

# Effect of Pursed Lip Breathing and Mouth Mask on Dyspnea in Healthy Individuals- A Pilot Study

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## ABSTRACT

**Background:** Dyspnea or shortness of breath is a common symptom both in general practice and hospital emergency rooms affecting the patients seen in the ambulatory setting. It has been observed that healthy subjects may also experience dyspnea in intense emotional states and during heavy exercises.

**Methods:** Thirty male and female subjects of age group 20-32 years and with normal BMI were randomly assigned into two groups, fifteen subjects in each group. Subjects in Group A (n=15) performed pursed lip breathing and Group B (n=15) performed the pursed lip breathing through Mouth Mask. All subjects were assessed for vitals including their Heart rate, Respiratory rate, Blood Pressure before and after the procedure. Outcome measures in the form of Treadmill walking time and level of dyspnea according to Modified Borg scale was assessed after the procedure.

**Result:** Pursed Lip Breathing through Mouth Mask showed significant improvement in relieving dyspnea and increasing treadmill walking time compared to pursed lip breathing. Both the groups proved themselves to be equally effective in recovery of vital parameters to baseline.

**Conclusion:** Result of the study proved that pursed lip breathing through Mouth Mask showed significantly higher improvement in relieving dyspnea and in increasing the treadmill walking time.

**Key Words:** Dyspnea relief, Treadmill walking time, Pursed Lip Breathing, Mouth Mask

## INTRODUCTION

Dyspnea is a subjective perception of difficulty breathing commonly seen in patients with respiratory and cardiovascular diseases. It has been seen that healthy subjects may also experience dyspnea in intense emotional states and during heavy exercises. [1]

It is a general term which varies in intensity and is generally used to characterized as breathing discomfort which in usually described by air hunger or uneasy awareness of breathing at rest or on exertion. [2]

Dyspnea is a limiting symptom which reflects the disequilibrium between ventilator capacity and ventilator demand. There are some factors which increase the

demand on the ventilator system when the ventilator capacity is inadequate to meet heightened ventilator needs and these factors collectively results in dyspnea. [3]

According to American Thoracic Society' Dyspnea is defined as a subjective experience of breathing discomfort that consists of qualitatively distinct sensations that vary in intensity and it derives from interactions among multiple physiological, social and environmental factors and further induces some secondary physiological and behavioral responses. [4]

It has been observed that there are many different clinical disorders which produces the symptoms of dyspnea such as cardiac disorders, pulmonary and neurological disorder and there are also

many different situations where healthy subjects can experience dyspnea e.g.- at high altitude, during stressful situation that cause anxiety or panic and more commonly during strenuous exercise. [5]

Dyspnea is a common symptom. It has been reported that 7.4% of patients presenting to emergency room complain of dyspnea. Among patients in general practice, 10% complain of dyspnea when walking on flat ground and 25% complain of dyspnea on more exertion, e.g., climbing stairs. [6]

There are different factors included in the mechanism of dyspnea, some of these are- functional status of respiratory muscles, the role of chemoreceptors and mechanoreceptors, chest wall receptors, central motor output. [7]

Healthy subjects usually complain of dyspnea during exercise. It has been seen that during exercise increased sensation of respiratory effort mostly lead to dyspnea both in normal subjects and in patients with COPD. [8]

Various scales and questionnaires are used to assess dyspnea, ranging from simple descriptions of intensity (Borg Scale, Modified Borg Scale) to multidimensional questionnaires (e.g., the multidimensional dyspnea profile). [9]

Dyspnea is often treated with a variety of pharmacological and non-pharmacological intervention. Various breathing exercises help in reducing dyspnea. Pursed Lip Breathing is one of the maneuvers which help in reducing dyspnea, it is defined as a breathing technique in which patients are taught to inhale slowly through the nose and exhale out more slowly through pursed lips. [10]

Pursed Lip Breathing helps in prolonging the exhalation period which further prevents bronchiolar collapse and air trapping. It also reduces the hyperventilation and helps in increasing the ratio of ventilation-perfusion and helps in relieving shortness of breath and promotes comfort by increasing the level of oxygen in the blood. [11]

Mouth Taping is one technique which works on the same principle as of pursed lip breathing, modification here is the application of tape around and over the lips with a small opening as the centre, creating a central aperture. [12]

One study has been done on healthy subjects by Gaurav Maind et.al., in this study he compared a technique called mouth taping with pursed lip breathing and he found both effective in relieving dyspnea and author suggested that mouth taping can be used as an adjunct to pursed lip breathing in order to relieve dyspnea and can also be used in those who have difficulty in maintaining and therefore performing pursed lip breathing. [12]

It may appear an unconventional approach as it will be very difficult for the subject to regularly apply and wean off the tape because it will be very painful for the subject, and it has been found that it is being very difficult to co-ordinate with the subjects who are walking on treadmill with pursed lip breathing, it was difficult for them to hold the aperture of the mouth as of pursed lip breathing, so, in the current study a mouth mask has been designed which automatically holds the aperture as of pursed lip breathing and works on the same principle as pursed lip breathing.

So, the need of the current study was to observe whether the effect of mouth mask would be similar to the beneficial effects of pursed lip breathing.

## METHODOLOGY

This prospective comparative study was carried out in SGT Hospital and research institute, Budhera, Gurugram. Ethical research committee approved the study.

Thirty male and female subjects between 20- 32 years old with normal BMI were recruited in the study. All the subjects with any kind of musculoskeletal deformity limiting the performance of activity regimen, cardio-respiratory disease, uncontrolled hypertension, unstable cardiac disease, recent pneumothorax, asthma or

any other medical or surgical condition like restrictive pulmonary disease were excluded from the study.

Subjects who fulfilled the inclusion and exclusion criteria were divided into two groups by using simple random sampling method i.e, Group A included 15 subjects who performed the pursed lip breathing exercise and Group B included 15 subjects who performed the pursed lip breathing through mouth mask. All the subjects underwent baseline assessment including the vitals (HR, RR and BP). Whole procedure of the training was explained to all the subjects and a written informed consent was obtained.

**Procedure-**

Before the test, subjects were instructed to stand on treadmill with hands loosely holding the handrails. All of them were subjected twice to the Bruce’s protocol with a rest period of 4 days as a wash out period in between the tests.

At each stage of Bruce’s protocol, subjects graded their dyspnea status. Test was terminated either when the subject reported “maximal” on the Modified Borg Scale or when the subject stopped due to any reason other than dyspnea (e.g. leg cramps, giddiness). All the vital parameters were reassessed immediately after and until recovery to baseline values. Time required for recovery to pre-test parameters was noted. This denoted time for dyspnea relief.

**Group A- Pursed Lip Breathing-**

Pursed lip breathing (Subjects were instructed to purse their lips while walking on treadmill and advised to inhale from nose and exhale through pursed lips [12]).

**Group B- Mouth Mask-**

Subjects of this group were given a mouth mask, this mask was designed in such a way that only central aperture, i.e., only 1/4<sup>th</sup> of the total lip length is kept open. Then subject were asked to wear the mask and demonstrate the breathing pattern, like pursed lip breathing group. After the confirmation of the breathing pattern, subjects were asked to walk on treadmill and advised to inhale from nose and exhale

through the mouth right from beginning of the test. Before making this mask, the mouth impression of the subject was taken by using alginate impression material on the Plaster of Paris (POP) cast then with the use of heat over acrylate sheet (Poly Methyl-Meth- Acrylate- PMMA), the impression is adapted on this sheet with the help of heat, then by keeping 1/4<sup>th</sup> of the total lip length open aperture was created so that it holds the position of the lip similar to that of pursed lip breathing.



Fig. 1

**RESULT**

The data was analyzed by using software package SPSS 21for window version. Mean and standard deviation of all the variables were calculated. The level of significance was set at p <0.05. Paired ‘t’ test was used for comparison within the groups, i.e., for pre and post-test values of Group A & B. Unpaired ‘t’ test was used for comparison between the two groups of all the values. Non significant differences were found in all the vitals of both the groups when comparison was made between pre test and post test. It was found that subjects in Group B were walked significantly more than Group A. Significantly more dyspnea was found in Group A during walking on treadmill.

**Table 1: Comparison of Vitals in Group A**

Variables	Pre-test Mean ± SD	Post-test Mean ± SD	t value	P value
RR (per min.)	20.73±1.98	18.73±2.05	.449	.657 <sup>NS</sup>
HR (per min.)	85.73±7.430	81.93±7.06	.120	.905 <sup>NS</sup>
SBP (mmHg)	132.93±5.76	129.53±4.50	.064	.950 <sup>NS</sup>
DBP (mmHg)	87.13±2.47	82.87±2.29	.640	.528 <sup>NS</sup>

NS- Non Significant  
(RR- Respiratory rate; HR- Hear rate; SBP- Systolic BP; DBP- Diastolic BP)

**Table 2: Comparison of vitals in Group B**

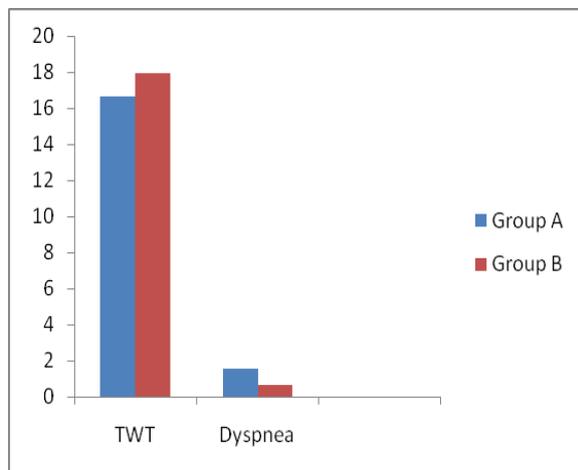
Variables	Pre-test Mean ± SD	Post-test Mean ± SD	t value	P value
RR (per min.)	21.07±2.08	18.00±2.26	.929	.361 <sup>NS</sup>
HR (per min.)	86.07±7.75	81.67±7.35	.101	.920 <sup>NS</sup>
SBP (mmHg)	132.80±5.76	127.67±5.19	1.05	.302 <sup>NS</sup>
DBP (mmHg)	87.73±2.65	83.07±2.96	.207	.838 <sup>NS</sup>

NS- Non Significant  
(RR- Respiratory rate; HR- Hear rate; SBP- Systolic BP; DBP- Diastolic BP)

**Table 3: Comparison of Variables between the Groups**

Variables	Group A (n=15) Mean ±SD	Group B (n=15) Mean ± SD	t value	P value
DRT (min.)	1.313±0.302	1.320±0.283	.062	.951 <sup>NS</sup>
TWT (min.)	16.67±1.175	17.93±1.163	3.69	.006 <sup>**</sup>
Dyspnea	1.53±0.718	0.66±0.55	26.3	.001 <sup>**</sup>

NS-Non Significant  
\*\*- Highly significant  
(DRT- Dyspnea relieving time; TWT- Treadmill walking)



**Fig.2 Comparison of Treadmill walking time and Dyspnea between the Groups**

## DISCUSSION

Dyspnea commonly known as shortness of breath or labored breathing that consists of qualitatively distinct sensations that vary in intensity. It is a common symptom which derives from interactions among various factors including physiological, psychological, social, and environmental and is a normal symptom of heavy exertion but can be pathological if it occurs in unexpected situations. [13]

The pathophysiology of dyspnea is multifactorial. Due to the activation of the several pathways there occur increased work of breathing, stimulation of the upper or lower airway receptors, lung parenchyma or chest wall and because of the central and peripheral chemoreceptors excessive stimulation of the respiratory centre occur. Activation of these pathways reaches to the

central nervous system via respiratory muscle and vagal afferents, and in the context of affective state, attention, and prior experiences these are consequently interpreted by the individual and results in the awareness of breathing. [14]

Studies in healthy subjects have shown that the increase in effort represents the increase in motor command. During exercise, there are certain changes which occur in respiratory impedance it can be either increased or decreased resulting in greater pressure and lesser velocity of contraction, or greater velocity of shortening and less pressure respectively, both peak of pressure and velocity of inspiratory muscle shortening collectively lead to the sensation of dyspnea. [15]

There are various pharmacological and non-pharmacological interventions which are specifically used to reduce dyspnea. Pharmacological treatment includes- bronchodilators, glucocorticoids, opioids and Non-pharmacological intervention includes- pulmonary rehabilitation, oxygen therapy, ventilator support, breathing exercises, pursed lip breathing. [16,17]

Pursed lip breathing is a ventilator strategy which helps in reducing dyspnea by improving pulmonary gaseous exchange, by altering breathing pattern and by improving alveolar ventilation. Additionally, a faster recovery from dyspnea and a slower respiratory rate were found after walking with pursed lip breathing. [18]

In the current study a mouth mask has been designed which can be used as an alternative to pursed lip breathing. It works on the same principle as of pursed lip breathing and can be used as an adjunct to pursed lip breathing as it automatically holds the aperture of the mouth as of pursed lip breathing by continuously giving the feedback and helped in reducing dyspnea by reversing dynamic hyperinflation through increased intraluminal pressure in the airways resulting in a shift of equal pressure point from distal to proximal and helped in preventing airway collapse.

Results of this study revealed that Group B who performed pursed lip breathing through mouth mask showed statistically more significant improvement in relieving dyspnea and improved the treadmill walking time ( $p < 0.005$ ).

It has been seen that pursed lip breathing reduces respiratory rate, dyspnea and arterial partial pressure of carbon dioxide and improves tidal volume and oxygen saturation in resting conditions.

Roberts et. al. performed a review on pursed lip breathing and concluded that 40% of dyspnea was reduced when pursed lip breathing was used. [19]

The results of the study by Nurul Kartika et.al. concluded that self efficacy pursed lip breathing is more effective to decrease tightness and increase oxygen saturation compared with relaxation breath. [20]

A study conducted by Fateme. S Izadi Avajji showed that pursed lip breathing exercise if done regularly can increase oxygen saturation and further improves alveolar ventilation. [21]

To reduce dyspnea a study was conducted by Gaurav Maind et al. in which they compare the effect of mouth taping and pursed lip breathing on dyspnea in normal individuals and he found no significant difference between both the groups. It was concluded that the exercises responses reflected by treadmill walking time, the dyspnea status reached during exercising timings and time for recovery to baseline parameters were similar in both the groups, suggesting that mouth taping can be use an alternative of pursed lip breathing. But to use micropore tape was a painful approach, and it was found to be very difficult to coordinate with the patients because due to increase level of dyspnea or state of acute exacerbation they were not well oriented and cannot follow the command of the therapist and was very difficult for them to hold the aperture of the mouth as of pursed lip breathing so in the current study a mouth mask was designed and by using this mask one can perform pursed lip breathing

comfortably and more efficiently and can be used by those who finds difficulty in performing pursed lip breathing and when pursed lip breathing required for prolonged duration.

## CONCLUSION

Result of the study showed that subjects who performed pursed lip breathing through mouth mask showed significantly higher improvement in relieving dyspnea and increasing treadmill walking time, suggesting that Mouth Mask can be used as an alternative to pursed lip breathing especially when patients find it difficulty in holding the aperture of the mouth as pursed lip breathing or unable to understand the pattern of pursed lip breathing.

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