



IMPACT OF PURSED LIP BREATHING IN IMPROVING EXERCISE ENDURANCE IN NON-SPONTANEOUS PURSED LIP BREATHING CHRONIC OBSTRUCTIVE PULMONARY DISEASE PATIENTS.

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ABSTRACT

COPD is a progressive disease associated with cough, mucus, wheezing, shortness of breath. This study was done to find out the effects of pursed lip breathing in terms of improvement in the endurance and reduction in exertional dyspnea among COPD patients. Thirty subjects were taken from Saveetha medical college and hospital and they were equally divided into two groups. The pre test evaluation was done using six minute walk test and Borg's scale. Group A was given six minute walk along with pursed lip breathing and Group B was given six minute walk alone for fifteen days. On fifteenth day post test values were taken. The comparison of pre test and post test values were done within and between the groups using t tests. The pre test and post test values of Group A and Group B for six minute walk test is 359.16 & 414.23, 360.66 & 383.06. The pre test and post test values of Group A and Group B for Borg's scale is 18.13 & 17.46, 17.53 & 18.06. This study concludes that there is a significant impact of pursed lip breathing on improving endurance and reducing exertional dyspnea in Group A treated with six minute walk along with pursed lip breathing.

KEYWORDS: *Chronic Obstructive Pulmonary Disease, Pursed lip breathing, Six minute Walk test, Borg's scale.*



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INTRODUCTION

According to WHO Chronic obstructive pulmonary disease (COPD) is characterized by chronic obstruction of lung airflow that interferes with normal breathing and is not fully reversible¹. In COPD, less air flows in and out of the airways because of one or more of the following

- 1) The airways and air sacs lose their elastic quality
- 2) The walls between many of the air sacs are destroyed
- 3) The walls of the airways become thick and inflamed
- 4) The airways make more mucus than usual, which can clog them²

Chronic obstructive pulmonary disease (COPD) is now the third leading cause of death worldwide. The prevalence of COPD reported in different population from India is 6.5% to 7.7 % .The disease is distinctly more common in males³. Airflow limitation is the slowing of expiratory as measured by Spirometry, with a persistently low forced expiratory volume in first second (FEV₁) and a low ratio of FEV₁ to forced vital capacity (FVC), not reversible with treatment.⁴ The current GOLD and American Thoracic Society/European Respiratory society definition of airflow limitation is an FEV₁/FVC of <70% measured with post bronchodilator therapy.

Spirometry is the most robust test of airflow limitation in patients with COPD. A low FEV₁ with FEV₁/FVC ratio below the normal range is a diagnostic criterion for COPD.⁵ Impact of disease on patient's life, including limitation of activity; missed work and economic impact; effect on family routines; and feelings of depression or anxiety. Dyspnea is the most common complaint for which patients with COPD seek medical attention and influence general health status in patients with chronic respiratory disease.⁶ In COPD, ventilation during exercise is often higher than expected because of increased dead-space ventilation, impaired gas exchange, and increased ventilator demands related to deconditioning and peripheral muscle dysfunction. This leads to dynamic hyperinflation resulting in increased work of breathing, increased load on the respiratory muscles and the intensified perception of respiratory discomfort⁽⁶⁾. Exercise-induced dyspnea has been associated with the increased intensity and duration of respiratory muscle force generation as well as with an increased amplitude and velocity of muscle shortening⁸. Pursed-lips breathing (PLB) is a technique whereby exhalation is performed through a resistance created by constriction of the lips. Although the breathing maneuver is often spontaneously adopted by COPD patients, it is also routinely taught as a breathing-retraining exercise in pulmonary rehabilitation programs because it is thought to alleviate dyspnea. It appears, however, that not all patients obtain symptom benefits from PLB⁹. Pursed lip breathing is one of the simplest ways to control shortness of breath. It provides a quick and easy way to slow pace of breathing, making each breath more effective. Pursed lip breathing: improves ventilation, keeps the airways open longer and decreases the work of breathing, releases trapped air in the lungs, prolongs exhalation to slows the breathing rate, improve breathing patterns by moving old air out of the lung and allowing for new air to enter the lung¹⁰. The 6MWT is a practical simple test that requires a 100-ft hallway but no exercise equipment or advanced training for technicians which helps in improving walking

endurance in COPD patients..This test measures the distance that a patient can quickly walk on a flat, hard surface in a period of 6 minutes (six minute walk distance)¹¹. It evaluates the global and integrated responses of all the systems involved during exercise, including the pulmonary and cardiovascular systems, systemic circulation, peripheral circulation, blood, neuromuscular units, and muscle metabolism. The self-paced 6MWT assesses the submaximal level of functional capacity. Most patients do not achieve maximal exercise capacity during the 6MWT; instead, they choose their own intensity of exercise and are allowed to stop and rest during the test. However, because most activities of daily living are performed at submaximal levels of exertion the 6MWD may better reflect the functional exercise level for daily physical activities¹². Captivating in report the increasing number of COPD patients whose specific causes and exact treatment are still puzzling to medical fraternity all the major techniques used till date provide the symptomatic treatment and therefore just provide short term effect and early recurrences. The current literature suggests that COPD often becomes a chronic problem, with frequent episodes of minor or severe symptoms. Thus, it is significant for clinicians treating COPD to be conscientious of this intermittent nature and look for suitable interventions that not only aim to alleviate acute symptoms, but also help prevent further occurrences. As based on the available resources, limited research has evaluated the impact of pursed lip breathing in non-spontaneous pursed lip breathing COPD patients. No study has utilized simple, clinically practical measures to improve exercise endurance in COPD patients. So the need the of this study is to determine whether the pursed lip breathing in non-spontaneous pursed lip breathing patients is related to the improved incidence of exercise endurance and rate of perceived exertion.

METHODOLOGY

This study was approved by Institutional ethics committee Saveetha University The study was conducted from June - July 2016. This experimental study was conducted in the Department of sports physiotherapy, saveetha medical college and hospital. After getting referral from Pulmonologist, study procedure were explained to the subjects and informed consent was taken. Both male and female subjects between the age group of 40-60 years, Non smoker and Ex-Smoker (The person has quit smoking since 5 years), Moderate (FEV₁/FVC <0.70 50% ≤FEV₁< 80% predicted) to severe (FEV₁/FVC <0.70 30% ≤FEV₁< 50% predicted) chronic obstructive pulmonary disease patients were included and those who Unstable angina, Recent Myocardial Infarction, Resting heart rate of more than 120bpm, Systolic blood pressure of more than 180 mm Hg, and diastolic blood pressure of more than 100 mmHg, impaired lower extremity function, Patients requiring oxygen supplementation during walking, Acute exacerbation. Using non probability randomized sampling method thirty subjects were selected for the study and were equally divided into two groups. The patients were from Chronic Obstructive Pulmonary Disease group out of which 10 males and 5 females in experimental group (n=15) and in control

group (n=15) and 12 males and 3 females. The pre test evaluation was done using six minute walk test and Borgs scale. Group A was given six minute walk along with pursed lip breathing and Group B was given six minute walk alone for fifteen days. Now the distance performed by patients in six minute in each group and RPE-Rate of Perceived Exertion) Borg scale rating is measured. The post test values were taken on fifteenth day. The comparisons of pre test and post test values were done within and between the groups using Paired t test and unpaired t test.

Outcome measures

Six minute walk test

The 6-minute walk was linearly related to maximum METs ($r = 0.687$, $P < 0.001$), supporting the validity of the test¹³. Patients walked significantly farther in each 6-minute walk ($F = 19.83$, $P < 0.001$), and strong test-retest reliability was demonstrated (intraclass correlation = 0.97). Distance walked decreased with the 6-minute walk was moderately correlated with scores from the DASI ($r = 0.502$, $P < 0.001$), and the Physical Function subscale of the SF-36 ($r = 0.624$, $P < 0.001$). The 6-minute walk is a valid and reliable method of assessing functional ability.⁽¹³⁾

STATISTICAL ANALYSIS

The collected data was tabulated & analyzed using descriptive & inferential statistics. To all parameters mean & standard deviation (SD) were calculated. Paired t test was used to analyze the pre-test and post-test values within the groups. Student t-test was used as to analyze the post-test values between the groups.

RESULTS

The data was analyzed using dependent t test and independent t test. The statistical analysis revealed significant difference between pretest and post-test values among intra and inter group comparison. The pre test mean value of Group A and group B for six minute walk test is 359.16 and 360.66 respectively. The post-test mean value of Group A & B is 414.23 & 383.06. The pre test and post test values of Group A and Group B for rate of perceived exertion is 18.13 & 17.46, 17.53 & 18.06. when comparing the pre-test and post-test mean value of Group A & B there are significant improvement in the endurance and the exertional dyspnoea also got reduced considerably in Group A treated with six minute walk along with pursed lip breathing.

Table 1
Mean and standard deviation of six minute walk test at pre and post conditions for the group A (Experimental Group)

S.no	Group A	Mean	Standard Deviation	T- value
1	Pre Test	359.16	9.10	4.44
2	Post test	414.23	8.90	

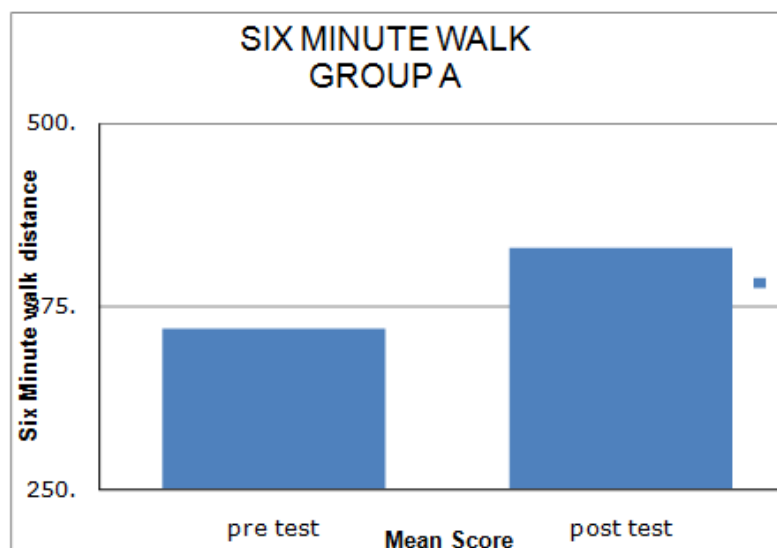


Figure 1
Comparison of Six Minute walk distance for Group A

Table 2
Mean and standard deviation of six minute walk test at pre and post conditions for the group B (Control Group)

S.no	Group A	Mean	Standard Deviation	T- value
1	Pre Test	360.66	7.04	2.23
2	Post test	383.06	7.16*	

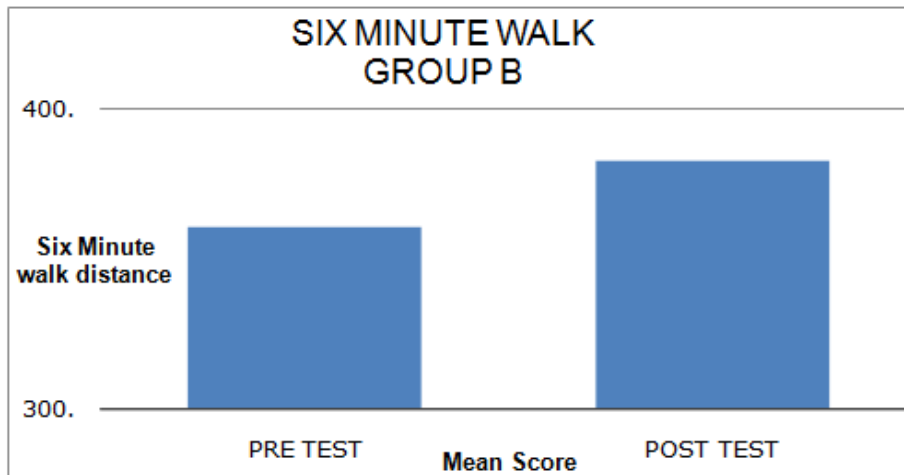


Figure 2
Comparison of Six Minute walk distance for Group B

Table 3
Mean and standard deviation of Rate of Perceived Exertion at pre and post conditions for the group A.

S.no	Stage	Mean	Standard Deviation	t- value
1	Pre Test	18.13	0.27	2.38
2	Post Test	17.46	0.37	

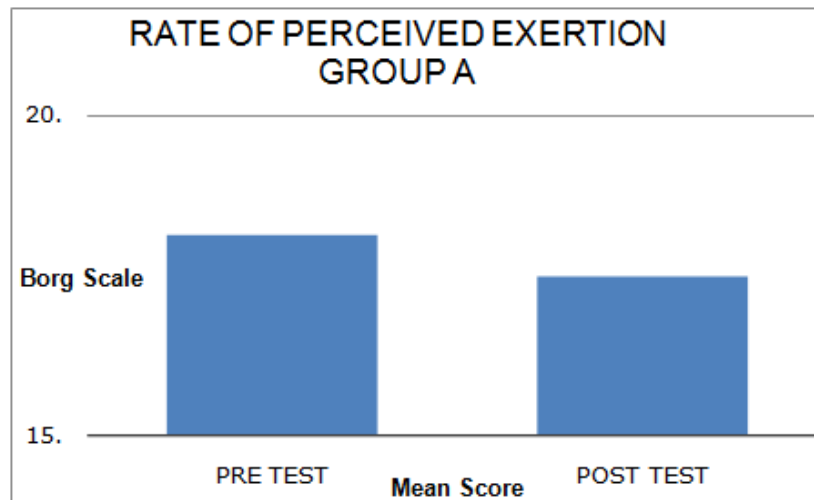


Figure3
Comparison of Rate of Perceived Exertion for Group A

Table 4
Mean and standard deviation of Rate of Perceived Exertion at pre and post conditions for the group B.

S.no	Stage	Mean	Standard Deviation	t- value
1	Pre Test	17.53	0.41	0.99
2	Post Test	18.06	0.34	

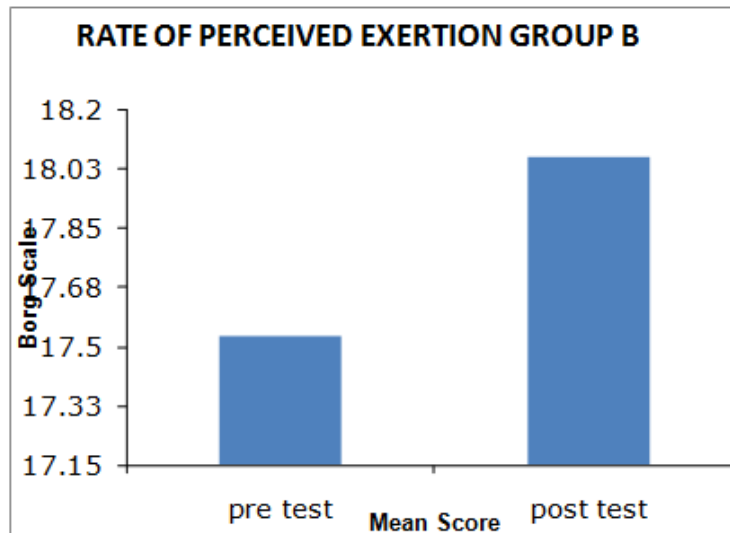


Figure 4
Comparison of Rate of Perceived Exertion for Group B

Table 5
Comparison of post values of six minute walk between group A and group B

S.no	Group	Mean	Standard Deviation	t- value
1	A	414.23	8.90	3.23
2	B	383.06	7.16	

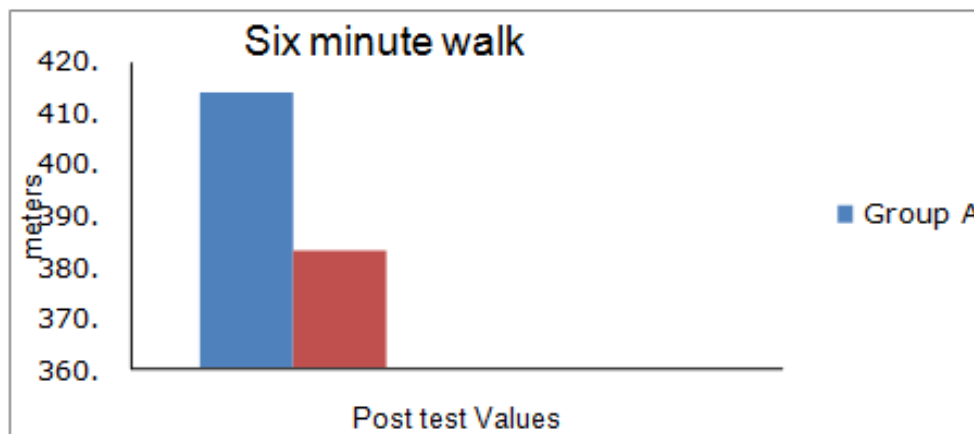


Figure 5
Comparison of Six Minute walk distance between Group A and B

Table 6
Comparison of post values of Rate of Perceived Exertion between group A and group B

S.no	Group	Mean	Standard Deviation	t- value
1	A	17.46	0.37	9.02
2	B	18.06	0.34	

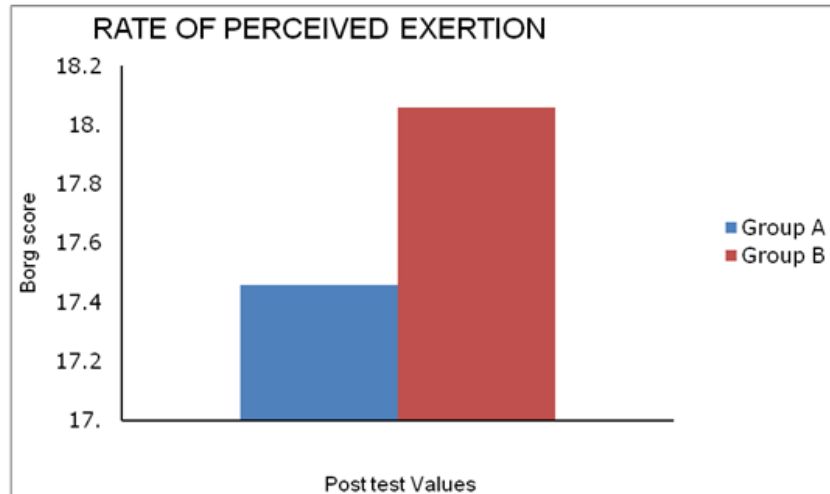


Figure 6
Comparison of Rate of Perceived Exertion between Group A and B

DISCUSSION

The present study shows that imposed pursed lip breathing in non-spontaneous pursed lip breathing .COPD patients showed improvement in walking endurance and exertional dyspnea and it was shown in Fig 5 and 6. Initially, the patients were reluctant due to the possibility of exertional dyspnea while six minute walking. The patients we studied were medically stable and not experiencing an acute exacerbation of their COPD. We could expect that exertional dyspnea would be accentuated during an exacerbation that would cause reduced walking endurance. After the imposed pursed lip breathing they really got benefited in terms of increased endurance during walking and reduced exertional dyspnea. Mueller et al^{14,15} concluded that COPD patients who obtained dyspnea relief with the pursed lip breathing exhibited larger increase in tidal volume In this study, the patients in the experimental group showed greater improvement as compared to control group in terms of increased endurance and reduced exertional dyspnea. More than 95% of the patients in the experimental group showed improvement statistically and clinically. In control group the patients showed moderate improvement in six minute walking as compared to experimental group but not with exertional dyspnea since they did not impose pursed lip breathing The rate of perceived exertion also improved in Experimental group since pursed lip breathing as suggested by Berlin E.⁸ (chest 1992) that PLB may act to unload the diaphragm and consequently may help to protect it against the development of fatigue. Out of 8 female patients who participated in the study 3 belongs

to control group and 5 belongs to experimental group. Most of the female patients in experimental group showed improvement as they easily mastered the technique of pursed lip breathing than male. PLB performed during exercise in the present study led to an increase in the recruitment of the abdominal muscle. The abdominal muscle recruitment during expiration can lengthen the diaphragm, improving its tension-generating capacity during inspiration. Dodd et al¹⁶ (Am Rev-Respir dis 1984) postulated that abdominal muscle recruitment can store elastic and gravitational energy within the diaphragm which when released during the initial part of inspiration enhances inspiratory pressure generation and lung inflation. Because our patients exhibited substantial expiratory muscle recruitment during exercise alone, PLB has been unable to further improve on the existing pattern, thus having little impact in altering dyspnea. As we discussed earlier in terms of simple and cost effective measures that Pursed lip breathing improves ventilation, keeps the airways open longer and decreases the work of breathing, releases trapped air in the lungs, prolongs exhalation to slows the breathing rate, improve breathing patterns by moving old air out of the lung and allowing for new air to enter the lung. Garrod et al¹⁷ determined that PLB during exercise lowers post-exercise breath rate and accelerates recovery as compared with exercise with non-pursed lips. When trying to improve a patient's ability to function, dyspnea relief is an important goal. There is limited research available on the outcome of Six minute walk test and Pursed lip breathing in COPD. Distance testing was first advocated Balke in 1963 as a means of assessing physical fitness KennethH. Cooper later used a 12-min walk/run test in healthy Air Force

personnel that demonstrated a strong correlation with maximal oxygen consumption, as obtained on maximal exercise testing on a treadmill, as well as the ability to detect changes in conditioning. Mc Gavin made additional modifications to the test in 1986, as he used a walk test to assess disability in patients with COPD. Subsequent work determined the effectiveness and reliability of shorter distance walk testing and eventually, the 6-min time became the most widely accepted protocol. In our study, the pre tests mean of 6MWD for experimental and control group was 359.16 and 360.66 respectively and it was depicted in Fig 1 and 2. The post tests mean of 6MWD for experimental and control group was 414.23 and 383.66 respectively and it was shown in Fig 3 and 4. The experimental group showed significant improvement in terms of walking distance since they incorporated pursed-lip breathing. The present study showed significant improvement in 6MWD for experimental group because the Six minute walk when coupled with pursed lip breathing improved exercise endurance since the greater muscle mass especially quadriceps involved in walking that would increase muscular oxygen extraction thereby inducing a substantial decrease in venous pressure of oxygen and also improved overall oxidative capacity of the individuals with COPD. According to Frank I. Katch and Victor L. Katch, R⁽¹⁸⁾ several weeks of walking training at sub maximal intensity reduces the ventilator equivalent for oxygen (VE/VO₂) and lowers the percentage of the total exercise oxygen cost attributable to breathing. They also added that reduced oxygen consumption by the ventilator musculature enhances exercise endurance for two reasons: (1) it reduces the fatiguing effects of exercise on the ventilator musculature and (2) any oxygen freed from use by the respiratory musculature becomes available to the active locomotors muscles. This would support our hypothesis that 6MWT improves endurance and evaluates exercise tolerance in COPD patients. Since we didn't measure VO₂ Max to

estimate the Oxygen Capacity, this might be one of the limitations in our study. Six minute walk test could determine over all involved system during exercise, as activity of daily living was performed at sub-maximal level, 6MWD possible reflected the functional exercise level for daily activity in COPD patients. In our study we gave six minute walking in COPD patients which is a functional exercise for lower extremity and it carries importance to generate muscle function and improves functional performance in COPD patients.

CONCLUSION

Based on the analysis of data it can be interpreted that pursed lip breathing produces significant effect on improving walking endurance and rate of perceived exertion in non-spontaneous pursed lip breathing COPD patients. Pursed lip breathing was related to its ability to promote a slower and deeper breathing, improves ventilation, keeps the airways open longer and decreases the work of breathing, releases trapped air in the lungs. It is evident that this study is beneficial as this technique can be therapeutically utilized by the COPD patients to improve walking ability and dyspnea which is the main limiting factor in the non-spontaneous COPD patients. In the future, regarding the impact of pursed lip breathing on lung function will definitely reinforce the knowledge of comprehensive pulmonary rehabilitation. Therefore, from the literature available and statistical analysis of data, it can be accepted and stated that *"There is a significant impact of pursed lip breathing on improving exercise endurance in non-spontaneous pursed lip breathing in chronic obstructive pulmonary disease patient."*

CONFLICT OF INTEREST

Conflict of interest declared none.

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