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The Immediate Effect of Chest Mobilization Technique on Chest Expansion in Patients of COPD with Restrictive Impairment

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Abstract: ***Background: Chronic Obstructive Pulmonary Disease (COPD) is a primary lung disease but as it advances, there is restriction in chest wall mobility which decreases pulmonary functions and vital capacity of lung. So purpose of this study is to assess the immediate effect of Chest Mobilization (CM) on improving the Chest Expansion (CE). Objective Of Study: To improve Chest Expansion in patients of COPD with restrictive impairment by chest mobilization technique. Method: An Experimental study was conducted on 30 COPD patients having vital capacity <80%, to assess the pre and post differences in Modified Chest expansion by applying chest mobilization techniques - Rib rotation, Chest wall rotation, Lateral flexion of chest wall, Chest wall extensionandPectoralis major muscle stretching. Result: For within group analysis, comparison of data for Chest Expansion value were done using paired t test. And for between groups analysis, comparison of data for Chest Expansion value were done using unpaired t test. Statistical analysis showed that there was significant improvement in Chest Expansion after application of chest mobilization technique. Conclusion: It can be concluded from the present study that Chest Wall mobilization has significant effect on Chest expansion in COPD patients who are having restrictive impairment of chest wall in later stage of disease.***

Keywords: Chest mobilization, COPD, Chest expansion, Cloth tape measurement

1. Introduction

The term Chronic Obstructive Pulmonary Disease (COPD) refers to chronic disorder that disturbs airflow. COPD is a major cause of morbidity and mortality in INDIA[1]. COPD is a preventable and treatable disease with some significant extra-pulmonary effects that may contribute to the severity in individual patients. Its pulmonary component is characterized by airflow limitation that is not fully reversible.[2]

Normally, people take deep breaths or sigh regularly. These actions stretch the respiratory structures. Patients of COPD with chronic respiratory muscle weakness have reductions in lung volumes and vital capacity (VC) and they may have decrease in lung distensibility with lung volume restriction. As shown by Mizuri et al, failure to fully expand the lungs causes increasein lung tissue and chest wall elasticity and decreases in compliance.[3]

The total mechanical work of breathing (WOB) is the sum of the work of overcoming both the elastic and frictional forces opposing inflation. In healthy adults, about two thirds of the WOB can be attributed to elastic forces opposing ventilation. The remaining third is due to frictional resistance to gas and tissue movement. In diseased states, the WOB can dramatically increase. In patients with restrictive lung disease, work is the integration of the volume-pressure breathing curve. The increase in the WOB is a function of tissue elastance and an inverse function of pulmonary compliance.[4]

Failure to take periodic deep breaths can change alveolar surface forces and increase the tendency for alveolar collapse. Gross muscle weakness alters the passive recoil of the thoracic cage, modifying the neutral position at which lung and cage recoil pressures are balanced. These results in altered inspiratory muscle length-tension relationships. The lungs and chest walls are susceptible to the effects of incomplete regular mobilization. The tendons and ligaments of the rib cage and the costovertebral and costosternal articulations stiffen, and the latter ankylose, as the intercostal and other respiratory muscles become fibrotic and contracted.[5]

Expiratory airflow is limited because of the obstruction, leading to air trapping and hyperinflation. This accentuates when the minute ventilation or respiration rate is increased, for example during exercise.[6] The hyperinflation induces increased strain on the respiratory muscles, which are forced to work in a limited range of movement with negative pressure/effort relationship, leading to fatigue and increased dyspnoea.[7] To avoid the distressing feeling of dyspnoea, the patients with COPD tend to avoid physical exertion and adapt a more sedated lifestyle than healthy elderly subjects.[8] This, in turn, leads to a vicious cycle of reduced exercise capacity inducing increased dyspnoea during exercise which leads to a further avoidance of exercise and so on.

Mobilization of rib cage joints appears as a specific aim for physiotherapy, as rib cage mobility seems to be reduced with obstructive lung disease. Chest wall mobilization improves mobility of chest wall, reduces respiratory rate, increases tidal volume, improves ventilation gas exchange, reduces dyspnea, decreases work of breathing and facilitate relaxation.[9,10,11,12,13,14,15]

2. Materials and Methods

Study Design: Experimental study (Before and after with control), one time study.

Sample Design: Random sampling

Sample Size: 30 patients

Study Setting: General Hospital, Ahmedabad

Selection Criteria

- Inclusion Criteria:-Patients diagnosed as having COPD by the physician. The diagnosis was confirmed by COPD questionnaire, Patients with COPD with restrictive impairment (VC<80%), Age: >40yrs, Sex: male.
- Exclusion Criteria: Patients with unstable vital parameters, Those who have active lung infection, Patients with congenital heart disease, ischemic heart disease, rheumatic heart disease, Paatients who have recently taken bronchodilator drugs, Patients with continuous Oxygen therapy, Patients with artificial ventilation.

Materials: Assessment format, COPD Questionnaire, Cloth Measure tape, Stethoscope, Pencil, Pulmonary Function Test

Table 1: Difference in means of Age

Group A [Y]	55.47±5.06
Group B [Y]	57.47±8.22

[Y] - Mean ± SD

Outcome Measures

Chest Expansion Value[16]: Measurement of thoracic excursion with a cloth tape measure heldaround the circumference patients's chests attwo levels. Upper thoracic excursion measurements were takenat the level of the fifth thoracic spinous process and the thirdintercostal space at the midclavicular line. Lower thoracicexcursion measurements were taken at the level of the 10th thoracicspinous process and the xiphoid process.

Procedure

30 patients were randomly selected according to inclusion criteria. PFT of all these patients were done. These patients were divided randomly into two groups (15 in each group), one group was experimental and other was control group.
Group A: Chest mobilization and Breathing exercise
Group B: Breathing exercise only
Chest expansion values were measured before and after giving chest mobilization technique. 3 Repetitions of each maneuver was done.

Chest Mobilization tech. are[10]:

Figure 1: Rib rotation

Figure 2: Chest wall rotation

Figure 3: Lateral flexion of chest wall

Figure 4: Chest wall extension

Figure 5: Pectoralis major muscle stretching

3. Statistical Analysis

Statistical analysis was done using Graph Pad InStat 3 version software for windows. Parametric paired test was applied for within group comparison. And unpaired t test was applied for comparison between the groups. P value less than 0.05 was considered as significant for all measurements.

4. Result

Table 2: Difference in means of chest expansion values (3rd IC SPACE):

	Before	*After*	*t-value*	*p value*
Group A [Y]	2.77±1.15	3.73±1.07	8.47	<0.0001
Group B [Y]	2.73±0.98	2.80±1.10	1.47	>0.05

[Y] - Mean ± SD

Table 3: Difference in means of chest expansion values (XIPHOID PROCESS):

	Before	*After*	*t-value*	*p value*
Group A [Y]	2.70±0.86	4.10±1.02	9.46	<0.0001
Group B [Y]	2.87±1.26	2.93±1.28	1.47	>0.05

[Y] - Mean ± SD

Table 4: The mean of differences of outcome measures between the groups

	Chest Expansion	
	3rd IC Space	XIPHOID Process
Group A [Y]	1±0.42	1.4±0.57
Group B [Y]	0.07±0.18	0.07±0.17

[Y] - Mean ± SD

The Chest Expansion Value (3rd IC SPACE) mean of differences shows significant difference between the groups. (t= 7.9, P<0.0001).

The Chest Expansion Value (XIPHOID PROCESS) mean of differences shows significant difference between the groups. (t= 8.61, P<0.0001)

5. Discussion

Though COPD is obstructive type of pulmonary disease, as disease progresses, there is stiffening of chest wall which gives restrictive pattern to the diseased lung. If this little but important thing is missed in the rehabilitation of COPD patient then it can hamper the progress of rehabilitation as this restriction alters other physiology of lungs and chest wall and it doesn't allow other rehabilitation protocols to work in improving the condition of the patient.

Minoguchi H, Shibuya M, et al. in 2002, in their study "Cross over comparision between Respiratory muscle stretch Gymnastics and inspiratory training" had concluded that RMSG may have clinically significant benefits, which may be somewhat different from the benefits of IMT, in patients with COPD.[17]

Kriel, Achmat (2005) had done study "An investigation into the immediate effect of rib mobilization and sham laser application on chest wall expansion and lung function in healthy asymptomatic males" and concluded that there is significant improvement in lung function. [18]

Leelarungrayub D, Pothongsunun P et al. (2009) in their study "Acute clinical benefits of chest wall-stretching exercise on expired tidal volume, dyspnea and chest expansion in a patient with chronic obstructive pulmonary disease: a single case study" and got benefitial effects.[19]

Putt MT, Watson M et al. in 2008, in their study on "Muscle stretching tech. increases Vital capacity and range of motion in patients with COPD" had concluded that the hold and relax technique to the pectoralis major compared with the sham technique produced significant effects on VC and upper-limb range of motion. There was no significant effect on Axilary Chest Expansion, Xiphisternum Chest Expansion, perceived dyspnea, or respiratory rate. There was no order effect for either technique.[12]

T.Shioya, M.Satake, et al. in 2007, in their study**"**Combination of chest wall mobilization and respiratory muscle training in comprehensive out patient pulmonary rehabilitation improves pulmonary function in patients with COPD" had concluded that combination of chest wall mobilization by squeezing technique, Respiratory Muscle Training and Respiratory muscle stretch Gymnastics in outpatient Pulmonary Rehabilitation improve pulmonary function, exercise capacity and Health Related Quality Of Life in patients with stable COPD.[15]

Above studies suggest that chest mobilization can even affects the patient's Quality of life so using of this technique can give a better life to the patient.

The study has certain limitations like it was done on male patients only so future study can be done with taking female patients also in the study so result of this study generalized. The major limiting factor in present study was smaller sample size. So future study can be done by taking a large sample size. This was a one time study and no further follow up was taken so could not assess the long term effect of aerobic exercise on hypertension.

6. Conclusion

It can be concluded from the present study that Chest Wall mobilization has significant effect Chest expansion values in COPD patient who is having restrictive impairment of chest wall in later stage of disease. Chest Mobilization is the definite tool for the improving condition of the patient of COPD with restrictive impairment of chest wall. So it should be included as a part of management in the patient of COPD with other exercise treatment program.

References

[1] Singh V, Khandelwal DC, Khandelwal R, Abusaria S. Pulmonary rehabilitation in patients with chronic obstructive pulmonary disease. Indian J Chest Dis Allied Sci. 2003 Jan-Mar;45(1):13-7
[2] Celli BR, MacNee W. Standards for the diagnosis and treatment of patients with COPD: a summary of the ATS/ERS position paper. EurRespir J 2004;23(6):932-46.
[3] De Troyer, A, Borenstein, S, Cordier, R Ankylosis of lung volume restriction in patients with respiratory muscle weakness. Thorax1980;35,603-610
[4] Slonim, NB, Hamilton, LH Respiratory physiology St. 5th ed. 1987,26-38 Mosby. St. Louis
[5] Estenne, M, Heilporn, A, Delhez, L, et al Chest wall stiffness in patients with chronic respiratory muscle weakness. Am Rev Respir Dis.1977;115,389-395
[6] O'Donnell DE (2006). "Hyperinflation, Dyspnea, and Exercise Intolerance in Chronic Obstructive Pulmonary

Disease". The Proceedings of the American Thoracic Society 3: 180–184.
[7] Bellemare F, Grassino A. Force reserve of the diaphragm in patients with chronic obstructive pulmonary disease. J Appl Physiol. 1983;55:8-15.
[8] Pitta F, Troosters T, Spruit MA, Probst VS, Decramer M, Gosselink R. Characteristics of physical activities in daily life in chronic obstructive pulmonary disease. Am J RespirCrit Care Med 2005;171(9):972-7.
[9] Calverley PM, Rennard SI, Wouters EF, Agusti A, Anthonisen N, et al. Proposal for a multidimensional staging system for chronic obstructive pulmonary disease. Respir Med 2005;99(12):1546-54.
[10] TabiraKelzuyuki, Sekikawa Noriko. et. al.: The immediate effect of chest mobilization tech. in patients of COPD. The Journal of Japanese Physical Therapy Association.(JPTA) Vol. 34, No. 2(20070420) pp. 59-64
[11] Kakizaki F. Shibuya M. et. al.: Preliminary report on the effects of respiratory muscle stretch gymnastics on chest wall mobility in patients with chronic obstructive pulmonary disease, Respir Care 44 (44): 409-414, 1999.
[12] Putt MT, Watson M. et al.: Muscle stretching technique increase vital capacity and range of motion in patients with chronic obstructive pulmonary disease. Arch Phys Med Rehabil. 2008. Jun: 89(6):1103-7.
[13] Kozu Ryo, Yanase Kenji et. al.: Influence of chest expansion on pulmonary function and Dyspnoea in patients with chronic obstructive pulmonary disease. The Journal of Japanese Physical Therapy Association (JPTA) Vol. 25, No. 6(19980930)
[14] Weiss HR: The effect of an exercise program on vital capacity and rib mobility in patients with idiopathic scoliosis, Spine 16(1): 88-93, 1991.
[15] T.Shioya, M.Satake, H.Takahashi, K.Sugawara, C.Kasai, N.Kiyokawa, T.Watanabe, S.Fujii, M.Honma. Combination of chest wall mobilization and respiratory muscle training in comprehensive out patient pulmonary rehabilitation improves pulmonary function in patients with COPD. Department of Rehabilitation, Akita City General Hospital, Akita, Japan. 2007
[16] Susan E. Bockenhauer, HaifanChen,et al. Measuring Thoracic Excursion: Reliability of the Cloth Tape Measure Technique. JAOA; Vol 107;No 5, May 2007 :191-196.
[17] Minoguchi H, Shibuya M, et al. Cross-over comparison between respiratory muscle stretch gymnastics and inspiratory muscle training. Intern Med. 2002 Oct;41(10):805-12.
[18] Kriel, Achmat. An investigation into the immediate effect of rib mobilization and sham laser application on chest wall expansion and lung function in healthy asymptomatic males : a pilot study.Dept. of Chiropractic, Durban Institute of Technology.2005.
[19] Leelarungrayub D, Pothongsunun P, et al. Acute clinical benefits of chest wall-stretching exercise on expired tidal volume, dyspnea and chest expansion in a patient with chronic obstructive pulmonary disease: a single case study. J BodywMovTher. 2009 Oct;13(4):338-43.

Author Profile

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