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# EFFECT OF POSTURAL CORRECTION ON DYSPNEA INDEX AND PULMONARY FUNCTIONS IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE PATIENTS

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## ABSTRACT

To study the effectiveness of postural correction on dyspnea index and pulmonary functions in COPD patients, 30 subjects of age group 40-70 years were included according to GOLD criteria having MILD (FEV1/FVC < 0.70, FEV1 > 80% predicted), MODEARTE (FEV1/FVC < 0.70, 50% < FEV1 < 80% predicted) and SEVERE (FEV1/FVC < 0.70, 30% < FEV1 < 50% predicted). They were divided into two groups for two different treatments selected by chit method into their respective GROUP 1 and 2. GROUP 1 patients were given pursed lip breathing and GROUP 2 patients were given postural correction along with pursed lip breathing. Pre and Post PFT, ISD, Borg Score and 6MWTD were taken as outcome measures, were compared and the results showed the effectiveness of postural correction.

**KEYWORDS**: ***Postural Correction, COPD, Dyspnea Index, Lung Function.***

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## INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is the most common obstructive airway disorder. Global initiative for chronic obstructive lung disease (GOLD) defines COPD as a common preventable and treatable disease and is characterized by persistent airflow limitation that is usually progressive and associated with an enhanced chronic inflammatory response in the airways and the lung to noxious particles or gases. Exacerbations and co-morbidities contribute to the overall severity in individual patients.[1] According to crude estimates, 30 million people suffer with COPD in India, and these numbers are only going to increase in the forthcoming years.[2]

***Thorax And Chest Wall***

The thorax provides a base for the attachment of muscles of the upper extremities, the head and neck, the vertebral column, and the pelvis. Probably the most important function of the chest wall is its role in ventilation. The process of ventilation depends on the mobility of the bony rib thorax and the ability of the muscles of ventilation to move it.[3,4] Ventilatory function can be affected when pathology interferes with the structure of the bony thorax. These musculoskeletal abnormalities limit range of motion of the chest cage and the spine and, therefore, decrease ventilation abilities.[5] Musculoskeletal dysfunction contributes to dyspnea, decreased exercise capacity and ventilatory failure.[6] Patients with advanced COPD, especially having predominant emphysema, have forward shoulder posture (FSP) (rounded shoulder posture). It is one of the numerous deviations from the normal or standard posture.[7] Postural kyphosis is a flexible deformity which is not associated with any underlying bony abnormality. Patients with COPD will attain forward shoulders and kyphotic posture affecting the respiratory function values.[8] Imbalance of musculature that results from tightness or weakness in these abnormal postures affects the lung volumes and capacities by reducing the ability to straighten the upper back, which in turn limits the ability to raise and expand the chest and maximize the lung capacity.[9] Ghanbari in his study reported a reduction in Forced Vital Capacity (FVC) following an increase in the FSP.[10] There are many ways in which COPD patients can be treated and given the treatment among them are by the Drugs, Physiotherapy and many more. Evidence-based support for pulmonary rehabilitation in the management of patients with chronic respiratory disease has grown tremendously, and this comprehensive intervention has been clearly demonstrated to reduce dyspnea, increase exercise performance, and improve health-related quality of life (HRQL).

**Spirometry** The spirometry, as seen in figure 6, was done as per the ATS guidelines.[11]

**Interscapular distance (ISD)** was measured in inches using an inch tape. The horizontal distance between T3 spinous process and the vertebral border of both the scapulae was measured in inches.

**The 6-min walk test distance (6MWTD)** was calculated as per the guidelines given by the American Thoracic Society, pre and post assessment.[12] Subjects were instructed to dress comfortably and avoid vigorous exercise or eating at least 2 hours before the test. The subject's usual medical regime was continued; the required equipment for this test were collected prior to the test. The test was performed indoor on a non-slippery hard surface, along a long flat, straight corridor. The walking course was 30 m in length which was marked at every 3 m. The turnaround point was marked with a visible orange cone. The Borg scale was used to measure the sensation of breathlessness .[13] Borg's scale of dyspnea starts at number 0 where the breathing causes no difficulty at all and progresses through to number 10 where breathing difficulty is maximal.

***Breathing exercises***

Patients were made to sit comfortably in a relaxed position and were educated for pursed lip breathing (PLB) as seen in figure 5. In a comfortable sitting position, the patients with mouth closed, were asked to inhale through their nose for at least 2-3 s, then exhale slowly for 4-6 s through pursed lips held in a whistling position. Then the patients were made to practice the technique. This exercise was done for 10 breaths, 4 times daily.

***Postural Correction Exercises***

Postural correction was done in the study group through stretching and strengthening exercises to the weak muscles of neck and thorax and spinal kyphosis correction . They are as follows:

***Strengthening Exercises***

a) For strengthening lower cervical and upper thoracic erector spinae, resisted axial extension or neck isometrics for correction of forward head posture was done, in sitting by asking the patient to sit as erect as possible and then press the skull against the therapist's hand and hold each press for 10 seconds without holding breath.

b) For strengthening scapular retractor muscles (rhomboids and middle trapezius), the patient was made to lie prone, as seen in figure 4, or sit on a stool or on bedside with feet fixed on the floor, hip flexed to a comfortable range and spine as erect as possible. The arm was horizontally abducted to $90^0$ and then the patient was asked to approximate the scapulae posteriorly, i.e. scapular retraction and elbows were extended for greater resistance.

c) Lattissimus Dorsi muscle strengthening in sitting position was done by shoulder girdle depression using body weight for resistance, by placing fist on bed , elbow extended and depressing the scapulas to lift buttocks off the bed as seen in figure 1. Positive training effects were yielded by all these exercises done for 4 weeks, with a frequency of 5 times a week, 3 sets in each session and 15 repetitions in each set.

***Stretching Exercises***

Passive manual stretching was applied at low intensity for 30 secs and 3 repetitions and 5 times a week. Static stretching was given slightly beyond the point of tissue resistance and available ROM to increase flexiility.[14] Muscles to be stretched were :

- Sternocleidomastoid and scalene: axial extension, side bend, neck opposite and then rotate neck toward side of restriction as seen in figure 3.
- suboccipital rectal capitis : capital nodding
- pectoralis major and minor : corner stretch

**Spinal Extension exercises** were also included along with postural awareness training: As seen in figure 2, patient is in erect sitting position with both his hands clasped behind his head, chin is tucked in and then he goes for mid thoracic extension with the help of the therapist. It was done 15 times in a row and divided in three sets. Extension was increased in a comfortable range. Posture is one of the components that is often over looked while rehabilitating the patients with COPD, hence there is scarce data on whether an addition of posture correction to respiratory exercises would provide additional benefits to that achieved by respiratory exercises alone in COPD patients. Hence, the present study was carried out to evaluate the overall effect of postural correction and respiratory exercises in patients with COPD.

## METHODS

### *Study design*

The study was experimental and simple random sampling was done. The research protocol was approved by guide, institution. Approval Reference Number: DYPCPT/319/201. Ethical clearance was taken from the committee. Written consent was taken from the participants.

### *Procedure*

30 subjects coming under the age group of 40-70 were assessed according to the GOLD criteria MILD, MODERATE and SEVERE. Pre assessment was done by PFT, ISD, borg score with 6MWTD. Subjects were divided into group 1 and 2. Group 1 received only pursed lip breathing exercise whereas Group 2 received a combination of PLB exercise and postural correction by strengthening and stretching of weak neck and thoracic muscles to prevent and correct the dorsal thoracic kyphosis and forward shoulder posture. Pre and post values of all the 7 outcome measures were obtained and compared.

### *Outcome measures*

ISD, Dyspnea scores using Modified Borg Scale with 6MWTD; Spirometric values: PEFR, FEV, FVC and FEV1 /FVC.

## STATISTICAL ANALYSIS

Pre and post values of all the seven outcome measures were compared by Paired T-test and Independent T-Test was applied for the post value data which had no significant baseline difference of the pre values between the groups. ANCOVA (Analysis of Covariance) Test was applied for the post value data which had significant baseline difference of the pre values between the groups, i.e. for FEV1/FVC and PEFR. Level of significance for the mean difference was set to $P < 0.05$ with a Confidence Interval (CI) of 95 %.

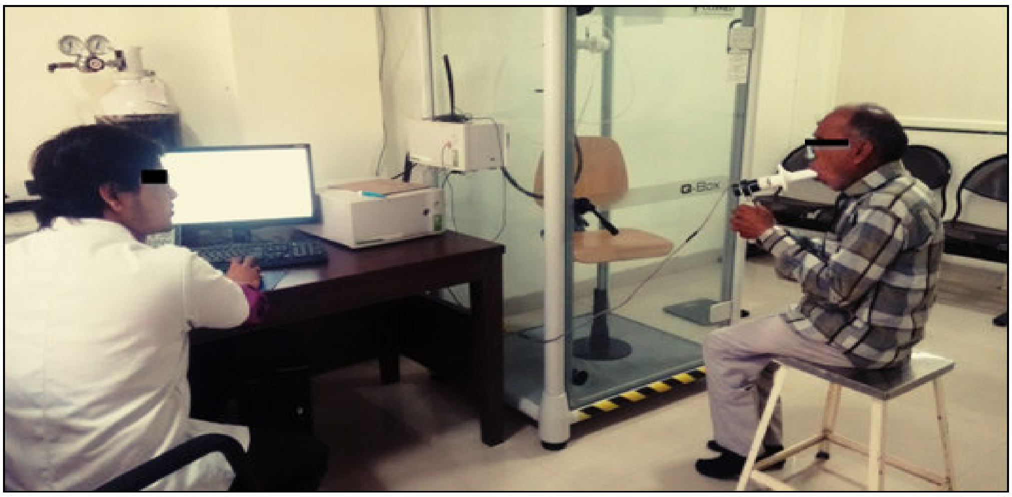
1. Lattissimus Dorsi Strenghthening

2. Thoracic Spine Extension

3. Scalene Muscle Stretching

4. Rhomboideus and Middle Trapezius Strengthening

5. Pursed Lip Breathing



6. Technician guiding the patient while performing PFT

**Table 1**
***shows the values of mean difference of outcome measures***

| OUTCOME MEASURE | GROUP 1 | GROUP 2 | P value |
|---|---|---|---|
| **ISD** | -0.03 | 0.83 | <0.05 |
| **BORG SCORE** | -1.07 | 2 | <0.05 |
| **6MWTD** | 3.33 | 33.33 | <0.05 |
| **FVC** | -0.10 | 0.11 | <0.05 |
| **FEV1** | -0.005 | 0.081 | <0.05 |

***[ISD - InterScapular Distance, 6MWTD – 6 Minute Walk Test Distance, FVC – Forced Vital Capacity, FEV1 – Forced Expiratory Volume in 1 sec, P value represents level of significance]***

**Table 2**
***shows the values of mean difference of FEV1/FVC & PEFR.***

| **FEV1/FVC** | | | | | | |
|---|---|---|---|---|---|---|
| Group | Pre Mean±SD | Post Mean±SD | difference | t value | P value | D.F. |
| Control Group 1 | 51.3 ± 8.17 | 51.28 ± 7.84 | 0.05 ± .59 | 2.42 | 0.023 | 27 |
| Study Group 2 | 59.3 ± 6.67 | 61.35 ± 5.73 | 2.02 ±4.85 | | | |
| **PEFR** | | | | | | |
| Group | Pre Mean±SD | Post Mean±SD | difference | t value | P value | D.F. |
| Control Group 1 | 2.07 ± 1.08 | 2.06 ± 1.13 | 0.01 ±0.27 | 3.38 | 0.002 | 27 |
| Study Group 2 | 3.04 ± 1.47 | 3.44 ± 1.33 | 0.39 ±0.47 | | | |

***[PEFR – Peak Expiratory Flow Rate]***

## RESULTS

Table 1 shows the mean difference values of 5 outcome measures of pre and post values for comparison between the groups. The mean difference for ISD of group 1 is -0.03±0.13 and for group 2 is 0.83±0.41, for BORG SCORE of group 1 is -1.07±0.79 and group 2 is 2±0.93. The mean difference for 6MWTD of group 1 is 3.33±14.96 and for group 2 is 33.33±12.34. The mean difference for FEV1 of group 1 is -0.01±0.119 and for group 2 is 0.08±0.115. The mean difference for FVC of group 1 is -0.09±0.25 and group 2 is 0.11±0.14. For both the groups interpretation was done by independent t test. The results of analysis were obtained by p-value. The p-value for ISD, Borg Score, 6MWTD, FEV1 and FVC was <0.05. Table 2 shows the mean difference values of FEV1/FVC and PEFR of pre and post values for comparison between the groups. The mean difference for FEV1/FVC of group 1 is 0.05 ± .59 and for group 2 is 2.02 ±4.85. The mean difference for PEFR of group 1 is 0.01 ± 0.27 and group 2 is 0.39 ± 0.47. Interpretation was done by ANCOVA on post values using pre values as covariate. ANCOVA was used because the resultant value for baseline difference between the pre values of both groups was significant. The results of analysis were obtained by p-value. The p-value for FEV1/FVC is 0.023, for PEFR is 0.002. Therefore, the results were statistically significant.

## DISCUSSION

This study shows a comparison between a study group receiving postural correction and pursed lip breathing while the control group receiving only pursed lip breathing with COPD. The major findings suggested that an addition of postural correction along with the trained breathing as a part of the pulmonary rehabilitation program led to not only correction of posture, but had additional improvements in dyspnea scores and pulmonary functional capacity in patients. Postural abnormality was assessed by measuring ISD. Spinal kyphosis causes impaired respiratory function which in turn leads to fatigue and thus decreased exercise tolerance, eventually affecting activities of daily living. Gosselink *et al.* in their study have reported that respiratory muscle dysfunction is attributed to multiple factors related to the presence and severity of COPD. Indeed, intrinsic (muscular and metabolism mass) as well as extrinsic factors (changes in chest wall geometry and diaphragm position and systemic metabolic factors) may alter respiratory muscle function. There was a significant reduction of ISD in between the two groups after 4 weeks of intervention by the postural correction exercises in the study group thus reducing the degree of kyphosis and straightening the spine in patients with COPD. Kendall *et al*. has reported that bad posture or weakness of upper back erector spine, middle and lower trapezius muscle interferes with the ability to straighten the upper back, thus limiting the ability to raise and expand the chest and maximize the lung capacity. Hence, we assume that the postural correction exercises would have played a role in straightening the spine and increasing the lung volume and capacities. 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 better reflects the functional exercise level for daily physical activities.[15] Changes in 6MWD after therapeutic interventions suggest the subjective improvement in dyspnea is better in the study group than in the control group due to corrected posture thus leading to better recruitment of respiratory muscles. The 6MWT has been widely used for preoperative and postoperative evaluation and for measuring the response to therapeutic interventions for pulmonary and cardiac disease. In the present study, the FVC, FEV1, FEV1/FVC and PEFR showed significant improvement within the groups after 4 weeks of intervention (*P* < 0.05). In between group comparison showed significant difference between the groups (*P* < 0.05) after 4 weeks of training, however the study group showed highly significant improvement in FVC, FEVI and PEF ($P < 0.05$). During active or forced breathing occuring with increased activity or with pulmonary pathologies, accessory muscles of both inspiration and expiration are recruited to perform the increased demand for ventilation. In patients of COPD, chronic hyperinflation of the lungs results in a resting position of the diaphragm, lower (more flattened) than normal. Consequently, with more severe disease, an active contraction of the diaphragm pulls the lower ribs inwardly more than pulling the diaphragm down which results in less of a reduction in thoracic size and thus decreased inspiration. The range of motion, or excursion, of the thorax is thus limited. With flattened diaphragm, majority of inspiration is now performed by other inspiratory muscles that are not as efficient as the diaphragm. The barrel-shaped and elevated thorax puts the sternocleidomastoid muscles in a shortened position, making them less efficient. The parasternal and scalene muscles generate greater forces while nearing total lung capacity; consequently, hyperinflation has a less dramatic effect on them.[16] The diaphragm has a limited ability to expand the rib cage laterally leading to increased inspiratory motion in the upper rib cage. The disadvantages of these biomechanical alterations of hyperinflation are compounded by the increased demand for ventilation in COPD. More work is required of a less effective system. The work of breathing is thus markedly increased. Postural exercises have been recommended since the posture of a COPD is typically pronounced by thoracic kyphosis. These postural misalignments can lead to a decrease respiratory capacity and can severely affect visceral functioning. However, these postural abnormalities have been found to be improved following postural retraining that includes breathing, strengthening, stretching and spinal extension exercises. Possible reasons why postural retraining is implicated is since a COPD's posture is affected by changes in the contractile (i.e. muscles) and non-contractile units (i.e. bone, ligaments, tendons, cartilage and connective tissue). Further, since they have a loss of midcervical lordosis more weight and tension is exerted at the cervical-thoracic junction which can lead to an increase in thoracic kyphosis that abducts the scapulae which shortens the pectoralis major and pectoralis minor, lengthens the rhomboids and lowers the trapezius I and II and shortens the serratus anterior, scm, latissimus dorsi, subscapularis and teres major, all of which affect normal breathing. Spinal extension corrects thoracic kyphosis and improve breathing when the vertebral alignment occurs along with intercostal muscles stretching. Postural retraining should focus on the facilitation of correcting righting, equilibrium and protective reactions with normal tactile, proprioceptive and kinesthetic input. The major findings of this study were that an addition of postural correction along with pursed lip breathing as a part of the pulmonary rehabilitation program led to not only correction of posture, but had an additional improvements in overall well being of the study group. Thus its a meaningful addition to pulmonary rehabilitation programs directed at COPD patients with muscle weakness and faulty posture.

## CONCLUSION

In this study we concluded that postural correction along with pursed lip breathing is effective among the COPD patients to improve the dyspnea index and pulmonary function when compared to pursed lip breathing alone. In addition to this, we can include respiratory muscle strengthening, for a more effective rehabilitation programme, in further studies.

## CONFLICT OF INTEREST

Conflict of interest declared none.

## REFERENCES


1. Vestbo J, Hurd S. Global Strategy for the Diagnosis, Management, and Prevention of Chronic Obstructive Pulmonary Disease.AJRCCM[Internet].2012 Aug [cited 2013 Feb 15;187(4) : 347-365.
2. Salvi S, Agrawal A. India Needs a National COPD Prevention and Control Programme: supplement to Japi. J Assoc Physicians India.2012 Feb;60 Suppl: 5-7. Available from: https://www.ncbi.nlm.nih.gov/pubmed/23155805.
3. Brannon F, Foley M, Starr J, et al.Cardiopulmonary Rehabilitation: Basic Theory and Practice.3rd ed. Philadelphia:FA Davis;1998.
4. De Troyer A, Estenne M. Functional anatomy of the respiratory muscles. Clin Chest Med . 1988 Jun; 9(2): 175-93.
5. Leong JCY, Lu WW, Karlberg EM. Kinematics of the chest cage and spine during breathing in healthy individuals and in patients with adolescent idiopathic scoliosis. Spine.1999 July 1; 24(13):1310–1323.
6. Ramirez‑Sarmiento A, Orozco‑Levi M, Guell R, Barreiro E, Hernandez N, Mota S, *et al*. Inspiratory muscle training in patients with COPD: Structural adaptation and physiologic outcomes. Am J Respir Crit Care Med. 2002 Dec 1; 166(11):1491‑7.
7. Nield MA. Inspiratory muscle training protocol using a pressure threshold device: Effect on dyspnea in chronic obstructive pulmonary disease. Arch Phys Med Rehabil.1999 Jan; 80(1):100‑2.
8. Kisner C, Colby LA. Therapeutic Exercise: Foundations and Techniques. 3rd ed. Philadelphia: F A Davis Co. Publication; 1996. p. 111‑20.
9. Kendall FP, Kendall E, Provance PG, Rodgers MM, Romani WA. Muscles Testing and Function with Posture and Pain. 5th ed. Baltimore, MD: Lippincott, Williams and Wilkins Publication; 2005. p. 49‑54.
10. Ghanbari A, Ghaffarinejad F, Mohammadi F, Khorrami M, Sobhani S. Effect of forward

shoulder posture on pulmonary capacities of women. Br J Sports Med 2008 Dec; 42(7): 622‐3.

11. Pellegrino R, Viegi G, Brusasco V, Crapo RO, Burgos F, Casaburi R, *et al*. Interpretative strategies for lung function tests. Eur Respir J. 2005 Nov; 26(5):948‐68.
12. ATS Committee on Proficiency Standards for Clinical Pulmonary Function Laboratories. ATS statement: Guidelines for the six‐minute walk test. Am J Respir Crit Care Med. 2002 July; 166(1):111‐7.
13. Kendrick KR, Baxi SC, Smith RM. Usefulness of the modified 0‐10 Borg scale in assessing the degree of dyspnea in patients with COPD and asthma. J Emerg Nurs 2000 Jun; 26(3):216‐22.
14. Sahyoun NR, Lentzner H, Hoyert D. Robinson KN. Trends in Causes of Death Among the Elderly. Aging Trends; No.1. Hyattsville, Maryland: National Center for Health Statistics. 2001Mar; (1):1-10. American Thoracic Society. ATS Statement: Guidelines for the Six-Minute Walk Test.
15. Am J Respir Crit Care Med[Internet] 166. pp 111–117, 2002, DOI: 10.1164/rccm.166/1/11
16. Decramer M: Hyperinflation and respiratory muscle interaction. Eur Respir J. 1997 Apr;10(4):934–941.

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