	99.74 ± 7.45	109.7 ± 8.14	54.5	56.4	50	0.68	NS
Diastolic pre	59.1 ± 6.83	58.4 ± 5.41	45.7	21.4	50	0.60	NS
Systolic post	109.7 ± 7.59	116.1 ± 7.16	56.4	50.3	50	4.38	S
Diastolic post	67.94 ± 8.59	71.4 ± 8.45	72.3	70	50	2.05	S
PR pre	78.56 ± 9.1	81.04 ± 8.09	81.1	64.1	50	1.45	NS
PR post	85.3 ± 10.8	97.7 ± 13.7	115	184	50	4.46	S

Table 2: Shows Statistical analysis between pre and post of group A

Blood Pressure	Mean ± SD		Variance		Observation	Z- stats	Significance
	Pre	Post	Pre	Post			
Without backpack systolic	99.7 ± 7.45	109.7 ± 7.59	54.5	56.4	50	0.68	NS
Without backpack Diastolic	59.1 ± 6.83	67.9 ± 8.59	45.7	72.3	50	5.75	S
With backpack Systolic	98.7 ± 8.19	116.1 ± 7.16	95.8	50.3	50	11.4	S
With backpack Diastolic	59.1 ± 5.41	71.4 ± 8.45	28.7	70	50	8.75	S
Without backpack PR pre	78.5 ± 9.1	86.3 ± 10.8	81.1	115	50	3.91	S
With backpack PR post	81.6 ± 8.09	97.7 ± 13.7	64.1	184	50	6.63	S

Table 3: Shows Statistical analysis between with and without backpack of Group B

Blood Pressure	Mean± SD		Variance		Observation	Z- stats	Significance
	Without backpack	With backpack	Without backpack	With backpack			
Systolic pre	96.8 ± 10.27	97.4 ± 10.9	29.8	39.2	50	0.51	NS
Diastolic pre	57.8 ± 6.72	58.4 ± 6.94	35.2	21.4	50	0.56	NS
Systolic post	97.4 ± 10	109.8 ± 11.2	39.2	71.5	50	8.38	S
Diastolic post	57.8 ± 10.9	64.5 ± 7.49	35.2	27.3	50	5.99	S
PR pre	79.5 ± 8.21	84.3 ± 9.68	59.5	92.4	50	2.77	S
PR post	92.18 ± 15	103.4 ± 17.7	153	185	50	4.31	S

Table 4: Shows Statistical analysis between Pre and Post of group B

Blood Pressure	Mean± SD		Variance		Observation	Z- stats	Significance
	Pre	Post	Pre	Post			
Without backpack systolic	97.4 ± 10.27	109.8 ± 7.38	39.2	71.5	50	8.38	S
Without backpack Diastolic	57.8 ± 6.72	64.5 ± 10	35.2	27.3	50	5.99	S
With backpack Systolic	96.8 ± 10.9	113.6 ± 11.2	29.8	52	50	13.1	S
With backpack Diastolic	66.6 ± 6.94	58.4 ± 7.49	30.4	21.4	50	8.05	S
Without backpack PR pre	79.54 ± 8.21	92.1 ± 15	59.5	153	50	6.13	S
With backpack PR post	84.38 ± 9.68	103.4 ± 17.7	92.4	185	50	8.07	S

Table 5: Shows Comparison Between Group A and Group B without back pack

Blood Pressure	Mean± SD		Variance		Observation	Z- stats	Significance
	A	B	A	B			
Without backpack Systolic pre	99.7 ± 7.45	97.4 ± 10.27	54.5	39.2	50	1.70	NS
Without backpack Diastolic pre	59.1 ± 6.83	57.8 ± 6.72	45.7	35.2	50	1.02	NS
Without backpack Systolic post	109.7 ± 7.59	109.8 ± 7.38	56.4	71.5	50	0.11	NS
Without backpack Diastolic post	67.9 ± 8.59	64.5 ± 10	72.3	27.3	50	2.43	S
Without backpack PR pre	78.5 ± 9.1	79.5 ± 8.21	81.1	59.5	50	0.58	NS
Without backpack PR post	86.3 ± 10.8	92.8 ± 15	115	153	50	2.53	S

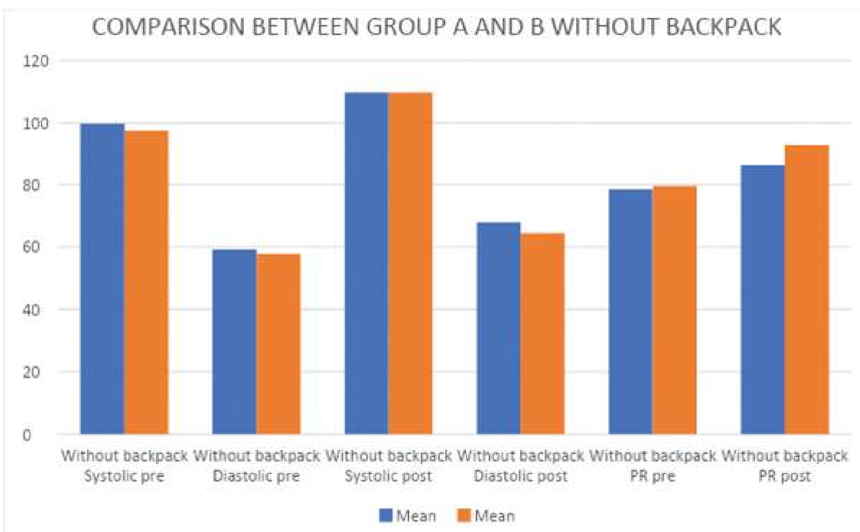

Fig. 1: Showing comparison between group A and B without backpack

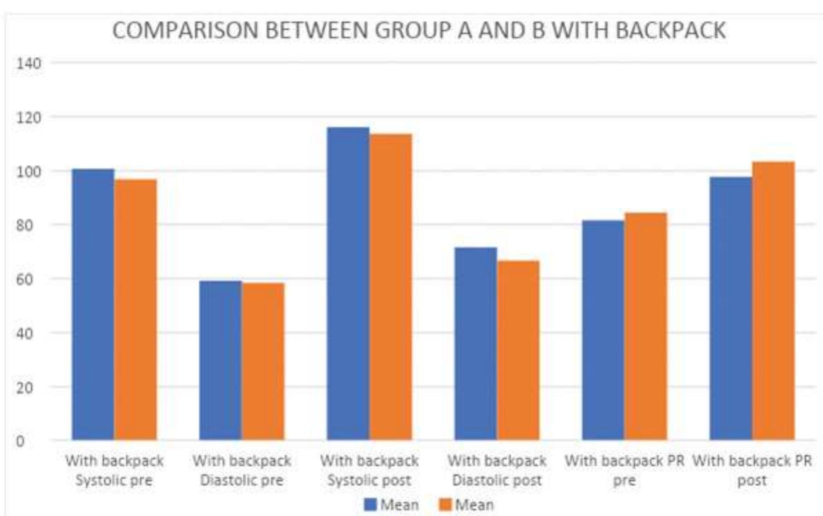

Fig. 2: Showing comparison between group A and B with backpack

Table 6: Shows Comparison between Group A and Group B with backpack

Blood Pressure	Mean± SD		Variance		Observation	Z- stats	Significance
	A	B	A	B			
With backpack Systolic pre	100.7 ± 8.14	96.8 ± 10.9	57	29.8	50	2.95	NS
With backpack Diastolic pre	59.1 ± 5.41	58.4 ± 6.94	28.7	21.4	50	0.69	NS
With backpack Systolic post	116.1 ± 7.16	113.6 ± 11.2	50	52	50	2.75	S
With backpack Diastolic post	71.4 ± 8.45	66.6 ± 7.49	70	30.4	50	3.38	S
With backpack PR pre	81.4 ± 8.09	84.3 ± 9.68	68	92.4	50	1.86	NS
With backpack PR post	97.7 ± 13.7	103.4 ± 17.7	184	185	50	2.09	S

Discussion

On comparison between group A and group B. Without backpack SBP post shows non- significant result while with backpack SBP post shows significant result. This gives the conclusion that the SBP had variations with and without backpack. The reason behind this could be walking tends to put some additional demand on our cardiovascular system because of which our muscles need more oxygen than they do when at rest, so it makes person to breathe more quickly and our heart starts to pump more harder and faster to circulate our blood to deliver oxygen to the muscles , that results in rise in SBP. The result shows more increase in SBP in group A than in group B. The possible reason behind this could be increased weight of the children than normal because of the unhealthy lifestyle. The DBP post both with and without backpack shows non-significant result this concluded that the DBP had no variations with without backpack and with backpack. Researches show that DBP increases more with intensive exercise and high load than moderate exercise and low load the force at which our heart contracts also increase while exercising.

Most of the time it is seen that PR is lower in trained athletes. it increases when person exercise to deliver more amount of blood and oxygen to the working muscles. In UG and HG both systolic and diastolic pre with and without backpack shows non-significant results because the BP is measured when the body is at rest and at rest bp does not show any variations. While both the systolic and diastolic post with and without backpack shows significant results because after 6MWT the force at which person's heart contracts increases that makes to pump more blood with each beat. Because of this effect BP increases after 6MWT. PR pre both with and without backpack shows non-significant results while PR post both with and without backpack shows significant results because the pulse rate of the person increases as person exercise to deliver more amount of blood and oxygen to the working muscles. On comparison of BP and PR pre and post without backpack systolic, diastolic pre and post shows significant result. With backpack systolic, diastolic pre and post shows significant results also pulse rate without backpack with backpack pre post shows significant results. This is because there are some variations of bp and pulse rate on rest without backpack and after six- minute walk with backpack.

Conclusion

Non-significant changes resulted in all the parameters except in systolic blood pressure among the systolic BP, diastolic BP and pulse rate.

Conflict of Interest – Nil

Funding – The study was funded by the authors.

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Original Article

Physiotherapy and Occupational Therapy Journal
Volume 12 Number 2, April - June 2019
DOI: http://dx.doi.org/10.21088/potj.0974.5777.12219.2

Heating Modalities and Stretching on Hamstring Flexibility among Football Players: A Single Blinded, Randomized Controlled Trial

Sutantar Singh[1], Kavita Kaushal[2]

How to cite this article:
Sutantar Singh and Kavita Kaushal. Heating Modalities and Stretching on Hamstring Flexibility among Football Players: A Single Blinded, Randomized Controlled Trial. Physiotherapy and Occupational Therapy Journal, 2019;12(2): 81-84

Abstract

Background: The ability of an individual to move smoothly depends on his flexibility, an attribute that enhances both safety and optimal physical activities. The hamstrings are example of muscle groups that have a tendency to shorten.

Purpose: To compare the efficacy of superficial and deep heating modalities in the management of hamstring flexibility among football players

Methods: A total of 60 football players, aged 18-26 years were recruited by the simple random sampling to participate in this two group pretest-posttest, single blinded randomized clinical study. Recruited football players were randomly allocated into two groups, group A and group B. Group A received superficial heating for 20 minutes on hamstring muscles by hydrocollator packs (moist heat packs). While in group B received deep heating for hamstring muscles through the short wave diathermy for 20 minutes. Then both the groups received static stretching for 30 seconds duration x 5 repetition/session x 2 days. Difference in range of motion (ROM) in knee extension from 90-90 position, pre-post intervention were used for analysis.

Results: Both group A and Group B demonstrated significance difference ($p<0.05$) in ROM.

Conclusion: Two session of static stretching after the application of superficial and deep heating modalities to hamstring muscles have no difference in flexibility among the elite football players.

Keywords: Diathermy; Football; Hamstring Muscles; Heating; Pliability; Soccer.

Introduction

Poor extensibility is a predisposing factor to muscle injury, especially with regard to the hamstring muscle group. Hamstring muscle injuries are the one of the most common musculotendinous injury in the lower extremity. According to the National Collegiate Athletic Association Injury Surveillance System, upper leg muscle-tendon strains constituted 10% of the practice injuries in men's football and 11% of the game injuries in men's baseball. In women's field hockey, 26.9% of the practice injuries consisted of upper leg strains [1]. Probably the most widely used method for increasing joint range of motion is stretching. Static stretching is most commonly performed to increase muscle length. In some settings, clinicians use a combination of heat and stretch for increasing flexibility and decreasing joint stiffness. A wide variety of heating modalities, including moist heat packs, whirlpools, ultrasound, and diathermy have traditionally been used in an effort to promote greater increases in flexibility [2]. Heating has long been used clinically to increase tissue extensibility. Both deep and superficial methods of heating are used for this purpose. The main methods of producing deep heating are ultrasound and short-wave diathermy. An important difference between

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Received on: 07.02.2019, **Accepted on** 16.04.2019

these methods is that short-wave diathermy can heat a larger area and volume of tissue than Ultrasound in the same time period. By contrast, most methods of superficial heating can heat large areas but smaller volumes of tissue because the depth of penetration is less [3]. Our purpose in this study was to compare the effects of deep heating (short-wave diathermy) and superficial heating (hydro collator packs) on hamstring flexibility.

Methodology

The study protocol was approved by the university research and ethics committee (AU/PT/2016/17) and the study was done strictly in accordance with the guidelines of Helsinki declaration, revised 2013 [4]. The study was registered under prospective clinical trial registry recognized under World Health Organization (WHO) clinical trials registry and conducted between September, 2015 and March, 2017. A total of 60 elite male football players were recruited by the simple random sampling (random number tables from standard statistics book) to participate in this two group pretest-posttest, single blinded randomized clinical study. The participants were blinded to the study. After the demographics, recruited male football players were randomly

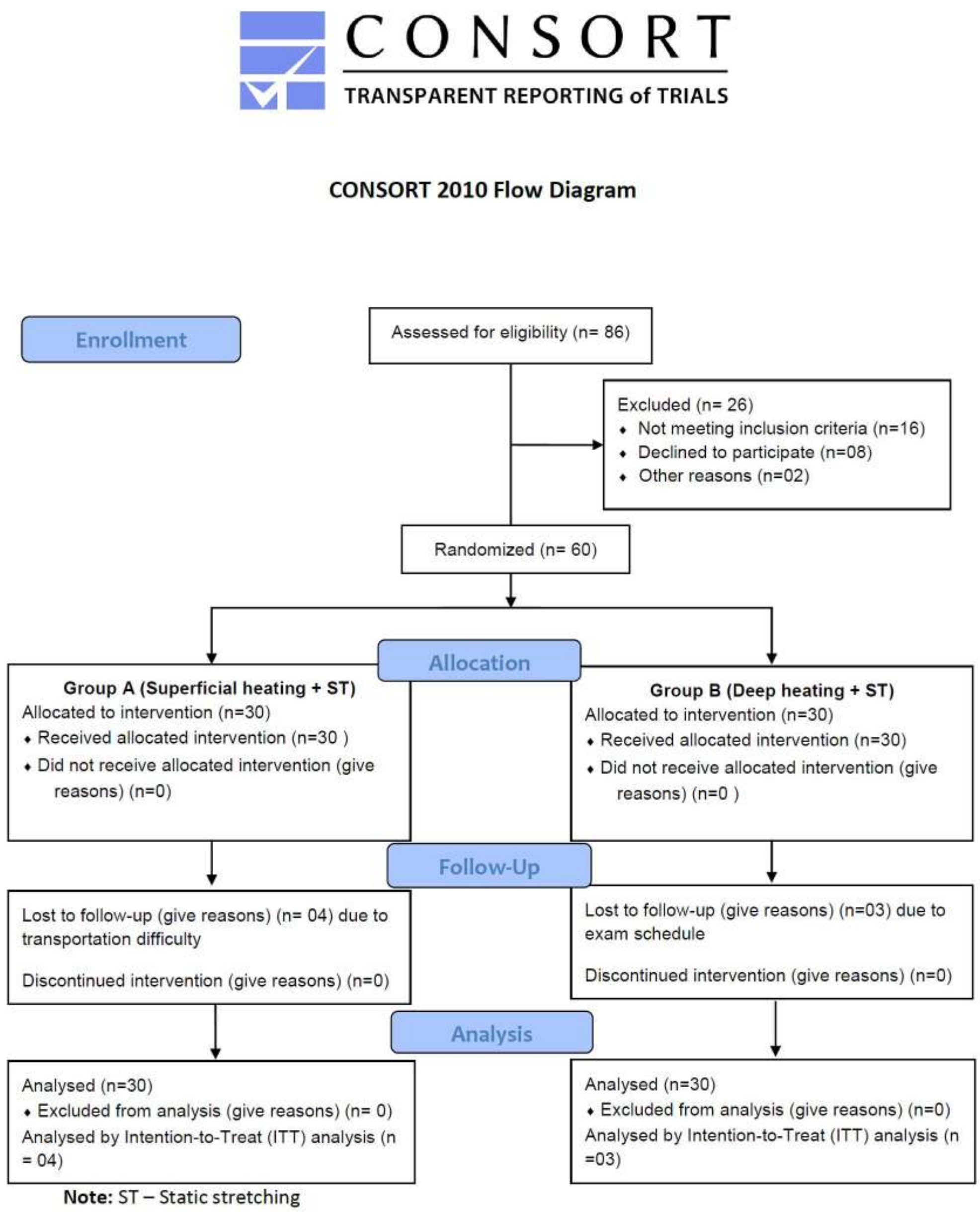

Fig. 1: Consort diagram describing the study flow

divided into two groups, group A and group B with by block randomization. There were five blocks, with the matrix design of 12 x 5, where 12 being rows. Each block contained 12 chits (6 chits for each group), totaling 60. The male football players were allotted to the group based on the randomly chosen chit. Once the block was allotted, next row block was opened. Thus, equal number of subjects were assigned to each group over time. Group A received superficial heating for 20 minutes on hamstring muscles by hydrocollator packs (moist heat packs) [1]. While in group B received deep heating for hamstring muscles through the short wave diathermy for 20 minutes. Both the groups received common intervention of single session static stretching to hamstring muscles which was given in 90-90 position for 30 seconds duration [5] x 5 repetition/session x 2 days. Difference in range of motion (ROM) in knee extension from 90-90 position, pre-post intervention were used for analysis. First session was performed under supervision, and other at their home without supervision. The Consolidated Standards of Reporting Trials (Consort) [6] flow chart describing the details of the study is displayed in Figure 1.

Data analysis

The collected demographic and outcome measures were assessed for their normality using Kolmogorov-Smirnov test. As the data follow normal distribution, all the descriptive were expressed in mean ± standard deviation. Paired t test was adopted to find out the differences within Group- A and group-B for pre-post intervention changes. While independent t- test was used to compare the changes in mean values of knee extension ROM between Group- A and Group- B at baseline and end of two days intervention. The data was analysed using statistical software, statistical package for social science (SPSS), IBM SPSS version 20.0 (Armonk, NY: IBM Corp.). The p-value ≤0.05 was considered to be statistically significant.

Results

Among sixty elite male football players were recruited for the study, seven were dropouts. The missing data was analysed using intention-to-treat analysis. The demographic characteristic of the elite male football players recruited were displayed in Table 1. The demographic characteristics were elaborated in Table 1. There exists no significance difference between the two groups. Between the session and group comparison at baseline and end of end of two days intervention for the outcome measures passive knee extension ROM (Fig. 2) were displayed. Both the groups demonstrated significant improvement in knee extension ROM when compared to baseline and post application of heating modalities with static stretching. No significant difference between groups were demosnstrated in their knee extension ROM.

Table 1: Demographic characteristics among the elite football players recruited

Demographic characteristic	Group A (Superficial heating)	Group B (Deep heating)	p- value
Age (Years)	22.1 ± 3.9	22.9 ± 3.1	0.8
Height (cm)	166.5 ± 3.7	168.1 ± 4.1	0.7
Weight (kg)	64.5 ± 6.1	66.9 ± 7.2	0.5
BMI (kg/m2)	22.2 ± 2.8	21.9 ± 3.6	0.9

Abbreviations: cm – centimeter; kg – kilogram; BMI – Body mass index.

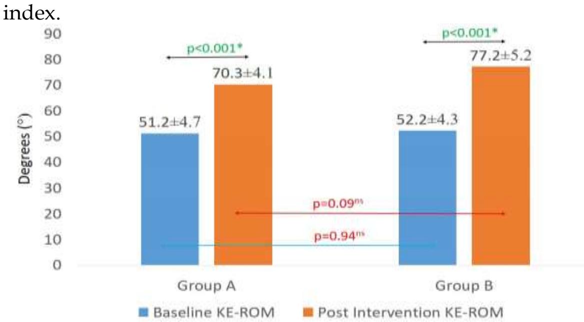

Figure 2: Mean knee extension range of motion (ROM) at baseline and end of 2 day intervention between group A and group B

Discussion

The purpose of the study was to compare the effectiveness of superficial heating and deep heating modalities on hamstring flexibility in football players. Both the groups group A and group B showed a significant increase in active knee extension ROM but the results were more significant for the group B. Thus the Deep heating following static stretching was more effective than superficial heat following static stretching.

The results of this study support the theory that when a soft tissue is heated then ROM is increased due to its elastic property. The results of our study are consistent with the result published by Robertson V.J et.al that the deep heat is more effective than superficial heat in increasing flexibility [3]. The previous studies showed that heating at 3-cm depth by using SWD identified the temperature increases of 4° to 4.6°C. The method of applying hot packs is, a silicate gel pack heated to 75° to 80°C in a water hydro collator. At 3-cm tissue depth, the expected muscle temperature elevation is 1°C [3].

This study had few limitations. The generalizability of the results might be affected by the slightly less sample size and the sample size, n=60 used in this study was not estimated by sample size calculation. This was just an arbitrary value, which might affect the extrapolation of the results. Second, we have failed to measure the skin temperature of hamstring muscle, pre and post heating by both the method. Nevertheless, this was the first study to estimate the efficacy of hamistring flexibility by superficial and deep heating modality among the football players in India. Future studies should be drafted with adequate sample size (after sample size calculation) and maintaining power of the study >80% to minimize type-II error.

Conclusion

Two session of static stretching after the application of superficial and deep heating modalities to hamstring muscles have no difference in flexibility among the elite football players.

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Original Article

Physiotherapy and Occupational Therapy Journal
Volume 12 Number 2, April - June 2019
DOI: http://dx.doi.org/10.21088/potj.0974.5777.12219.3

To Compare the Effectiveness of Incentive Spirometer and Inspiratory Muscles Trainer in Patients with Chronic Obstructive Pulmonary Disease

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How to cite this article:
Jaya Negi, Niraj Kumar and Nishu Sharma *et al.* To Compare the Effectiveness of Incentive Spirometer and Inspiratory Muscles Trainer in Patients with Chronic Obstructive Pulmonary Disease. Physiotherapy and Occupational Therapy Journal. 2019;12(2):85-94

Abstract

Introduction: Chronic obstructive pulmonary disease is characterized by persistent airflow limitation that is usually progressive and associated with an enhanced chronic inflammatory response in the airways to noxious particles or gases. Exacerbations and co morbidities contribute to the overall severity in individual patients [1]. In India, according to National Commission on Macroeconomics and Health background paper by Murthy et al., the annual treatment costs for COPD had been estimated to be greater than Rs. 35,000 crores in 2011 and Rs. 48,000 crores in 2016 [3]. COPD produces obstruction to the airflow which affects both the mechanical function and gas exchange of the lung. Respiratory muscles must work harder to overcome this resistance and therefore it leads to weakness of the respiratorymuscles. Drug therapy is the main treatment in patients with COPD which includes bronchodilators, mucolytics, appropriate antibiotics and corticosteroids. Following drug therapy, physical rehabilitation is the only management which reduce dyspnea [4]. Resistive Inspiratory Devices are hand-held devices of varying diameter. The resistance is increased by decreasing the diameter of the devices and resistance is decreased by increasing the diameter of the devices airway [7].

Aims and Objectives of the Study: To compare the effectiveness of Incentive Spirometer and Inspiratory muscles trainer on ventilatory muscle strength on patients with COPD.

Methods: Thirty subject male or female with COPD aged between 40-80 years were selected according to convenience (purposive) sampling based on the selection criteria. Subjects were are 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.

Discussion: In this study, efforts were made to compare the effects of Incentive Spirometer and Inspiratory muscles trainer devices as a treatment for improving ventilatory muscle strength in patients with mild to severe dyspnea in COPD. The study was done on randomized 30 COPD patients with mild to moderate dyspnea diagnosed by physician. The patients were randomly divided into 2 groups consisting of 15 subjects each. Group A was treated with Inspiratory muscles trainer and Group B with Incentive spirometer for a duration of 4 weeks. 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. However statistically there was significant difference between the two groups.

Conclusion: 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.

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Received on: 02.01.2019, **Accepted on** 02.02.2019

Keywords: Datacollectionsheet;Wristwatch;Timer; Incentive Spirometry withaccessories;Threshold inspiratory muscle training device (Philips Company); Modified Medical Research Council Dyspnea Scale (mMRC); Baseline Dyspnea Index (BDI) and Transition Dyspnea Index (TDI).

Introduction

Chronic obstructive pulmonary disease is characterized by persistent airflow limitation that is usually progressive and associated with an enhanced chronic inflammatory response in the airways to noxious particles or gases. Exacerbations and co morbidities contribute to the overall severity in individual patients [1]. As per WHO, Non communicable diseases refer to "Diseases that are chronic, life style related and usually progressive when not intervened". This holds true for COPD also as it is chronic, progressive and most of the risk factors are lifestyle related (smoking, biomass fuel exposure etc). Recently, the BOLD study conducted in Pune, Mumbai and Srinagar reported overall COPD prevalence estimates of 6.25%, 6.8% and 16.05%, respectively [2].

In India, according to National Commission on Macroeconomics and Health background paper by Murthy et al., the annual treatment costs for COPD had been estimated to be greater than Rs. 35,000 crores in 2011 and Rs. 48,000 crores in 2016 [3]. COPD produces obstruction to the airflow which affects both the mechanical function and gas exchange of the lung. Respiratory muscles must work harder to overcome this resistance and therefore it leads to weakness of the respiratorymuscles. Drug therapy is the main treatment in patients with COPD which includes bronchodilators, mucolytics, appropriate antibiotics and corticosteroids. Following drug therapy, physical rehabilitation is the only management which reduce dyspnea [4].

Patients with COPD present diverse degree of dyspnea and deterioration in exercise capacity in association with impaired cardio pulmonary function. Weakness and deconditioning of the respiratory muscles and peripheral muscles reduce exercise capacity and quality of life. Most commonly the functions of the inspiratory muscles are found to be impaired (decreased strength and endurance). Ventilatory Muscle Training (VMT) is an important component of the physical rehabilitation which improves the strength and endurance of the respiratory muscles. The different types of ventilatory muscle training includes Incentive Spirometry, Inspiratory resistance training with various Resistive Inspiratory Devices, and different breathing techniques for the relief of dyspnea [5].

The incentive spirometer is a device that encourages patients with visual and other positive feedback, to maximally inflate their lungs and sustain that inflation. It is a common mode of postoperative respiratory therapy and involves deep breathing facilitated by a simple mechanical device. Maximal lung inflation is thought to open collapsed alveoli and thereby prevent and resolve atelectasis. Incentive spirometer (IS) is the treatment technique which utilizes the incentive spirometer for respiratorytherapy [6].

Resistive Inspiratory Devices are hand-held devices of varying diameter. The resistance is increased by decreasing the diameter of the devices and resistance is decreased by increasing the diameter of the devices airway [7].

Incentive Spirometry and Resistive Inspiratory Devices are widely used to improve inspiratory muscle strength and to reduce dyspnea. These devices offer resistance while performing inspiration. Incentive Spirometer is a simple instrument which provides visual and auditory feed-back to the patient while performing inspiration, so that patient can achieve their preset goals. It encourages deep breathing and a sustained inspiration [8].

Objectives

Need of Study

To best of our knowledge there are several studies has been done on COPD but no studies has been done to compare the effectiveness of Incentive Spirometer (ICS) and Inspiratory muscles trainer (IMT) in patients with COPD.

Aims and Objectives of the Study

To compare the effectiveness of Incentive Spirometer and Inspiratory muscles trainer on ventilatory muscle strength on patients with COPD.

Hypothesis

Experimental Hypothesis

There is significant difference between the effect of incentive spirometery and inspiratory musclestrainer.

Null Hypothesis

There is no significant difference between the effect of incentive spirometery and inspiratory muscles trainer.

Review of Literature

Lung Anatomy

Each lung is conical in shape. It has:

(1) An apex at the upper end;

(2) A base resting on the diaphragm;

(3) Three borders, i.e. anterior, posterior and inferior; and

(4) Two surfaces, i.e. costal and medial. The medial surface is divided intovertebral and mediastinal parts.

Fissures and Lobes of the Lungs

The right lung is divided into 3 lobes (upper, middle and lower) by two fissures, oblique and horizontal. The left lung is divided into two lobes by the oblique fissure. The oblique fissure cuts into the whole thickness of the lung, except at the hilum.

Root of the Lung

Root of the lung is a short, broad pedicle which connects the medial surface of the lung to the mediastinum. It is formed by structures which either enter or come out of the lung at the hilum. The roots of the lungs lie opposite the bodies of the fifth, sixth and seventh thoracicvertebrae [9].

The Blood Vessels

The lungs have two blood supplies. The first arises from the right ventricle and carries deoxygenated blood via the pulmonary artery to the pulmonary capillaries, and thence the pulmonary vein back to the left atrium.

Bronchial Tree

The trachea divides at the level of the lower border of the fourth thoracic vertebra into two primary principal bronchi, one for each lung. The right principal bronchus is 2.5 cm long. It is shorter, wider and more in line with the trachea than the left principal bronchus. The left principal bronchus is 5 cm. It is 1 longer, narrower and more oblique than the right bronchus. Each principal bronchus enters the lung through the hilum, and divides into secondary lobar bronchi, 1 one for each lobe of the lungs. Thus there are three 1 lobar bronchi on the right side, and only two on the 1 left side.

Each lobar bronchus divides into tertiary or segmental bronchi, one for each broncho pulmonary segment; which are 10 on the right side and 10 on the left side. The segmental bronchi divide repeatedly to form very small branches called terminal bronchioles. Still smaller branches are called respiratory bronchioles. Each respiratory bronchiole aerates a small part of the lung known as a pulmonary unit.

The respiratory bronchiole ends in microscopic passages which are termed:

(i) Alveolarducts,

(ii) Atria,

(iii) Air saccules,and

(iv) Pulmonary alveoli. Gaseous exchanges take place in thealveoli.

Broncho pulmonary Segments

These are well-defined sectors of the lung, each one of which is aerated by a tertiary or segmental bronchus. Each segment is pyramidal in shape with its apex directed towards the root of the lung. There are 10 segments on the right side and 10 on the left. Inter segmental planes. Each segment is surrounded by connective tissue which is continuous on the surface with pulmonary pleura. Thus the broncho pulmonary segments are independent respiratory units [9].

Right lung		
Upper lobe	Middle lobe	Lower lobe
1. Apical 2. Posterior 3. Anterior	4. Lateral 5. Medial	6. Superior 7. Anterior basal 8. Medial basal 7. Lateral basal 8. Posterior basal

Left lung	
Upper lobe	Lower lobe
1. Apical 2. Posterior 3. Anterior 4. Superior lingular 5. Inferior lingular	6. Superior 7. Medial basal 8. Anterior basal 9. Lateral basal 10. Posterior basal

Physiology

A. The principal organs of the respiratory system include the nose, pharynx, larynx, trachea bronchi, and lungs. Within the lungs the main bronchi branch into 22 generations.

1. Air distribution to the gas exchangesurface.
2. Warming and humidifying theair.
3. Serving as a part of body defencesystem.
4. Preventing the alveolar oxygen and carbon dioxide partial pressures fromextreme changing

B. Air Flow and Airway Resistance

1. The volume of air that enters or leaves the alveoli per time unit is directly proportionate to the pressure difference and inversely proportionate to the airwayresistance.
2. The airway resistance is directly proportionate to the length of the airway and the magnitude of interactions between the flowing gas molecules, and it is inversely proportionate to r^4 or r^5 (r - airway radius).

3. When the breathing frequency is 15 times per minute, the airway resistance provides 28% of the total resistance toventilation.
4. Many factors, such as lung expansion, stimulation of muscarinic or beta-adrenergic receptors modify the airway diameter and, consequently, the airway resistance [10].

C. Gas exchange

Diffusion Gas exchange is the process of transferring gases across the alveolar and capillary membranes and it requires both diffusion of gas and perfusion of blood. Diffusion is a passive process, and it is for this reason that the lungs have evolved the structure that we see in terrestrial mammals.

Perfusion is such an important part of the gas exchange process that it merits specific consideration in relation to gas exchange Deoxygenated blood is returned to the lungs via the right side of the heart and the pulmonary artery. The latter is the only artery in the body to carry deoxygenated blood, which is distributed to a huge capillary network within the lung.

The factors influencing blood-flow distribution in the lungs include:

- Gravity (via alveolar pressure and hydrostaticpressure)
- Bloodvolume
- Cardiacoutput
- Pulmonary arterialpressure
- Pulmonary arterialresistance
- Lung volume (via alveolar pressure)
- Alveolar gas pressure (influenced by lung volume andgravity) [10].

Control of Breathing

Automatic control of the cardiovascular system, the respiratory system is under direct voluntary control, which is essential for a wide range of everyday activities, e.g., speaking, blowing, sniffing, straining, lifting, etc. The respiratory control center resides within the brainstem, receiving a myriad of inputs from somatic receptors, as well as from other parts of thebrain [11].

Mechanism of Respiration

Respiratory Movements

Respiration occurs in two phases namely inspiration and expiration. During inspiration, thoracic cage enlarges and lungs expand so that air enters the lungs easily. During expiration, the thoracic cage and lungs decrease in size and attain the pre inspiratory position so that air leaves the lungs easily. During normal quiet breathing, inspiration is the active process and expiration is the passive process [10].

Muscles of Respiration

Primary Muscles: The primary inspiratory muscles are the diaphragm and external intercostal. Relaxed normal expiration is a passive process. However there are a few muscles that help in forceful expiration and include the internal intercostal, intercostalisintimi, subcostals and the abdominal muscles.

Accessory Muscles: The accessory inspiratory muscles are the sternocleidomastoid, the scalenus anterior, medius, and posterior, the pectoralis major and minor, the inferior fibres of serratus anterior and latissimusdorsi, the serratus posterior anterior may help in inspiration also the iliocostaliscervicis. The accessory expiratory muscles are the abdominal muscles: rectus, abdominis, external oblique, internal oblique and transversusabdominis. And in the thoracolumbar region the lowest fibres of iliocostalis and longissimus, the serratus posterior inferior and quadratuslumborum.

Movements of Lungs

During inspiration, due to the enlargement of thoracic cage, the negative pressure is increased in the thoracic cavity. It causes expansion of the lungs. During expiration, the thoracic cavity decreases in size to the pre inspiratory position. Pressure in the thoracic cage also comes back to the pre inspiratory level. It compresses the lung tissues so that, the air is expelled out oflungs.

Authors Statements

Kisner *et al.* defined, COPD as obstruction of flow of air in the respiratory tract thus affecting ventilation and gas exchange. COPD are the disease of the respiratory tract that produce an obstruction to the airflow and that ultimately can affect both the mechanical function and gas exchanging capability of the lungs [17].

Hillegass EA, Sadowsky HS (2001) *et al*. Chronic bronchitis is defined as the hyper secretion of mucus, sufficient to produce a productive cough on most days for 3 months during 2 consecutive years. Emphysema is abnormal and permanent enlargement of the air spaces distal to the terminal respiratory bronchiole, accompanied by destructive changes of the alveolar walls [18].

Donna Frownfelter, Elizabeth Dean (2006) *at el.* COPD is a disorder characterized by increase in airway resistance, particularly noticeable by prolonged forced expiration. Chronic bronchitis is a disease characterized by a cough producing sputum for at least 3 months and for 2 consecutive years [8].

Haslett C. Davidson S. Davidson's (1999) *et al.* COPD is chronic and slowly progressive disorder characterized by airflow obstruction (FEV1<80%) and chronic respiratoryfailure [19].

Sharma SK, Anand MP & Acharya VN (2003) *et al*. Various etiological factors are responsible for production of COPD. Cigarette smoking is one among the most prevalent risk factor for the development of COPD. As the tobacco exposure increases by hukka, bidi and cigarette, greater is the risk of developing COPD. Pipe and cigar smokers have higher morbidity and mortality from COPD than non- smokers although it is lower than cigarette smokers [20].

Sharma SK, Anand MP & Silverman (2003) *et al.* The cumulated amount of tobacco smoked is related to its adverse effects. Prolong smoking impairs the ciliary action and produces hypertrophy with hyperplasia of mucus secreting glands, further smoking inhibits the antiprotease and causes neutrophils to release proteolytic enzymes. Smoking causes recruitment of alveolar macrophages that's releases elastolytic enzymes and this elastase triggers emphysema [20,21].

O'Sullivan BS, Schmitz JT (2001) *et al*. Patients with COPD have airflow limitation due to airway obstruction. In emphysema exposure to chronic smoke leads to inflammatory cell recruitment within the terminal air space of the lungs. These inflammatory cells release elastolytic proteinase which damages the extra cellular matrix of lungs that leads to apoptosis of structural cells of the lungs. Inefficient repair of elastin and other extra cellular matrix component results in air space enlargement that defines pulmonary emphysema [23].

Gaude G S, Nadagouda & Katz MJ (2010-2011). In later stages of COPD, the patient does not have the energy to hyperventilate, so carbon dioxide builds up in the blood. Now the hypoxemia is accompanied by hyper- capnea (excess blood carbon dioxide), and the patient develops chronic respiratory acidosis, an ominous sign. Hypoxemia with acidosis is found in the late phase of the course of COPD [22,24].

Katz MJ (2010) *et al.* Chest x-rays are used to rule out other causes of airway obstruction, such as mechanical obstruction, tumours, infections, effusions, or interstitial lung diseases. In acute exacerbations of COPD, chest x-rays are used to look for pneumothorax, pneumonia, and atelectasis (collapse of part of a lung). When COPD includes significant chronic bronchitis, chest x-rays have a dirty look. There are more vascular markings and more nonspecific bronchial markings, and the walls of the bronchi look thicker than normal when viewed end on. Often, the heart appears enlarged [24].

Yoshimi K, Seyama K. Spirometry and Pitta F, Takaki (2007-2008) *et al.* Some of the other pulmonary function tests that are useful for understanding the pathophysiology of COPD include the diffusing capacity measurement of carbon monoxide per litter of alveolar volume (DLco/VA), measurement of lung volume using the nitrogen washout technique and whole body plethysmography, and measurement of lung compliance [25,26].

Methodology

Thirty (30) subjects were are randomly assigned into two group of 15 subjects each namely experimental Group A and control Group B. All the participant took a part in the experiments on a voluntary basis after signing a consent form and a demographic data was collected from each subject. This study was conducted in SMIH Hospital, Patel Nagar, Dehradun.

Inclusion Criteria: Age of 40-80 years of both sexes, Mild to moderate stable chronic obstructive pulmonary disease patients diagnosed by physician, Patient with an ability to perform incentive spirometry and inspiratory muscle training and Medically stable declared by the physician.

Exclusion Criteria: Patient with a history of asthma, allergic rhinitis or atopy are excluded.

Instrumentation: Data collection sheet, Wrist watch, Timer, Incentive Spirometry with accessories, Threshold inspiratory muscle training device (Philips Company), Modified Medical Research Council Dyspnea Scale (mMRC), Baseline Dyspnea Index (BDI) and Transition Dyspnea Index (TDI).

Procedure: Thirty (30) subjects were are 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.

Inspiratory Muscles Trainer 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 [Fig. 1].

Fig. 1: Training with Inspiratory muscles trainer Devices

Incentive Spirometry

The patients were positioned on a treatment couch in semi-Fowler's position with adequate back support.

Patients were asked to take three to four slow, easy breaths and maximally exhale with the forth breath. The patients were asked to place mouth piece of Incentive Spirometer in mouth, and maximally inhaled through the mouth piece. As the patient inhaled through the mouth piece, a pressure drop occurs and causes the ball in the tube to rise to a level equivalent to the flow around it. At the end of maximal inspiration, the patients were asked to hold and then to exhale. This sequence was repeated for 10 to 15 times in each session. Treatment was given 2 times per day for the period of 4weeks [Fig. 2].

Data Analysis: The data was analyzed by Graph Pad Prism software version 8.0.1. Paired T-test used to compare (mMRC) modified medical research council dyspnea scale between experimental and control group. 2 Way Anova test used to compare to baseline dyspnea index (BDI) and transition dyspnea index between experimental and control group.

Fig. 2: patient performing Incentive spirometry

Results

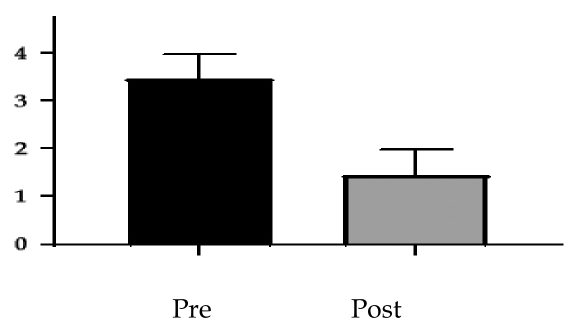
This results deals with the data analysis of the dyspnea scale between A and B. This course was analysed to compare the effectiveness of treatment protocols.

Paired T-test and 2 WAY- ANOVA test was used to compare the parameters of dyspnea between group A and group B.

Analysing mMRC revealed significant changes in pre-treatment experimental group with mean and SD (3.47 ± 0.5164) when compared with post treatment with mean and SD (1.47 ± 0.5164) [Table 1 & Graph 1].

Table 1: Mean and SD of mMRC of experimental group of pre and post treatment

Group	Mean ± SD	P value
Pre-treatment	3.47±0.5164	<0.0001
Post treatment	1.47±0.5164	<0.0001

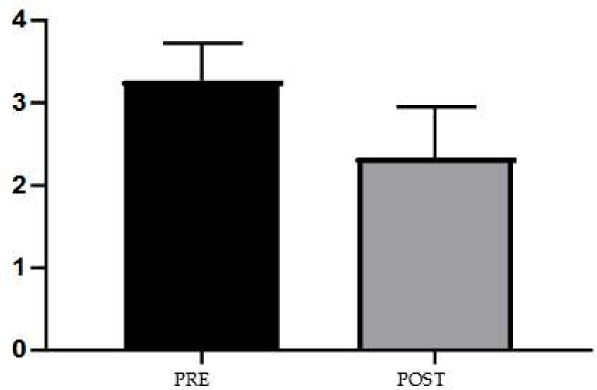


Graph 1: Comparison of Mean and SD of mMRC of experimental group of pre and post treatment

Analysing mMRC revealed significant changes in pre-treatment control group with mean and SD (3.27 ± 0.457) when compare with post treatment with mean and SD (2.33 ± 0.617) [Table 2 & Graph 2].

Table 2: Mean and SD of mMRC of control group of pre and post treatment

Group	Mean ± SD	P value
Pre treatment	3.27±0.457	<0.0001
Post treatment	2.33±0.617	<0.0001

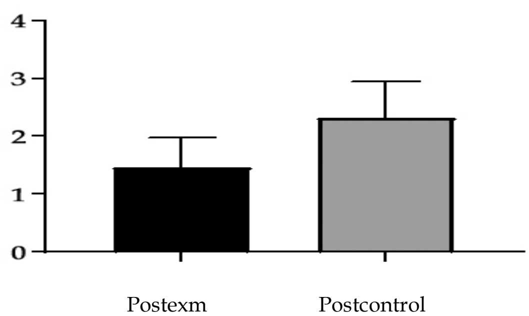


Graph 2: Comparison of Mean and SD of mMRC of experimental group of pre and post treatment.

Analysing mMRC revealed significant changes in experimental group with mean and SD (1.47 ± 0.5164) when compared with control group with mean and SD (2.33 ± 0.6172). [Table 3 & Graph 3].

Table 3: Mean and SD of mMRC of experimental group (group A) and control group (GroupB).

Group	Mean ± SD	P value
Experimental Group A	1.47±0.5164	<0.0001
Control Group B	2.34±0.6172	<0.0001

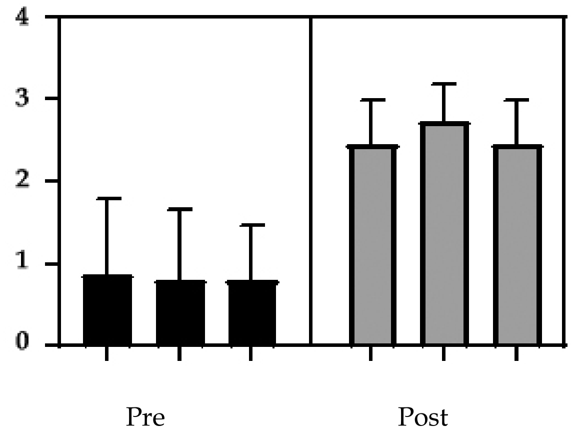


Graph 3: Comparison of Mean and SD of mMRC post treatment of experimental group and control group.

Analysing BDI and TDI revealed significant changes in pre-treatment experimental group with mean (3.47) when compared with post treatment with mean (1.47) [Table 4 & Graph 4].

Table 4: Mean and SEM of BDI/TDI of experimental group of pre and post treatment

Group	Mean± SEM	p value
Pre-treatment	0.83±0.09428	<0.0001
Post treatment	2.57±0.09428	<0.0001

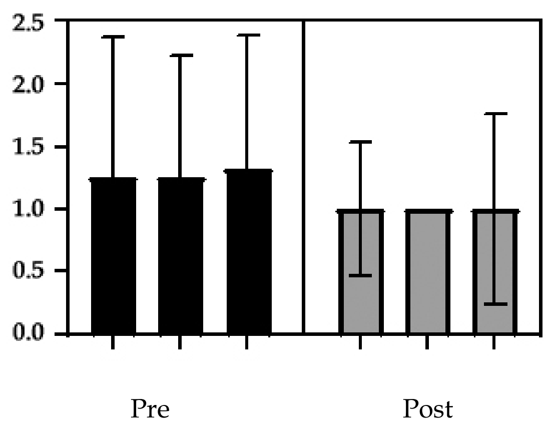


Graph 4: Comparison of Mean and SEM of BDI/TDI of experimental group of pre and post treatment

Analysing BDI and TDI revealed significant changes in pre-treatment control group with mean (1.29) when compared with post treatment with mean (1.00) [Table 5 & Graph 5].

Table 5: Mean and SEM of BDI/TDI of control group of pre and post treatment

Group	Mean± SEM	P value
Pre treatment	1.29±0.0948	<0.0033
Post treatment	1.00±0.0948	<0.0033

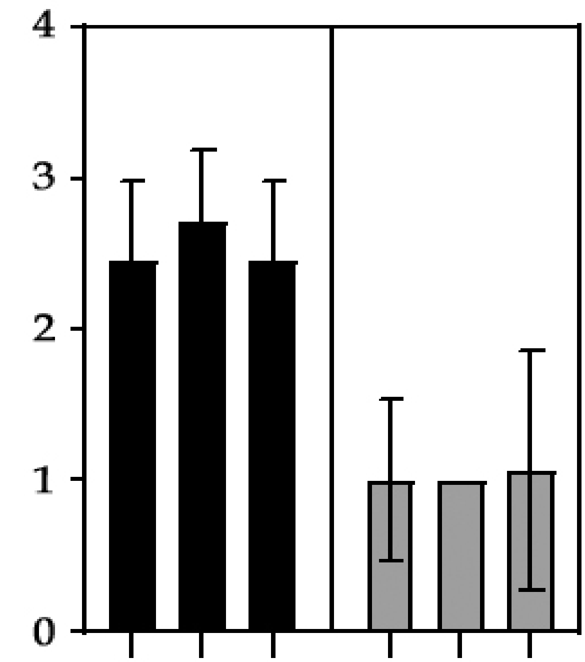


Graph 5: Comparison of Mean and SEM of BDI/TDI of control group of pre and post treatment

Analysing BDI and TDI revealed significant changes in experimental group with mean (2.56) when compared with control group with mean (1.02). [Table 6 & Graph 6].

Table 6: Mean and SEM of BDI/TDI of experimental group (group A) and control group (Group B)

Group	Mean ± SEM	p value
Experimental group	2.57± 0.1066	<0.0001
Control group	1.03± 0.1066	<0.0001



Graph 6: Comparison of Mean and SEM of BDI/TDI post treatment of experimental group and control group

Discussion

In this study, efforts were made to compare the effects of Incentive Spirometer and Inspiratory muscles trainer devices as a treatment for improving ventilatory muscle strength in patients with mild to severe dyspnea in COPD. The study was done on randomized 30 COPD patients with mild to moderate dyspnea diagnosed by physician. The patients were randomly divided into 2 groups consisting of 15 subjects each. Group A was treated with Inspiratory muscles trainer and Group B with Incentive spirometer for a duration of 4 weeks. 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. However statistically there was significant difference between the 2 groups.

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 tools such as mMRC, BDI/TDI. This scale is both reliable and valid significantly correlated with lung function and maximal exercise performance in patients significantly correlation between changes in maximal inspiratory pressure and commonest in the transitional dyspnea index support the concept increase inspiratory muscles strength may reduce dyspnea.

An improvement in inspiratory muscles strength and endurance might reduce symptoms and improve functional capacity in patients with severe COPD, even if airflow obstruction does not improve. Inspiratory muscles training is recommended for COPD patients and in a recent meta-analysis.

The "t" test and 2 way ANOVA was done to find out the significant of the data between two groups. Overall 15 COPD patient receive incentive spirometer technique and 15 patients receive inspiratory muscles trainer device technique. 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. 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 targeted inspiratory muscle straining result in significant increase in respiratory muscles functional 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). In this study proved that inspiratory muscles trainer is more effective than incentive spirometer in improving respiratory muscles strength and reduce dyspnea

The drawback of this study is and IS is simple device that can easily pursed and be used at the bed side of inspiratory muscle training and threshold device is very expensive and not easily available in themarket.

Conclusion

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.

Limitations of the Study

- The study is conducted for a short duration and no follow up is done with the patients so, study shows only immediate effects and not the long -term effects.

- 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 thestudy.

Scope for Further Study

- Further study can be done to check the combined effects of Incentive Spirometer and Resistive Inspiratory Devices.
- The exact mechanism behind the reduction of dyspnea following training and the relationship between the reduction of dyspnea and ventilatory muscle training can be studied in more detail.

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Original Article

Physiotherapy and Occupational Therapy Journal
Volume 12 Number 2, April - June 2019
DOI: http://dx.doi.org/10.21088/potj.0974.5777.12219.4

Comparison of The Effectiveness of Myofacial Release Technique and Stretching Exercise on Plantar Fascitis

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How to cite this article:
Hemlata, Niraj Kumar, Shama Praveen *et al.* Comparison of The Effectiveness of Myofacial Release Technique and Stretching Exercise on Plantar Fascitis. Physiotherapy and Occupational Therapy Journal. 2019;12(2):95-102

Abstract

Introduction: Planter Fasciitis is an annoying and painful condition that limits function. There is pain and tenderness in the sole of the foot, mostly under the heel, with standing or walking [1]. Plantar fasciitis is classified as a syndrome that results from repeated trauma to the plantar fascia at its origin on the calcaneus. It is a common foot disorder affecting more than 2 million individuals in the United States annually [2,3]. Myofascial release (MFR) is a system of therapy that combines principles and practice from soft tissue technique, MET and inherent force cranio-sacral technique. It includes a highly subjective transfer of energy from the therapist to the patient [11]. Stretching is a general term used to describe any therapeutic maneuver designed to increase the extensibility of soft tissues, thereby improving flexibility by elongating (lengthening) structures that have adaptively shortened and have become hypo mobile over time [13].

Aim and Objective: To compare the effects of MFR and Stretching exercise on plantar fasciitis.

Methodology: After assigning into 2 groups Group A - Subjects were received for MFR therapy and exercises for plantar fascia. 10 second MFR technique applied by knuckle on sole. The intervention was followed for 2 times / week for 4 weeks. And Group B - Subject receives static stretching and exercises of the plantar fascia, hold for 30 seconds with 5 repetition. This intervention was followed 3 sets for 30 seconds per session and 1 session per week i.e., 4 sessions 4 weeks.

Discussion: The results were showed that both group A, and group B were effective in the treatment of plantar fasciitis but after comparison group A shown better results than group B. William P. Hanten September 1994. *et al.* Myofascial release techniques are claimed to cause vasomotor response, increase blood flow to affected areas, increase lymphatic drainage of toxic metabolites, realign fascia 1 planes, influence the proprioception of affected soft tissue, alleviate musculoskeletal pain and dysfunction and restore functional ROM in areas of painful restriction [12]. Kuhar *et al.* showed a significant result that the myofascial release is an effective therapeutic option in the treatment of plantar fasciitis [16].

Conclusion: The present study concluded that Myofascial release (MFR) is better than Stretching exercises in 4 weeks intervention patients with plantar fasciitis.

Keywords: Myofascial release (MFR), Stretching exercises, Foot function index & Visual analogue scale.

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Received on: 20.03.2019, **Accepted on** 16.04.2019

Introduction

Planter Fasciitis is an annoying and painful condition that limits function. There is pain and tenderness in the sole of the foot, mostly under the heel, with standing or walking. There may be an associated tightness of the Achilles tendon. The pain is often worst when first getting up in the morning, with typical hobbling downstairs, or when first getting up from a period of sitting-the typical start up pain and stiffness [1].

Plantar fasciitis is classified as a syndrome that results from repeated trauma to the plantar fascia at its origin on the calcaneus. It is a common foot disorder affecting more than 2 million individuals in the United States annually [2,3].

It occurs over a wide age range and is seen in both sedentary and athletic individuals. Although its precise cause remains unclear, the most common theory is repetitive partial tearing and chronic inflammation of the plantar fascia at its insertion on the medial tubercle of the calcaneus [4].

The plantar fascia is a thick fibrous sheet of connective tissue that originates from the medial tubercle of the calcaneous and attaches distally to the metatarsophalangeal joints, forming the medial longitudinal arch [5].

It stabilizes the medial longitudinal arch dynamically, it restores the arch and aids in reconfiguring the foot for efficient toe-off and it provide static support of longitudinal arch and dynamic shock absorption [6,7, & 8].

Degeneration of the plantar fascia at its calcaneal origin is termed plantar fasciitis. Researchers have also reported that faulty biomechanics and plantar fasciitis in subjects with a higher-arched foot. A higher-arched foot lacks the mobility needed to assist in absorbing ground reaction forces. Consequently, its inability to dissipate the forces from heel strike to midstance increases the load applied to the plantar fascia, much like a stretch on a bowstring [3 & 5].

The plantar fascia shortening caused by changes in the collagen matrix of the plantar fascia is the pathophysiological basis of this condition, which evolves to include pain and functional changes of gait. Shortening of the plantar fascia leads to chronic bone traction in the heel and formation of heel spurs [9].

Treatment for plantar fasciitis can be divided into numerous categories as Conservative care (chiropractic therapy, electric modalities, patient education, soft tissue therapy massage, acupuncture, taping, night splints, stretching, ice, heat, strengthening, and orthotics) Extra-corporeal shock wave therapy, Injections and medication [10].

MFR is defined by Upledger et al that it is a softening or letting go when resistance melts and the tissue is felts and elongation. MFR techniques can involve deep superficial or deep Myofascial release (MFR) is a system of therapy that combines principles and practice from soft tissue technique, MET and inherent force cranio-sacral technique. It includes a highly subjective transfer of energy from the therapist to the patient [11].

Myofascial release (MFR) is a system of therapy that combines principles and practice from soft tissue technique, MET and inherent force cranio-sacral technique. It includes a highly subjective transfer of energy from the therapist to the patient [12].

Stretching is a general term used to describe any therapeutic maneuver designed to increase the extensibility of soft tissues, thereby improving flexibility by elongating (lengthening) structures that have adaptively shortened and have become hypo mobile over time. Stretching exercises are also thought to be an important element of fitness and conditioning programs designed to promote wellness and reduce the risk of injury and reinjury. When soft tissue is stretched, elastic, viscoelastic, or plastic changes occur. Elasticity is the ability of soft tissue to return to its pre-stretch resting length directly after a short-duration stretch force has been removed. Viscoelasticity is a time- dependent property of soft tissue that initially resists deformation, such as a change in length, of the tissue when a stretch force is first applied [13].

The Foot Function Index (FFI) Questionnaire was used to assess pain and disability associated with each subject's plantar fasciitis. The FFI is a functional outcome measure that consists of three subsections: pain, disability and activity [10].

Aim and Objective

To compare the effects of MFR and stretching exercise on pain and flexibility in plantar fasciitis.

Hypothesis

There may be difference in the treatment groups using MFR or Stretching on plantar fasciitis.

Statement of Question

Does myofascial release is more effective than static stretching in plantar fasciitis?

Does static stretching more effective than myofascial release in plantar fasciitis?

Operational Definitions

Plantar Fasciitis

Planter Fasciitis is an annoying and painful condition that limits function. There is pain and tenderness in the sole of the foot, mostly under the heel, with standing or walking. There may be an associated tightness of the Achilles tendon. The pain is often worst when first getting up in the morning, with typical hobbling downstairs, or when first getting up from a period of sitting-the typical start up pain and stiffness [1].

Myofascial Release

Myofascial Release is a massage technique that utilizes the stretching of the fascia and muscle to help increase Range of Motion or to decrease pain by breaking up these adhesions in the fascia.

Stretching Exercise

It is a technique to elongate the shortened structures and improve the overall function of the structures.

Review of Literature

The plantar fascia is synonymous with the deep fascia of the sole of the foot. The plantar fascia is comprised of pearly white longitudinally organized fibers. It begins at the medial tuberosity of the calcaneus where it is thinner and extends into a thicker center portion. This thicker portion is flanked by thinner lateral and medial portions. The thicker central portion of the plantar fascia then extends into five bands surrounding the digital tendons. Plantar fasciitis classically presents histologically with ''degenerative changes in the plantar fascia, with or without fibro-elastic proliferation and chronic inflammatory changes [14]. It is classified as a syndrome that results from repeated trauma to the plantar fascia at its origin on the calcaneus [2, 5].

Hicks originally described the foot and its ligaments as an arch-like triangular structure or truss. The calcaneus, midtarsal joint, and metatarsals (the medial longitudinal arch) formed the truss's arch. The plantar fascia formed the tie-rod that ran from the calcaneus to the phalanges. Vertical forces from body weight travel downward via the tibia and tend to flatten the medial longitudinal arch. Furthermore, ground reaction forces travel upward on the calcaneus and the metatarsal heads, which can further attenuate the flattening effect because these forces fall both posterior and anterior to the tibia [5].

Authors Statement

William P. Hanten and Sandra D. Chandler *et al.* in their study," Effects of Myofascial Release Leg Pull and Sagittal Plane Isometric Contract-Relax techniques on Passive Straight-Leg Raise Angle" The purpose of this study was to compare the effects of leg pull with those of sagittal plane isometric contract- relax on hip flexion ROM as measured by passive straight-leg raise. The results suggest that while both contract-relax and leg pull techniques can significantly increase hip flexion range of motion in normal subjects, contract-relax treatment was more ffective and efficient than leg pull treatment [12].

Niraj Kumar, (2018) *et al.*, The present study concluded that group A (Pneumatic Compression Therapy and Lymphatic Drainage Exercises) showed significant improvement as Group B (Manual lymphatic drainage (MLD) and control group (lymphatic drainage exercises) for upper limb in lymphoedema [20].

Romulo Renan Ordine *et. al.*, studied the Effectiveness of Myofascial Trigger Point Manual Therapy Combined with a Self-Stretching Protocol for the Management of Plantar Heel Pain: The study the effects of trigger point (TrP) manual therapy combined with a self-stretching program for the management of patients with plantar heel pain. Sixty patients were included in his study. He concluded that the addition of TrP manual therapies to a self-stretching protocol resulted in superior short-term outcomes as compared to a self-stretching program alone in the treatment of patients with plantar heel pain [21].

Aaron Lebauer *et al.* stated in their study," The effect of myofascial release (MFR) on an adult with idiopathic scoliosis" The purpose of this case study is to measure the effects of MFR as a manual therapy technique in the treatment of idiopathic scoliosis and They concluded that the subject improved in pain levels, trunk rotation, posture, quality of life and pulmonary function. But it suggested that further investigation is needed using MFR as an effective treatment for idiopathic scoliosis [22].

Clark R. Konczak and Rick Ames *et al.*, Treatment consisted of side posture SIJ diversified manipulation and myofascial release to the psoas muscle twice weekly for 2 weeks. The patient was also taught proprioceptive neuromuscular facilitation exercises of the psoas and iliotibial band muscles. He was instructed to substitute swimming instead of running on a daily basis. Reassessment at 3 weeks found the patient without pain in his hip or back and no clicking or popping in his left hip and concluded that Clinicians should consider that runners who present with coexisting SIJD and ISHS may benefit from the combined management of both conditions [25].

Dr Navneet Badoni (2015) *et al.*, Sinus tarsi approach is a less invasive method for fixation of calcaneal fractures. It permits good visualization of the fracture, and allows anatomic reduction of articular surfaces and can also be used to perform subtalar arthrodesis when necessary. This is a valid option of treatment for displaced intra-articular calcaneal fractures in young active adults [26].

Methodology

Sample

This is a experimental study. Total 30 participants residing in around Dehradun were previously diagnosed by orthopedic Physician were included. The subjects were selected on the basis of inclusion criteria- Male and female between age groups 20-50 years, Subjects having pain more than 3 months over the heel, Pain with first steps upon walking (greater than or equal to 3 on a 0 to 10 VAS scale) & Pain that is worse in the morning during the initial steps, but which decreases after walking continue. Subjects were excluded Persons who were undergoing corticosteroids injection, Receiving plantar non steroidal anti- inflammatory medications within the previous 3 week, Any known radiating pain (lower limb), Any other lower extremity injury during the previous 6 months. Currently engaging in any Physical therapy within previous 1 week & Calcaneal fracture. Instrumentation & Outcome measures- Foot function index & Visual analogue scale

Protocol

After assigning into 2 groups Group A - Subjects were received for MFR therapy and exercises for plantar fascia. 10 second MFR technique applied by knuckle on sole. The intervention was followed for 2 times / week for 4 weeks. And Group B - Subject receives static stretching and exercises of the plantar fascia, hold for 30 seconds with 5 repetition. This intervention was followed 3 sets for 30 seconds per session and 1 session per week i.e., 4 sessions 4 weeks.

Procedure

Thirty (30) Subjects were assigned according to inclusion and exclusion criteria. Subjects were divided into 2 groups by simple randomization using lottery method. Each subjects received static stretching, myofascial release therapy of the plantar fasciitis. Each subjects were examined before and after intervention on Foot Function. Index and Visual Analogue Scale.

Myofascial Release Technique

Position of subject was prone lying with feet off the end of the table to allow for easy dorsiflexion. Therapist position was sitting on a stool at the end of the table. Technique is using the knuckles, soft fist or elbow to engage the soft tissue just anterior of the calcaneus. Take up a line of tension in an anterior direction. Work progressively through to the ball of the foot as well as into deeper layers in subsequent passes.

Instruct the subject to lift their toes, with direction – Lengthen the bottom of your foot by taking your toes up under the table towards your knee cap'. Dorsiflexion can also be used in conjunction with this. (Fig. 1).

Fig. 1: Myofascial Release

Plantar Fascia Stretching Program

Plantar Fascia Stretching Program Position of the subject was sitting with affected leg cross over the contralateral leg.

Technique is while using the hand on the affected side, they were to place the fingers across the base of the toes on the bottom of the foot and pull the toes back toward the shin until they felt a stretch in the arch of the foot. They were to confirm that the stretching was correct by palpating the tension in the plantar fascia with the contralateral hand while performing the stretching [19] (Fig. 2).

Fig. 2: Stretching for plantar fascia

Data Analysis

Statistics are performed by using SPSS 13 and SIGMASTATE. Results were calculated using 0.05 level of significance. Differences in scores of all outcome measures, obtained by subtracting pre treatment scores from post treatment scores, were analyzed with repeated measures of analysis of variance using SPSS followed by Tukey Post hoc tests.

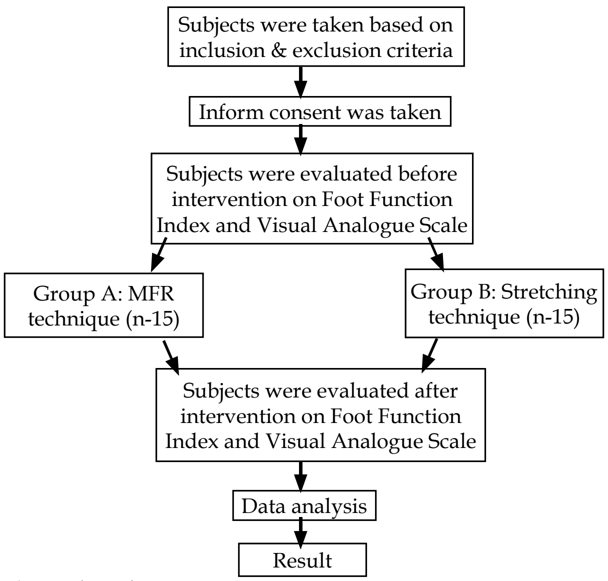


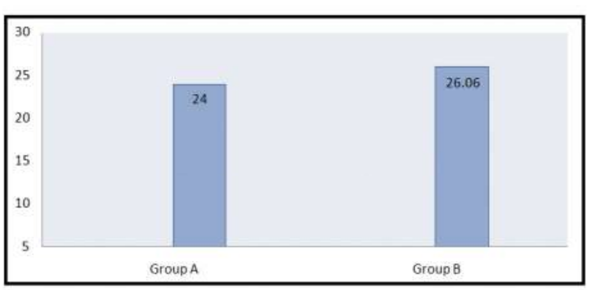
Fig. 3: Flow chart

Results

Group A-15 Subjects having mean age 24.00 years Group B- 15 Subjects having mean age 26.06 years Data on age are tabulated below in Table 1 & Graph 1.

Table 1: Shows Comparison of mean values of Age between Group A and Group B

Demographic	Group A		Group B	
	Mean	SD	Mean	SD
Age (Yrs)	24.00	3.11	26.06	5.7



Graph 1: Comparison of mean values of Age between Group A and Group B

At the end of stipulated treatment period results of improvement achieved in plantar fasciitis symptoms were studied and results reviewed and analyzed on selected parameters viz. Visual Analogue Scale and Foot Function Index using prevailing statistical techniques. The results are briefly detailed below.

Comparison within the Group

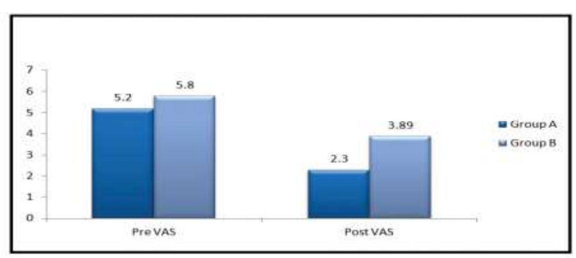
The results of treatment imparted to group A and group B for were measured and collected data was analyzed using Visual Analogue Scale and Foot Function Index for comparison of improvement within the group members of each group.

Analysis of mean and standard deviation values of improvement within the group of group A, which was treated by imparting Myofascial Release Techniques, results when viewed on Visual Analogue Scale and Foot Function Index shows significant improvement in the plantar fasciitis symptoms in comparison to group B who was subjected to Stretching exercise, While analysis of mean and standard deviation values within the two groups, Group A showed significant increase in VAS compare to group B. The results are tabulated in Table 2 & Graph 2.

Table 2: Mean and SD of Pre VAS and Post VAS for Group A and Group B

Session	Group A		Group B	
	Mean	SD	Mean	SD
Pre VAS	5.2	1.03	5.8	1.42
Post VAS	2.3	0.72	3.89	1.01

Session	Group A		Group B	
	t value	p value	t value	p value
Pre-VAS VS Post – VAS	12.85	p = 0.000 ($p<0.05$)	10.247	p = 0.000 ($p < 0.05$)



Graph 2: Comparison of mean values of pre VAS and post VAS between Group A and Group B

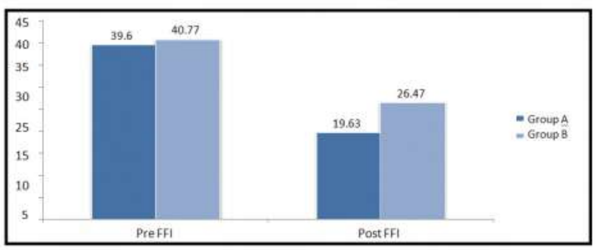
Comparison of Results Between the Group

Paired t- Test analyzed the results of treatment imparted to members of each group for comparison in improvement between the groups in symptoms of Plantar Fasciitis Comparison of outcome measures of improvement between the group of both the groups on Foot Function Index and Visual Analogue Scale shows that group A, who was treated by imparting Myofascial Release technique by comparing showed significant improvement in plantar fasciitis in comparison to group B who was subjected to Stretching exercises. The results are tabulated in Table 3 and Graph 3.

Table 3: Comparison of mean values between Pre FFI and Post FFI within Group A and Group

FFI	Group A		Group B	
	Mean	**SD**	**Mean**	**SD**
Pre FFI	39.6	8.50	40.77	13.96
Post FFI	19.63	6.24	26.47	7.3

FFI	Group A		Group B	
	t value	**p value**	**t value**	**p value**
Pre –FFI VS Post – FFI	12.101	P = 0.000 (p < 0.05)	4.95	p = 0.000 (p < 0.05)



Graph 3: Comparison of mean Values of Pre FFI and Post FFI between Group A and Group B

Discussion

The results were showed that both group A, and group B were effective in the treatment of plantar fasciitis but after comparison group A shown better results than group B.

Benedict F. Digiovanni *et al*., The major goals of the plantar fascia-stretching protocol were to recreate the windlass mechanism and to limit repetitive microtrauma and associated chronic inflammation by performing the exercises prior to the first steps in the morning or after any prolonged sitting or inactivity. This protocol provides a nonoperative treatment option that resulted in a rate of improvement of symptoms that surpassed the responses to more traditional treatment methods for patients with chronic, disabling proximal plantar fasciitis [4].

Joahua Dubin, (March 2007) *et. al*. Shea explained a piezoelectric effect produced when pressure is applied to the molecular crystalline lattices that he maintains are in myofascial tissue. Ground substance in extracellular space becomes gelled when injured fascia shortens and dehydrates. But with pressure or stretch, the piezoelectric effect can increase the electrical potential of this tissue to rehydrate the ground substance (Shea). This ground substance, or proteoglycan, provides lubrication for connective tissue and maintains distance between fibers. The idea that applying pressure or stretch to injured tissue can create an environment for connective tissue to move without restriction is implied. Myofascial techniques have been shown to stimulate fibroblast proliferation, leading to collagen synthesis that may promote healing of plantar fasciitis by replacing degenerative tissue with a stronger and more functional tissue [7].

Suman Kuhar, Khatri Subhash (2007) *et al.* showed a significant result that the myofascial release is an effective therapeutic option in the treatment of plantar fasciitis [16].

William P. Hanten September (1994) *et al.* Myofascial release techniques are claimed to cause vasomotor response, increase blood flow to affected areas, increase lymphatic drainage of toxic metabolites, realign fascia1 planes, influence the proprioception of affected soft tissue, alleviate musculoskeletal pain and dysfunction and restore functional ROM in areas of painful restriction. Considering that myofascial release is thought to hydrate dehydrated ground substance of injured tissue and restore functional ROM to areas of painful restriction, perhaps optimal ROM effects can only be expected on subjects with pathologic tissue [12].

Anders Henricson, Annika (1983) Stretching, regardless of how it is performed, causes a lengthening of the muscles or an increased range of motion in joints involved, even if methods utilizing contractions-relaxation or reciprocal inhibition appear to yield better results [17].

Neeraj Kumar, (2016) *et al.* In the present study, there was significant difference between the McKenzie treatment, Isometric strengthening exercise and Hot Pack treatment for neck pain. The McKenzie protocol has been found to be more beneficial that the Isometric Strengthening exercise and Hot Pack [18].

Jari Ylinen (2002) *et al.* Stretching exercises aim to relax the neuromuscular system in general. An increase in muscle tone will often lead to pain caused by the irritation of nerve endings or the increase in pressure in and between muscles, which causes slowing of the metabolism [19].

Shatrudhan Das, Niraj Kumar *et al.* In present study we found that both type of exercise protocols either close kinematic chain or open kinematic chain exercise are equally effective. However, various factors such position of lower extremity, type of exercise, directly or indirectly will affect the prognosis of certain conditions involving lower limb [24].

Niraj Kumar (2019) *et al*. The present study concluded that group A (Pneumatic Compression Therapy and Lymphatic Drainage Exercises) showed significant improvement as Group B (Manual lymphatic drainage (MLD) and control group (lymphatic drainage exercises) for lower limb in lymphoedema [27].

MFR is given in a quiet environment and with a slow stretch by the physiotherapist, so it will not elicit stretch reflex, thus while MFR treatment patients is felt more comfortable. Stretching was given passively and then patient was asked to perform as Home based Program as self stretching hence it hinders the study results.

Limitations and Future Research

Limitation of Study

1. Small sample size
2. No Follow Up

Future Research

1. Large sample size can be included
2. Other techniques can be used
3. Follow up study should be carried ou

Conclusion

The present study concluded that Myofascial release (MFR) is better than Stretching exercises in 4 weeks intervention patients with plantar fasciitis.

Clinical Significance

MFR should be recommended in plantar fasciitis subjects for pain relief and functional improvement.

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Original Article

Physiotherapy and Occupational Therapy Journal
Volume 12 Number 2, April - June 2019
DOI: http://dx.doi.org/10.21088/potj.0974.5777.12219.5

The Study to Compare the Effect of Buteyko Breathing Technique and Pursed Lip Breathing in COPD.

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How to cite this article:
Rakhi Sharma, Niraj Kumar, Nishu Sharma *et al.* The Study to Compare the Effect of Buteyko Breathing Technique and Pursed Lip Breathing in COPD. Physiotherapy and Occupational Therapy Journal. 2019;12(2):103-113

Abstract

Introduction: Chronic Obstructive pulmonary disease (COPD) is characterized by airflow obstruction with breathing-related symptoms such as chronic cough, exertion dyspnoea, expectoration, and wheeze [1]. The Buteyko concept is a system of breathing exercises originally devised in the 1950s by Professor Konstantin Buteyko, a Russian physician and academic personality [2].

Aim of The Study: To compare the better Effectiveness of Buteyko Breathing Technique and Pursed Lip Breathing in Chronic Obstructive Pulmonary Disease.

Methodology: Fifty (50) subjects clinically diagnosed of chronic obstructive pulmonary disease (COPD). The subjects divided randomly into two groups; Group A (25) and Group B (25). Group A receivedButeyko Berthing Technique (BBT) and Group B received Pursed Lip Breathing (PLB) and done for 4 weeks.

Discussion: The Buteyko method is a purported method of "retraining" the body's breathing pattern to correct for the presumed chronic hyperventilation and hypocapnea, and thereby treat or cure the body of these medical problems. Buteyko has been found to be effective in management of Asthma [10]. In our study daily Buteyko breathing exercise session of 30 to 35 minutes was given to patients. Progression of the exercise was made as per the exercise manual of Buteyko Institute of Breathing & Health.

Conclusion: In the present study both of the techniques are effective but the Buteyko breathing technique found more effective than pursed lip breathingfor 4 weeks. There was significant improvement in Pulmonary Function Test in patients with COPD.

Keywords: Buteyko breathing technique, Pursed lip breathing, FEV1, FVC, Spiro meter (koko peak pro 6), Stop watch and Tissue paper.

Introduction

Chronic Obstructive pulmonary disease (COPD) is characterized by airflow obstruction with breathing-related symptoms such as chronic cough, exertion dyspnoea, expectoration, and wheeze. These symptoms may occur in conjunction with airway hyper responsiveness and may be partially reversible. Although COPD is a nonspecific term referring to a set of conditions that develop progressively as a result of a number of different disease processes, it most commonly refers to chronic bronchitis and emphysema and a subset of patients with asthma. These conditions can be present with or without significant physical impairment [1].

The Buteyko concept is a system of breathing exercises originally devised in the 1950s by Professor Konstantin Buteyko, a Russian physician and academic personality. Following its popularity in Russia, the concept has gradually spread to western countries over the last 20 years, notably Australia and New Zealand and other parts of Europe. The technique offers a complementary method of reliving respiratory symptoms based

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Received on: 17.04.2019, **Accepted on** 04.05.2019

on the voluntary control of breathing, as well as considering the effects of environmental and dietary triggers [2].

Although this technique had been described and recommended in the mid-1950s and beginning of the 1960s, the first studies designed to establish the benefits and physiological effects of PLB were not published until the mid-1960s. Even now--forty years later-there are few studies on PLB in the literature and the factors underlying its efficacy are not well understood. While most studies have focused on patients with COPD, some have found that PLB may be beneficial in certain neuromuscular diseases and exercise-induced asthma [3].

End expiratory lung volume (EELV) represents the point of equilibrium between the forces of elastic recoil of the lungs and the chest wall. A decrease in EELV represents an increase in the elastic recoil of the chest and potentially more energy for inspiration, which may occur passively as a result of the potential energy of the chest wall at the end of expiration [4].

Mueller *et al.* evaluated the effect of PLB on PaO_2, $PaCO_2$ and oxygen saturation (SaO_2) in COPD patients at rest and during exercise. At rest, they found a significant increase in PaO_2 and SaO_2 and a significant decrease in $PaCO_2$; the results were the same for all patients, whether or not they perceived benefits from the PLB [5-7].

Need of The Study

Buteyko Breathing and Pursed Lip Breathing has been defined as a potent method to improve exercise capacity hence and quality of life.

Aim of the Study

To comparethe better Effectiveness of Buteyko Breathing Technique and Pursed Lip Breathing in Chronic Obstructive Pulmonary Disease.

Hypothesis

Null Hypothesis

There will be no significant effect of Buteyko Breathing Technique and Pursed Lip Breathing in Chronic Obstructive Pulmonary Disease.

Alternative Hypothesis

There would be significant effect of the Buteyko Breathing Technique or Pursed Lip Breathing in Chronic Obstructive Pulmonary Disease.

Review of Literature

Tang C, Taylor N *et al.* conducted a study to examine the effectiveness of chestphysiotherapy for patients admitted to hospital with an acute exacerbation of chronic obstructive pulmonary disease (COPD). Chest physiotherapy techniques such as intermittent positive pressure ventilation and positive expiratory pressure may benefit patients with COPD requiring assistance with sputum clearance, while walking programmes may have wider benefits for patients admitted with an exacerbation of COPD. Chest physiotherapy techniques other than percussion are safe for administration to this patient population [12].

Hogg JC, Chu F, Utokaparch S, *et al.* This studied evolution of the pathological effects ofairway obstruction in patients with COPD. The small airways were assessed in surgically resected lung tissue from 159 patients— 39 with stage 0 (at risk), 39 with stage 1, 22 with stage 2, 16 with stage 3, and 43 with stage 4 (very severe) COPD, according to the classification of the Global Initiative for Chronic Obstructive Lung Disease (GOLD). Progression of COPD is associated with the accumulation of inflammatory mucous exudates in the lumen and infiltration of the wall by innate and adaptive inflammatory immune cells that form lymphoid follicles. These changes are coupled to a repair or remodeling process that thickens the walls of this airways [17].

CM Parker, N. Voduc, SD Aaron, KA Webb *et al.* This study is conduct on "Physiological changesduring symptom recovery from moderate exacerbations of COPD" and concluded that moderate acute exacerbation of chronic obstructive pulmonary disease is characterized by worsening airflow obstruction and lung hyperinflation. Improvement of dyspnea was associated with reduction in lung hyperinflation and consequent increase in expiratory flow rates [18].

J Cross, F Elender, G Barton *et al.* Conducted study to estimate the effect, if any, of Manual Chest Physiotherapy (MCP) administered to patients hospitalized with COPD exacerbation on both disease-specific and generic health-related quality of life. To compare the health service costs for those who either receive or do not receive MCP while in hospitalimputed ITT and PP results were similar. No significant differences were observed in any of the outcome measures or subgroup analyses [19].

Elisabeth Ståhl, Anne Lindberg *et al.* This study to evaluate the associationbetween health-related quality of life (HRQL) and disease severity using lung function measures. The results showed that HRQL in COPD deteriorates with disease severity and with age. These data show a relationship between HRQL and disease severity obtained by lung function [20].

Research Methedology

Sampling Technique

Fifty subjects clinically diagnosed of chronic obstructive pulmonary disease (COPD). All the subjects considered for the study was done in SGRRIMHS/SMIH department of physiotherapy at Patel Nagar Dehradun. These subjects were then randomly assigned into two groups of fifty (50) subjects each namely Group A (25) and Group B (25). All the participants took part in the experiments on a voluntary basis after signing a consent form and a demographic data was collected from each subject. The purpose of the study was explained to all the subjects. The subjects were selected according to inclusion and exclusion criteria.

Inclusion criteria: Informed consent, Age group 40-65 yrs, Clinical diagnosis of COPD confirmed by smoking history, physical examination and PFT showing irreversible airflow limitation, Patients who are taking bronchodilators., Males and females referral established COPD.

Exclusion criteria: Musculoskeletal problems limiting mobility, Rapid intensifying or unstable Angina, Intermittent Claudication, Neurological problems limiting cognition/mobility, Resting O_2 saturation <90% with room air breathing and Patient with viral infection.

Instrumentation: Spiro meter (koko peak pro 6), Stop watch and Tissue paper.

Procedure

Fifty (50) subjects clinically diagnosed of chronic obstructive pulmonary disease (COPD) were selected according to inclusion and exclusion criteria and divided randomly into two groups; Group A (25) and Group B (25). Group A received. Buteyko Berthing Technique (BBT) and Group B received Pursed Lip Breathing (PLB) and done for 4 weeks.

Buteyko Brething Technique

At the starting of the session the subject should have an empty stomach and sit in a chair in comfortable position. Pulmonary function test was monitored after sitting and relaxing for about 5 minutes.

Patients were asked to nod head backwards and forwards slowly and coordinate thenodding movement with breathing. Breathe in smoothly, gently and as quietly as possible as head goes back and out as head comes forwards.

Pulse was measured with resting two fingers about one centimeter below the wrist-in line with the thumb-side of the hand.Patient was asked to take in a normal sized breath inand out through nose. Nose is held gently.

Stopwatch was used to keep track of time until patient felt the first onset of a feeling of lack of air. Nose was released, breathing in gently through nose and stopping the stopwatch. Time of Control Pause was noted.

Control pause was followed by relaxed breathing and this was continued for 3minsfollowed by short rest duration of 30 sec [22].

Post exercise control pause (final control pause) was measured. Post exercise pulse was measured.

The above mentioned protocol was followed for 3 times in a day for 4 weeks.

After the exercises the pulmonary function test and dyspnoea scale and ADL readings are measured. [Fig. 1]

Fig. 1: Patient performing buteyko breathing exercise

Pursed Lip Breathing

At the starting of the session the subject should have an empty stomach and sit in a chair in comfortable position. Pulmonary function test was monitored after sitting and relaxing for about 5 minutes. Patients were asked to relax the neck and shoulder muscles.

Breathe in (inhale) slowly through nose for two counts, keeping your mouth closed. Don't take a deep breath; a normal breath will do. It may help to count to inhale, one and two.

Pucker or "purse" lips as if a patients were going to whistle or gently flicker the flame of a candle. Breathe out (exhale) slowly and gently through your pursed lips while counting to four. It may help to count and exhale, one, two, three, four [21].

The above mentioned protocol was followed for 3 times in a day for 4 weeks.

After the exercises the pulmonary function test and dyspnoea scale and ADL readings are measured.

Procedure

Phase I - Pre exercise Phase (5mins)

Patients were advised to have an empty stomach, and sit in a chair in comfortable position with spine erect.

Step 1: Patients were asked to nod head backwards and forwards slowly and coordinate thenodding movement with breathing. Breathe in smoothly, gently and as quietly as possible as head goes back and out as head comes forwards.

Step 2: Pulse was measured with resting two fingers about one centimeter below the wrist-in line with the thumb-side of the hand.

Phase II - Exercise Phase (20mins)

Step 1: To measure Control Pause - Patient was asked to take in a normal sized breath inand out through nose. Nose is held gently.

Stopwatch was used to keep track of time until patient felt the first onset of a feeling of lack of air.

Nose was released, breathing in gently through nose and stopping the stopwatch.

Time of Control Pause was noted.

Step 2: Control pause was followed by relaxed breathing and this was continued for 3minsfollowed by short rest duration of 30 sec.

Step 3: Same as above was repeated four times followed by a long rest duration of 2mins.

Phase III Post exercise Phase (5mins)

Step 1: Post exercise control pause (final control pause) was measured.

Step 2: Post exercise pulse was measured. (Patient was advised to practice sets before breakfast, before lunch or dinner and before sleep and to note down the readings in daily log.)

The above mentioned protocol was followed in first week of the study. Second week was conducted following the same steps with key aim to become accustomed to a slight feeling of "air hunger" lasting several minutes. One way to do this was using the Extended Pause exercise - which introduces the concept of increasing air hunger. Patients were asked to hold breath a little longer than is comfortable. The last weeks of practice included learning how to fine-tune breathing to the point wherepatient were hardly breathing at all when practicing the exercises. In weeks 3-4, a further stage of Reduced Breathing was used called "Very Reduced Breathing". It included practicing reduced Breathing with hands on upper and lower chest and allowing patient to breath to reduce to less than normal volume settle into this pattern.

Post exercise values were measured after completion of 4 week [Fig. 2 & 3].

Fig. 2: Patient performing post exercise

Fig. 3: Patient performing Spirometer

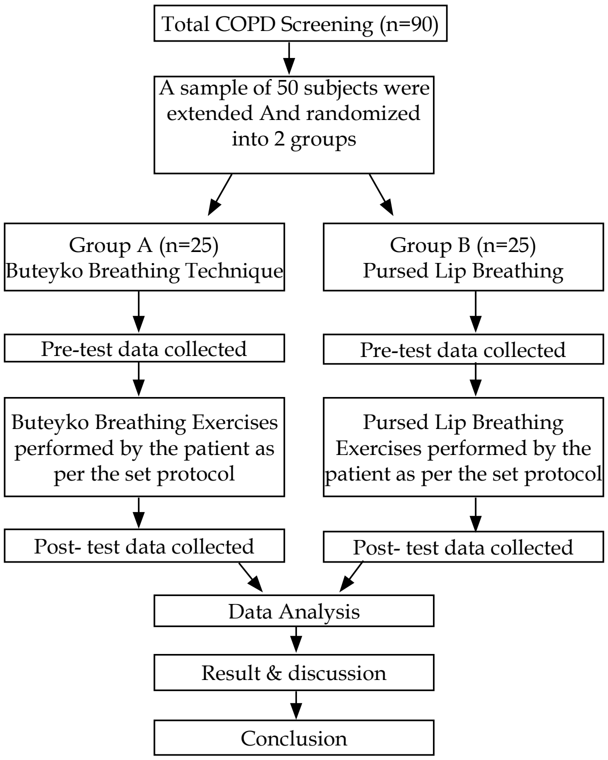


Chart 1: Procedure Chart

Data Analysis

Statistics were performed by using SPSS 16. Results were calculated by using 0.05 level of significance. In the present study 50 mild stage COPD patients were taken with homogeneous demographic data consisting of age and ratio of FEV1/FVC which shows no statistical difference. They were divided into two groups by simple random sampling. Group A performed Buteyko Breathing Exercise and Group B performed Pursed Lip Breathing Exercise. There pulmonary function test and dyspnoea grade were recorded before and after the exercises. The exercise protocol followed every day for 4 weeks and exercise done 3 times in a day. Data was analysed and the results concluded that the exercise assigned to both the groups was effective in showing significant reduction in both FEV1 and FVC and in the grade of dyspnoea. Reduction in Group A and Group B. Which was obviously but the mean difference values, but the exercises given to Group A (Buteyko Breathing Technique Exercise) showed much significant improvement in FEV1 and FVC and in the dyspnoea grade providing comparison study which state that Buteyko breathing exercise is more effective than Pursed lip breathing exercise.

Results

Demographic Data

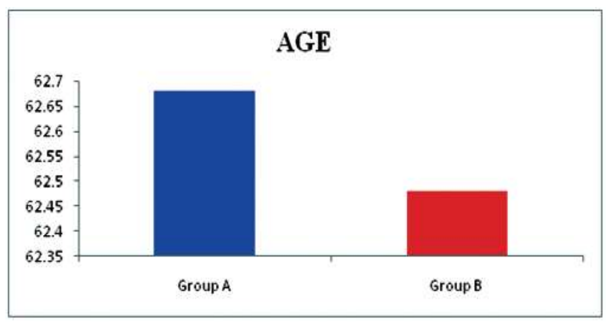
The general characteristics like age and height showed homogeneity and there was no significant difference statistically.

Age

Comparison of age of Group A and Group B showed a Mean ± SD of 62.68 + 0 and 62.48 ± 2.12 respectively [Table 1 & Graph 1].

Table 1: Mean and SD of age between Group A Group B

Age	N	Mean	SD
Group A	25	62.68	0
Group B	25	62.48	2.12



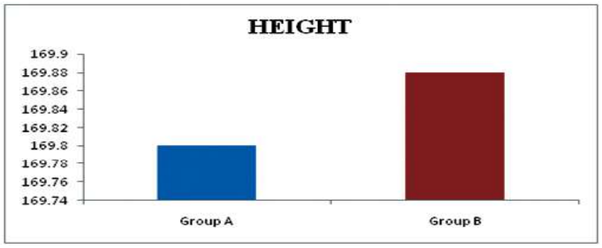
Graph 1: Mean of age between Group A Group B

Height

Comparison of height of Group A and Group B showed a Mean ± SD of 169.8 ± 19.09 and 169.88 ± 3.54 respectively [Table 2 & Graph 2].

Table 2: Mean and SD of height between Group A and Group B

Height	N	Mean	SD
Group A	25	169.8	19.09
Group B	25	169.88	3.54



Graph 2: Mean of height between Group A and Group B

Within Group Analysis

Data of Group A (Buteyko Breathing Technique)

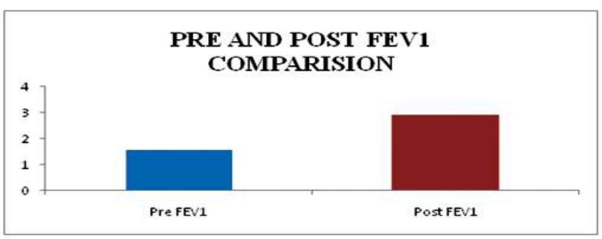
When data was compared within group, analysis for Group A showed following result.

FEV1

Comparison of pre and post FEV1 values within Group A showed a Mean ± SD of pre FEV1 is 1.59 ± 1.11 and Mean ± SD of post FEV1 is 2.90 ± 1.27 respectively. With t-value and p-value of which is significant. [Table 3 & Graph 3]

Table 3: Comparison of mean and SD values of pre and post FEV1 within Group A

FEV1	N	Mean	SD	t-value	p-value
Pre FEV1	25	1.59	1.11	4.0	0.01
Post FEV1	25	2.90	1.27		



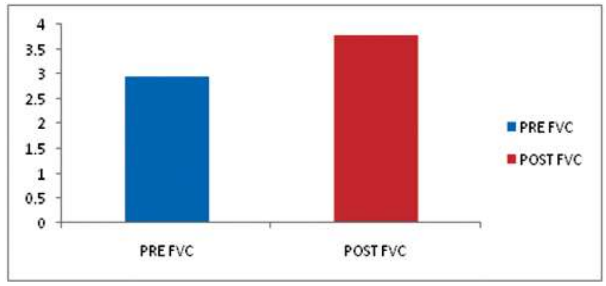
Graph 3: Comparison of mean values of pre and post FEV1 within Group A

FVC

Comparison of pre and post FVC values within Group A showed a Mean ± SD of pre FVC is 2.95 ± 1.75 and Mean ± SD of post FVC is 3.78 ± 1.34 respectively. With t-value and p-value of which is significant. [Table 4 & Graph 4]

Table 4: Comparison of mean and SD values of pre and post FVC within Group A

FVC	**N**	**Mean**	**SD**	**t-value**	**p-value**
Pre FVC	25	2.95	1.75	1.53	0.01
Post FVC	25	3.78	1.34		



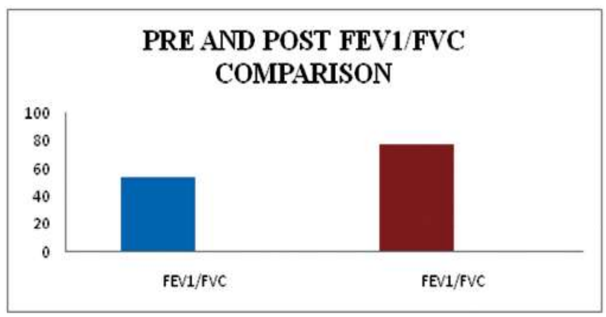
Graph 4: Comparison of mean values of pre and post FVC within Group A

FEV1/FVC

Comparison of pre and post FEV1/ FVC values within Group A showed a Mean ± SD of pre FEV1/FVC is 53.94 ± 5.50 and Mean ± SD of post FEV1/FVC is 76.83 ± 6.44 respectively. With t-value and p-value of which is significant. [Table 5 & Graph 5].

Table 5: Comparison of mean and SD values of pre and post FEV1/FVC within Group A

FEV1/FVC	N	Mean	SD	t-value	p-value
Pre FEV1/ FVC	25	53.94	5.50	13.54	0.01
Post FEV1/ FVC	25	76.83	6.44		



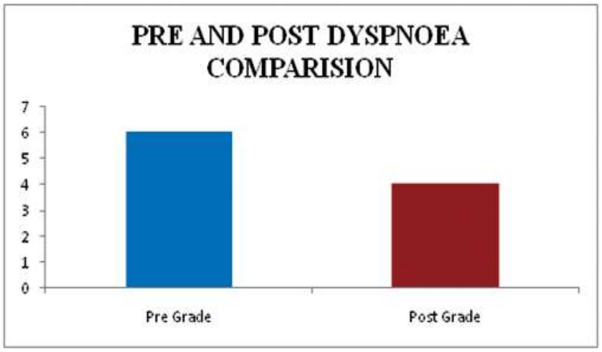
Graph 5: Comparison of mean values of pre and post FEV1/ FVC within Group A

Borg Scale

Comparison of pre and post dyspnoea grades within Group A showed a Mean ± SD of dyspnoea grade is 6.04 ± 0.71 and Mean ± SD of post dyspnoea grade is 4.05 ± 0.60 respectively. With t-value and p-value of which is significant [Table 6 & Graph 6].

Table 6: Comparison of mean and SD values of pre and post dyspnoea grades within Group A

BORG SCALE	**N**	**Mean**	**SD**	**t-value**	**p-value**
Pre Grade	25	6. 04	0.71	11.75	0.01
Post Grade	25	4.05	0.60		



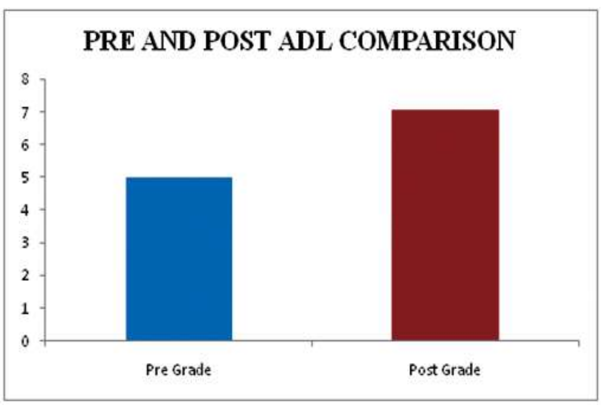
Graph 6: Comparison of mean values of pre and post dyspnoea grades within Group A

ADL Scale

Comparison of pre and post grades within Group A showed a Mean ± SD of grade is 5 ± 1.48 and Mean ± SD of post grade is 7.08 ± 2.25 respectively. With t-value and p-value of which is significant. [Table 7 & Graph 7].

Table 7: Comparison of mean and SD values of pre and post ADL Scale within Group A

ADL SCALE	N	Mean	SD	t-value	p-value
Pre Grade	25	5	1.48	3.85	0.01
Post Grade	25	7.08	2.25		



Graph 7: Comparison of mean values of pre and post ADL Scale within Group A

Data of Group B (Pursed Lip Breathing Exercise)

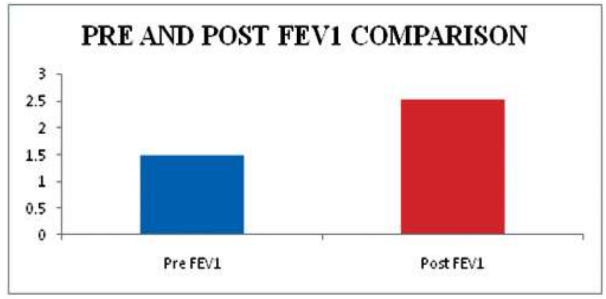
When data was compared within group, analysis for Group B showed following result.

FEV1

Comparison of pre and post FEV1 values within Group B showed a Mean ± SD of pre FEV1 is 1.49 ± 0.22 and Mean ± SD of post FEV1 is 2.52 ± 0.32 respectively. With t-value and p-value of which is significant. [Table 8 & Graph 8].

Table 8: Comparison of mean and SD values of pre and post FEV1 within Group B

FEV1	N	Mean	SD	t-value	p-value
Pre FEV1	25	1.49	0.22	0.2	0.01
Post FEV1	25	2.52	0.32		



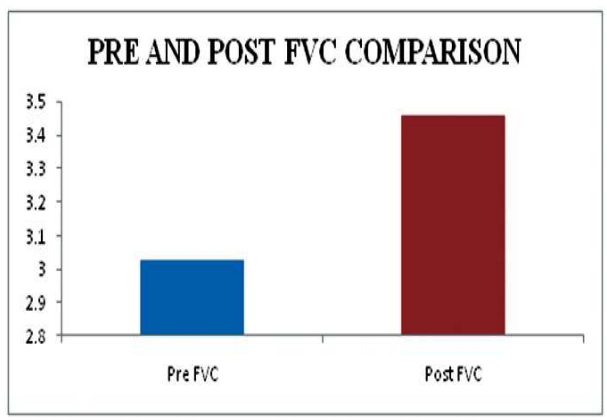
Graph 8: Comparison of mean values of pre and post FEV1 within Group B

FVC

Comparison of pre and post FVC values within Group B showed a Mean ± SD of pre FVC is 3.03 ± 0.07 and Mean ± SD of post FVC is 3.46 ± 0.42 respectively. With t-value and p-value of which is significant. [Table 9 & Graph 9]

Table 9: Comparison of mean and SD values of pre and post FVC within Group B

FVC	N	Mean	SD	t-value	p-value
Pre FVC	25	3.03	0.07	0	0.01
Post FVC	25	3.46	0.42		



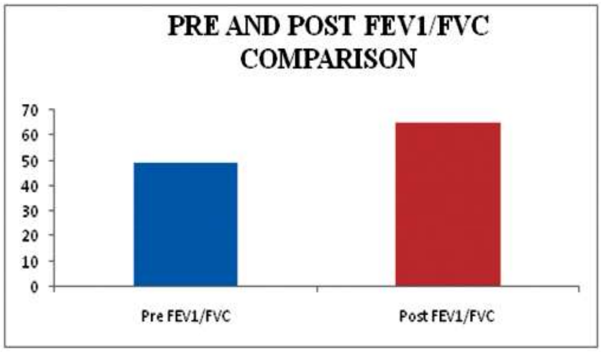
Graph 9: Comparison of mean values of pre and post FVC within Group B

FEV1/FVC

Comparison of pre and post FEV1/ FVC values within Group B showed a Mean ± SD of pre FEV1/ FVC is 49.37 ± 7.50 and Mean ± SD of post FEV1/FVC is 65.26 ± 1.02 respectively. With t-value and p-value of which is significant. [Table 10 & Graph 10].

Table 10: Comparison of mean and SD values of pre and post FEV1/FVC within Group B

FEV1/FVC	N	Mean	SD	t-value	p-value
Pre FEV1/ FVC	25	49.37	7.50	10.5	0.01
Post FEV1/FVC	25	65.26	1.02		



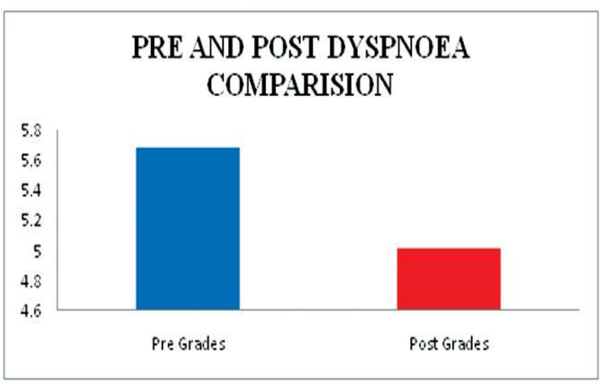
Graph 10: Comparison of mean of pre and post FEV1/FVC within Group B

Borg Scale

Comparison of pre and post grades within Group B showed a Mean ± SD of dyspnoea grade is 5.68 ± 0.55 and Mean ± SD of post dyspnoea grade is 5.02 ± 51 respectively. With t-value and p-value of which is significant. [Table 11 & Graph 11]

Table 11: Comparison of mean and SD values of pre and post dyspnoea grades within Group B

BORG SCALE	N	Mean	SD	t-value	p-value
Pre Grade	25	5.68	0.55	4.7	0.01
Post Grade	25	5.02	0.51		



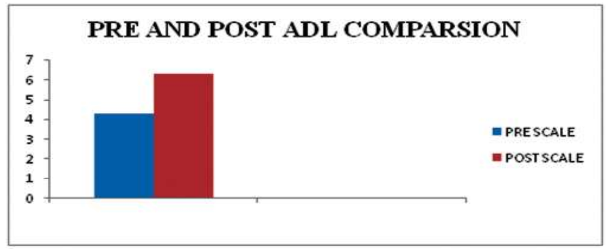
Graph 11: Comparison of mean values of pre and post dyspnoea grades within Group B

ADL Scale

Comparison of pre and post ADL scale within Group B showed a Mean±SD of grade is 4.28±0.71 and Mean±SD of post ADL scale is 6.32±1.41 respectively. With t-value and p-value of which is significant. [Table 12 & Graph 12]

Table 12: Comparison of mean and SD values of pre and post ADL Scale within Group B

ADL SCALE	N	Mean	SD	t-value	p-value
Pre Grade	25	4.28	0.71	5.51	0.01
Post Grade	25	6.32	1.41		



Graph 12: Comparison of mean values of pre and post ADL Scale within Group B

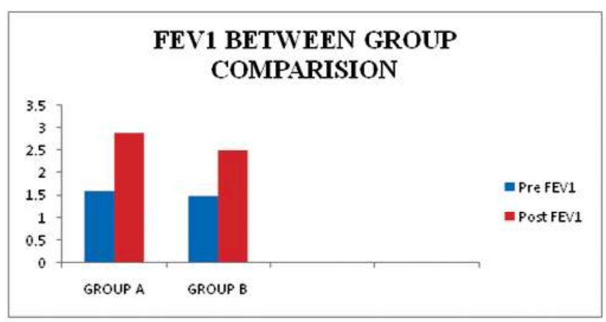
Between Group Comparison

FEV[1]

Comparing Mean and SD of pre FEV1 and post FEV1 between Group A and Group B. Mean ± SD of pre FEV1 of Group A is 1.59 ± 1.11 and post FEV1 of Group A is 2.90 ± 1.27 with a t-value of 4.0. Mean ± SD of pre FEV1 of Group B is 1.49 ± 0.22 and post FEV1 of Group B is 2.52 ± 0.32with a t-value of 0.2. [Table 13 & Graph 13]

Table 13: Mean and SD of pre FEV1 and post FEV1 for Group A and Group B

FEV1	Group A		Group B	
	Mean	SD	Mean	SD
Pre FEV1	1.59	1.11	1.49	0.22
Post FEV1	2.90	1.27	2.52	0.32



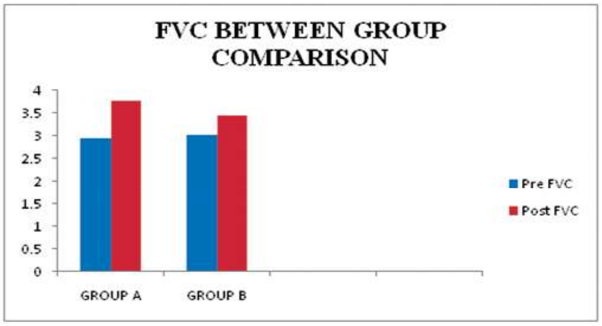
Graph 13: Mean pre FEV1 and post FEV1 for Group A and Group B

FVC

Comparing Mean and SD of pre FVC and post FVC between Group A and Group B. Mean ± SD of pre FVC of Group A is 2.95 ± 1.75 and post FVC of Group A is 3.78 ± 1.34 with a t-value of 1.53. Mean ± SD of pre FVC of Group B is 3.03 ± 0.07 and post FVC of Group B is 3.46 ± 0.42 with a t-value of 0. [Table 14 & Graph 14]

Table 14: Mean and SD of pre FVC and post FVC for Group A and Group B

FVC	Group A		Group B	
	Mean	SD	Mean	SD
Pre FVC	2.95	1.75	3.03	0.07
Post FVC	3.78	1.34	3.46	0.42



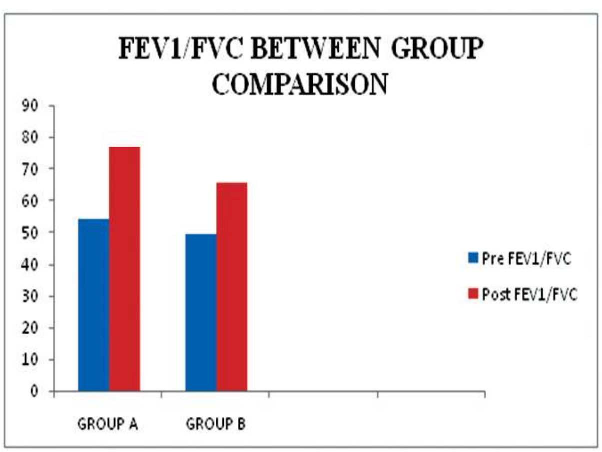
Graph 14: Mean of pre FVC and post FVC for Group A and Group B

FEV[1]/FVC

Comparing Mean and SD of pre FEV1/FVC and post FEV1/FVC between Group A and Group B. Mean ± SD of pre FEV1/FVC of Group A is 53.94 ± 5.50 and post FEV1/FVC of Group A is 76.83 ± 6.44 with a t-value of 13.54. Mean ± SD of pre FEV1/ FVC of Group A is 49.37 ± 7.50 and post FVC of Group B is 65.26 ± 1.02 with a t-value of 10.5. [Table 15 & Graph 15]

Table 15: Mean and SD of pre FEV1/ FVC and post FEV1/FVC for Group A and Group B

FEV1/ FVC	Group A		Group B	
	Mean	SD	Mean	SD
Pre FEV1/ FVC	53.94	5.50	49.37	7.50
Post FEV1/ FVC	76.83	6.44	65.26	1.02



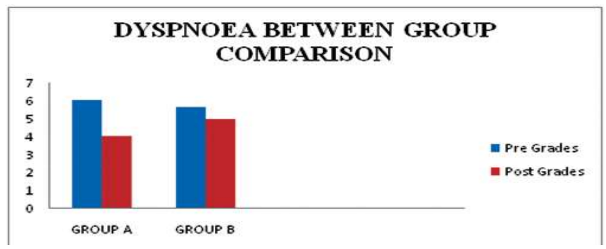
Graph 15: Mean of pre FEV1/ FVC and post FEV1/FVC for Group A and Group B

Borg Scale

Comparing Mean and SD of pre dyspnoea grade and post dyspnoea grade between Group A and Group B. Mean ± SD of pre dyspnoea grade of Group A is 6.04 ± 0.71 and post dyspnoea grade of Group A is 4.05 ± 0.60 with a t-value of 11.75. Mean ± SD of pre dyspnoea grade of Group B is 5.6 ± 055 and post dyspnoea grade of Group B is 5.02 ± 0.51 with a t-value of 4.7. [Table 16 & Graph 16].

Table 16: Mean and SD of pre dyspnoea grade and post dyspnoea grade for Group A and Group B

DYSPNOEA	Group A		Group B	
	Mean	SD	Mean	SD
Pre Grades	6.04	0.71	5.68	0.55
Post Grades	4.05	0.60	5.02	0.51



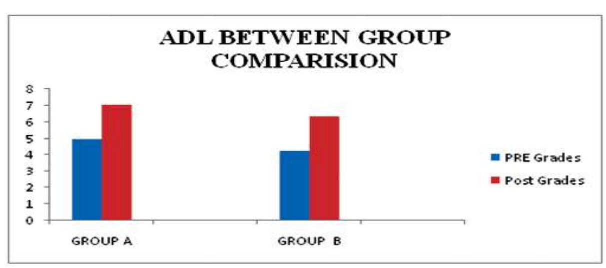
Graph 16: Mean pre dyspnoea grade and post dyspnoea grade for Group A and Group

ADL Scale

Comparing Mean and SD of pre ADL scale and post ADL scale between Group A and Group B. Mean ± SD of pre ADL scale of Group A is 5 ± 1.48 and post ADL scale of Group A is 7.08 ± 2.25 with a t-value of 3.85. Mean ± SD of pre ADL scale of Group B is 4.28 ± 0.71 and post ADL scale of Group B is 6.32 ± 1.41 with a t-value of 5.51. [Table 17 & Graph 17].

Table 17: Mean and SD of pre ADL scale and ADL scale for Group A and Group B

ADL Scale	Group A		Group B	
	Mean	SD	Mean	SD
Pre Grades	5	1.48	4.28	0.71
Post Grades	7.08	2.25	6.32	1.41



Graph 17: Mean and SD of pre ADL scale and ADL scale for Group A and Group B

Disscusion

As per the previous studies both of the techniques are used for COPD patients and both are effective but in this study we find that Buteyko breathing exercises are more effective and better than pursed lip breathing exercise.All the subjects underwent spirometric evaluation for FVC, FEV1. Subjects were demonstrated the steps and technique of Buteyko Breathing Exercise and Pursed Lip Breathing.

Advocates of this method believe that the effects of chronic hyperventilation has effects which include bronchospasm disturbance of cell energy production via krebs cycle, as well disturbance of numerous vital homeostatic chemical reactions in the body [9].

The Buteyko method is a purported method of "retraining" the body's breathing pattern to correct for the presumed chronic hyperventilation and hypocapnea, and thereby treat or cure the body of these medical problems. Buteyko has been found to be effective in management of Asthma [10].

The quality of evidence of the Buteyko Method according to an Australian Department of Health report is stronger than any other complementary medicine treatment of asthma [11].

There are now new definitions for both asthma and COPD that acknowledge the overlap and highlight the similarities and differences between them. Asthma and COPD have important similarities and differences [12] both are chronic inflammatory diseases that involve the small airways and cause airflow limitation [13,14,15,16] both result from gene-environment interactions and both are usually characterised by mucus and bronchoconstriction.

Niraj Kumar, (2018). The present study concluded that group A (Pneumatic Compression Therapy and Lymphatic Drainage Exercises) showed significant improvement as Group B (Manual lymphatic drainage (MLD) and control group (lymphatic drainage exercises) for upper limb in lymphoedema [23].

Taniya Singh, (2019) *et al*. 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 individually but comparatively there is no significant difference between 2 groups [24].

Limitations of the Study

Sample size in this study was small.

Only mild stage of COPD was taken as lack of instrumentation for proper screening of the patients.

Future Study

There is a need of research to carry out by taking large sample size.

The age group can be changed with more concern to patients.

Further studies can be done using different variables.

The follow up protocol can be taken more than 4 week.

Conclusion

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.

There was also significant improvement in FVC and FEV1 Buteyko breathing exercise for 4 weeks in patients with COPD. There is minimal changes found in activity of daily living rather than dyspnoea and pulmonary function test.

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