EFFECTIVENESS OF RESPIRATORY MUSCLE STRETCH GYMNASTICS IN COPD PATIENTS

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ABSTRACT:

Chronic obstructive pulmonary disease (COPD) is a leading causes of morbidity, hospitalization and disability among pulmonary diseases. Airway obstruction, reduced lung elasticity, increased chest wall stiffness, altered length-tension relationship, decreased chest mobility, increased functional residual capacity (FRC), decreased tidal volume and increased respiratory rate are the commonest problems seen in patients with COPD. Respiratory muscle stretch gymnastics (RMSG) has been proposed as a possible additional form of rehabilitation for patients with COPD. To find out the effectiveness of respiratory muscle stretch gymnastics RMSO) in improving tidal volume (TV) and reducing respiratory rate in COPD patients. The study was carried out with purposive sampling in the Division of Physical Medicine and Rehabilitation, Rajah Muthiah Medical College and Hospital, Annamalai University. Ten COPD patients with FEV1<70% and age group between 35 and 65 yrs were selected for the study. Acute breathlessness, associated cardiovascular disorders, and other significant medical problems were excluded. Ten patients with COPD were selected. Five pattern of RMSG training were given for 1 week duration. Pre and post respiratory rate and tidal volume measurements were obtained using Schiller Spirometer. Lung function was assessed based on the measurement of respiratory rate and tidal volume which were obtained by minute ventilation test through spirometer. The mean value of respiratory rate before treatment is 23.85 and after treatment is 14.57. The different is statistically confirmed by the obtained t-valuè5.55, p value p = 0.000. The't' test value and 1% level of significance shows that respiratory rate is significantly reduced after treatment, The mean value of tidal volume before treatment is 0.85and after treatment is 0.83. It shows that tidal volume is not improved, but it is maintained. It is statistically confirmed by the obtained t value 0.69 and p value 0.509. Respiratory muscle stretch gymnastics is effective in reducing the respiratory rate and maintaining the tidal volume.

Keywords: Chronic obstructive pulmonary disease (COPD), Respiratory muscle stretch gymnastics(RMSG),Chest Mobility, Tidal volume, Respiratory rate.

INTRODUCTION :

Chronic obstructive pulmonary disease (COPD) refers to a group of respiratory disorders that damage the lungs and make breathing increasingly more difficult over time. Obstructive airway diseases, which primarily include asthma and chronic obstructive pulmonary disease (COPD) are a major contributor to morbidity and mortality in India.

Chronic obstructive pulmonary disease (COPD) is a leading cause of morbidity, hospitalization and disability among pulmonary diseases.[1] COPD is the fourth leading cause of morbidity throughout the world.[2]Its incidence was expected to double in the world between 1990 and 2020 according to the Global Initiative for obstructive lung diseases.[3]COPD affects approximately 5 percent of adults in India.[3] Its chronic progressive nature and acute exacerbations influence the quality and expectancy of life of COPD

patients.[1] Airway obstruction, reduced lung elasticity, increased chest wall stiffness, altered length-tension relationship, decreased chest mobility, increased functional residual capacity (FRC), decreased tidal volume and increased respiratory rate are the commonest problems seen in patients with COPD.[4]In general, pulmonary rehabilitation is a basic non- pharmacological intervention in COPD. Its role is increasing in recent years, and also it has emerged as an adjunct to drug and oxygen therapy in the management of patients with COPD.[5]
Respiratory muscle stretch gymnastics (RMSG) has been proposed as a possible additional form of rehabilitation for patients with COPD.[6]

RMSG is designed to stretch inspiratory chest wall muscles during inspiration and expiratory chest wall muscles during expiration.[7]
Accessory muscles of inspiration are often shortened by overuse in COPD patients. These muscles may benefit from exercises to stretch them to their normal lengths. Since stretching has been shown to reduce the muscle stiffness.[6] RMSG designed to stretch the respiratory muscles in the chest wall thereby decrease the chest wall stiffness and increase the chest wall expansion.[6]
Minoru et al found that RMSG is effective in physical condition to improve pulmonary functions and to reduce dyspnea at rest and on exertion in COPD patients. It is also effective in reducing the (FRC) functional residual capacity and to improve the distance walked in six minutes.[6] **Minehiko Yamada et al** suggest that RMSG decreases the respiratory rate and improves the tidal volume and prolongates the expiratory duration (Te).[6]
These studies suggest that RMSG has clinically significant benefits for the rehabilitation of patients with COPD.[6] The present study is designed to investigate the response to RMSG in patients with COPD by observing changes in tidal volume (TV) and respiratory rate (RR).

OBJECTIVE

To find out the effectiveness of RMSG in improving tidal volume (TV) and reducing respiratory rate in. COPD patients.

METHODOLOGY

Study plan and procedure was explained in detail to the patients and informed consent was obtained.

Pre treatment Evaluation FEV1 measurements (FVC test) :

Each patient was given the detailed explanation and demonstration regarding the following procedure. The patients were made to stand and nose clip was applied. The patients were asked to take deep breathe in and blow out as fast as possible through the mouthpiece. Any mistakes or errors made by the patients were corrected and were trained in performing the procedure efficiently. Once they were learnt this procedure, they were asked to perform the test in the Schiller spirometer. The patients were performed the procedure three times. Out of three measurements, the best value was taken.

Tidal volume and Respiratory Rate Measurement (Minute ventilation test)
The patients were asked to breathe in and out as normal as possible for 1 minute in the spirometer. Respiratory rate and tidal volume were measured through this parameter and the values were recorded on the proforma.

RMSG TRAINING

Five patterns of RMSG were taught to the patient through proper demonstration.

Pattern 1 (Elevating and pulling back the shoulder)

Patient was asked to gradually elevate the shoulders while breathing slowly through the nose After taking a deep breath he/she was asked to breathe out through the mouth and lower his/ her shoulders.

Pattern 2 (Stretching the upper chest)

Patient was asked to place both bands on his/her upper chest. Then asked to pull back the elbows and pull down the chest while lifting the chin and taking a deep breath through the nose. This was followed by slow expiration through the mouth and attainment of normal position.

Pattern 3 (Stretching the back muscle)

Both hands were clasped in front of the patient's chest. He/she was asked to slowly breathe in through the nose, moving his/ her hands frontward and down and then asked to stretch the back. After taking deep inspiration, he/she was asked to slowly breathe out and resume the original position.

Pattern 4 (Stretching the lower chest)

Patient was asked to hold the ends of the towel with both hands outstretched at shoulder height. After taking a deep breath, he/ she was asked to move the arm up while breathing out slowly.After deep expiration the hands were lowered.

Pattern 5 (Elevating the Elbow)

Holding one hand behind the head, patient was asked to take deep breath through the nose. While slowly exhaling through the mouth he/she was asked to raise his elbows as high as possible to stretch his/her trunk. Then the elbows were returned to original position. The process was repeated with the other hand. At home, the patients performed the 5 stretch patterns 10 times each in the morning, at noon and in the evening daily for a period of one week.

Post treatment Evaluation

After 1 week duration, the respiratory rate and tidal volume were measured.

DATA ANALYSIS AND RESULTS

Comparative Mean Value, Mean Difference, Standard Deviation And Paired T-Test Value Of Respiratory Rate

Table 1 : Application Of Pre-Post Group

Groups	N	Mean	SD	t-value	p-value
Pre group	10	23.85	6.16	5.55	0.000
Post group	10	14.57	4.97		

The above table shows that the mean value of respiratory rate before treatment was 23.85 and after treatment was 14.57. Thus the difference is statistically confirmed by the obtained t-value (t = 5.55) with p value (p = 0.000). At 1% level of significance't' test shows that there is significant difference between the two groups. Hence after treatment there was significant reduction in respiratory rate was observed.

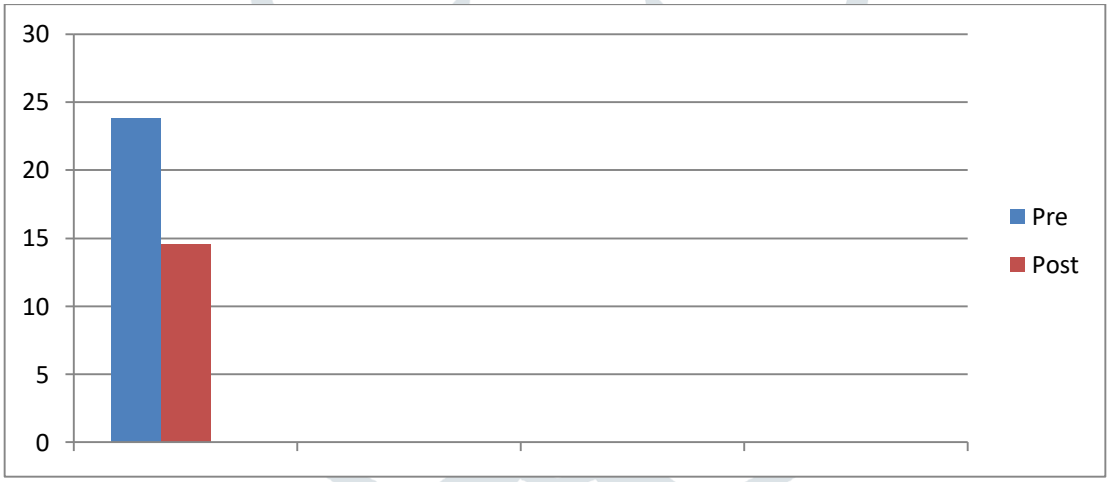
Comparative Mean Value, Mean Difference, Standard Deviation And Paired T-Test Value Of Tidal Volume.

Table 2: Application Of Pre & Post Group

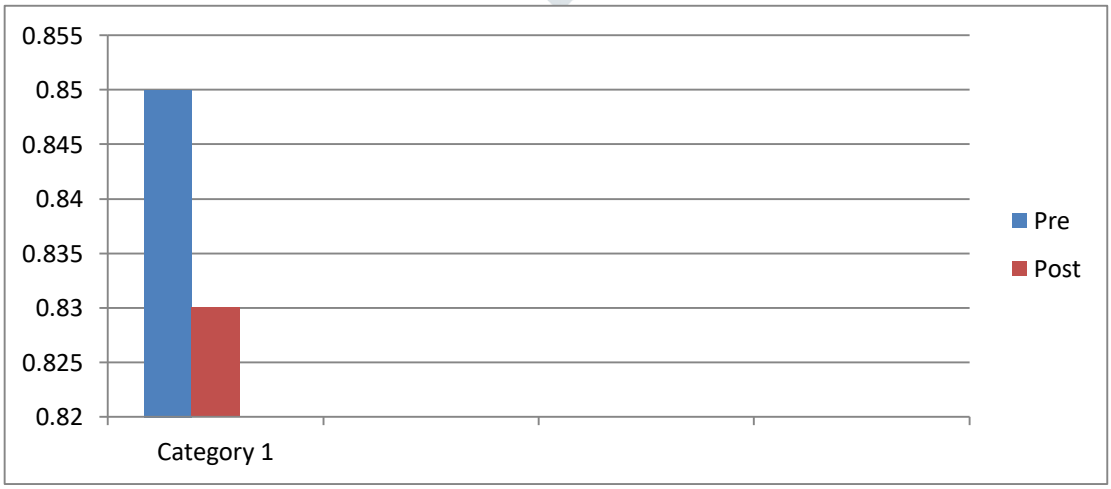
Groups	N	Mean	SD	t-value	p-value
Pre group	10				
0.85	0.36	0.69	0.509		
Post group	10	0.83	0.33		

The above table shows that the mean value of tidal volume before treatment was 0.85 and after treatment was 0.83. Thus the difference is statistically confirmed by the obtained t value (t=0.69) and p value (p=0.509). The 't' test shows that there is no marked significance.

GRAPH 1 : Respiratory Rate (Pre Vs Post)



GRAPH 2 : Tidal volume (Pre Vs Post)



DISCUSSION:

The present study was designed to investigate the effects of respiratory muscle stretch gymnastics (RMSG) on respiratory rate arid tidal volume in patients with COPD. Eleven patients with COPD were entered for the treatment program. Out of 11 patients 10 were completed the RMSG training program and follow up. One patient was not completed the entire duration of the study period hence he was not included in this study.As the study duration is one week, tidal volume and respiratory rate was only taken as outcome measures. Changes in values of these parameters can estimate the alteration of breathing pattern and implies the pulmonary and functional status of the patient. The other pulmonary parameters like maximum voluntary ventilation (MVV), exercise capacity and quality of life was not assessed in this study.

The results of.the current study show that there was significant reduction in the respiratory rate after the training & there were no significant changes in the tidal volume after RMSG. The average respiratory rate for the 10 patients before treatment was 23 85 and after treatment was 14.57. The normal reference value of the respiratory rate in adults is 8 to 18.[18] **Minoru Ito et al** in their study also found that there was overall significant reduction in the respiratory rate immediately following RMSG.[7]
Itisreported that in patient with COPD, the ribs become horizontal, inward movement of the chest wall and flattening of the diaphragm. All of these results in alteration of the length tension relationship of the respiratory muscles and contributes abnormal pattern of the breathing. A rapid and shallow respiratory pattern (increased respiratory rate) has been associated with disease severity and dyspnea in patients with COPD.

RMSG is designed to stretch inspiratory chest wall muscles during inspiration and expiratory chest wall musclesduring expiration.[6]It is helpful to mobilize the chest and can also reverse the biomechanical alteration of thoracic cage in COPD. Hence respiratory rate reduction after RMSG reflects the changes in the respiratory pattern towards the more economical way.
But in the current study there was no significant changes in the tidal volume after treatment but it was maintained. In the current study, the average value of tidal volume before treatment was 0.85. The value is higher than the normal reference values for adults.
This may be due to the increased ventilatory drive in patients with COPD. The evidence from studies of central drive in COPD patients with normal PaCO2 indicates an increased value that almost doubles that seen in normal volunteers.[4]This result again correlates well with the results obtained by the **Minoru Ito et al.** They also found that there was no significant changes in the tidal volume immediately after the RMSGin non experienced individuals (less than 3 months).[7] Short duration may be the contributing factor for not obtaining significant increase in tidal volume following RMSG. **Fujiyasukakizaki et al** in this study found the significant improvement in tidal volume in experienced patients (i.e. practicing RMSG more than 3 months).[7] Therefore RMSG has shown to reduce respiratory rate and maintain tidal volume thereby indirectly relieving breathlessness and contributes improvement in over all well being of the COPD patients. **Nobuaki miyahara et al** found the significant improvement in exercise capacity, maximum voluntary ventilation and quality of life following RMSG for a period of 3 weeks.[12]
In future, large duration study with more sample size is recommended. The.inclusion of other pulmonary parameters like MVV, PEFR, exercise capacity and quality of life is also suggested. The above recommendation may provide better insight for the understanding of RMSG.

CONCLUSION

This study was designed to find out the effects of RMSG on respiratory rate and tidal volume in COPD patients. Respiratory muscle stretch gymnastics is effective in reducing the respiratory rate and maintaining the tidal volume in COPD patients. It indirectly implies that this training is useful in altering the breathing pattern in the more economic way.

BIBLIOGRAPHY

1.Drozdowski J, Bakula. S, Kedziora. K. The effects of pulmonary rehabilitation on the quality of life in patients with COPD — Respiratory care 2007 sep;52(9): 1198 1206.
2. Romain A Pauwels, A. Sonia Buist, Peter. M.A Calverley, Christine R, Jenkins and Suzanne S Hurd. Global strategy for the diagnosis, Management and prevention of chronic obstructive pulmonary disease January 10,2001, NHLBi/ WHO global initiative for COPD workshop summary
3. Dr. Raj B. Singh, COPD - a lethal but preventable disease, Hindu Friendly Page.
4. John R Bach, Pulmonary rehabilitation-pg: 109-110,113.
5 AmanPande, PankajSinghal, Raj Kumar and S N Gaur. Effect of home based pulmonary rehabilitation programme on disability in patients. with COPD. Indian J Chest Dis Allied Sci 2005; 47:217-219.
6. Hideko Minoguchio, Masato shibuga Cross-Over comparison between respiratory muscle stretch gymnastics and inspiratory muscle training. Internal medicine 41: 805-812, 2002.
7. Minoru Ito, Fujiyasukakizaki. Immediate effect of RMSG and diaphragmatic breathing on respiratory pattern. (Internal Medicine 38: 126-132, 1999)
8. F. Kakizaki R.P.T, T. Yamazaki R.P.T. Effects of RMSG on chest wall motion in patients with chronic asthma (1996).
9. Tetsuo Miyagawa RRT, RPT, RCET, Hideko Kobayashi MD. Different effects of RMSG and inspiratory muscle training in patients with COPD (1997).
10. Yamada M, Kakizaki F. Clinical effects of 4 weeks of RMSG in patient with COPD (1996 Jun; 34(6): 646-52.
11. Tetsuo MiyagawaPhd, RRT, RPT, RCET. Meta analysis of respiratory physiotherapy program in Japan (2004).
12. Nobuaki Miyahara. Effects ofshort-term pulmonary rehabilitation on exercise capacity and quality of life in patients with COPD, ActaMedica Okayama. Volume 54, Issue 4.
13 N Kancko M D, M Yamada M D Effect of RMSG in COPD patients (1996).
14. Nobuko Aida, Masako Shibuya. RMSG in patients with post coronary artery bypass grafting pain, J Med Dent Sci, 2002 Dec; 49(4): 157-70.
15. Mason, Broaddus ,Murray, Nadel -Text Book of Respiratory Medicine(pg -719)
16. SusanB 0 'Sullivan,ThomasJ schmitz-Physical medicine and rehabilitation,pg-564, 569
17. Richard K. Albert, Stephen G. Spiro, James R. Jett — clinical respiratory medicine, second edition, 2004 pg - 1206
18. Anthony Seaton, Douglas Seaton, A. Gordon Leitch - Croftan and Douglas' s respiratory diseases, fifth edition, 2000, volume 1, pg – 26.