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Effect of Hold Relax Technique on Pectoralis Major muscle and Pulmonary Parameters in Patients with Chronic Obstructive Pulmonary Disease: An Experimental Study

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ABSTRACT

Chronic Obstructive Pulmonary Disease (COPD) is a prevalent and progressive disease that is distinguished by respiratory symptoms and airflow limitation. The limitation to the expiratory airflow results into hyperinflation of lung due to the trapping of air in addition to the changes in the chest wall mechanics. As the chest is in hyperinflation the pectoralis major muscle is shortened. This increases the resistance to the chest wall expansion there by increasing the work of breathing. Hold Relax is one of the Proprioceptive Neuromuscular Facilitation (PNF) Stretching techniques. The aim of the study was to determine the effect of hold relax on the Pectoralis major muscle and its implications on the pulmonary parameters in the COPD patients. An Experimental study was conducted with 25 patients fulfilling the inclusion and the exclusion criteria. Hold Relax technique was applied on the Pectoralis Major muscle for 6 weeks and pre and post pulmonary parameters were compared. Statistical Analysis was done with Paired T Test (P< 0.05). Result showed significant improvement in the chest expansion, PEFR value and dyspnea score post intervention. ***Conclusion****: The study concludes that Hold Relax technique is an effective PNF stretching technique and helps to improve the pulmonary parameters in COPD patients and thus may be considered in Pulmonary Rehabilitation.*

Keywords*: COPD, PNF, Hold Relax, PEFR,Chest Expansion, Dyspnea.*

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INTRODUCTION

The Global Initiative for Chronic Obstructive Lung Disease (GOLD) classified COPD as "a disease state characterized by airflow limitation that is not fully reversible. The airflow limitation is usually both progressive and associated with an abnormal inflammatory response of the lungs to noxious particles or gases [1]. COPD ranked 11th in 2002 and is expected to be in 7th place by the year 2030 and it is leading cause for chronic morbidity. [2] The pathophysiology states that among many pulmonary function abnormalities, persistent reduction in forced expiratory flow rates is the most typical finding.[3]

Dyspnoea, fatigue & discomfort are the principal symptoms that limit exercise and patient limit their activities to avoid their uncomfortable sensations. Respiratory rate increases proportionally to disease severity.Use of Accessory Respiratory muscles and paradoxical indrawing of lower costal spaces is evident. Due to the air being trapped and changes in the mechanics of the chest wall, the zone of opposition of the diaphragm decreases, and the expiratory airflow is restricted, causing hyperinflation of the lungs [4]. The hyperinflated lung limits the movement of the diaphragm by depressing it [5].

When the diaphragm is dysfunctional, the accessory muscles of respiration such the scalene, pectoralis major, sternocleiodomastoid, upper trapezius, and serratus anterior play a significant role. These muscles raise the shoulder girdle, and rib cage motion during the inspiratory phase increasing the vertical diameter. The chest's ability to expand is limited by the chest wall's soft tissues and muscles retracting [6].

The pectoralis major muscle will shorten because the chest is expanded. As a result, breathing becomes more difficult and the respiratory muscles must work harder to overcome the chest wall's resistance. This raises the resistance to the expansion of the chest wall. In addition to serving as accessory muscles, the pectoralis major and scalene muscles are also necessary for the movement of the neck and upper limbs [7]. In spirometric testing, the degree of reduced vital capacity, peak flow and FEV1, provides indices of the severity of obstruction. As the COPD severity increases, the usage of upper limb for the activities will become difficult. This disuse can lead to the tightness of the muscles around the quadrant further increasing the work of breathing [8].

Proprioceptive neurophysiological facilitation is also known as controlled breathing technique and have been employed in respiratory physiotherapy for more than 25 years. The application of external proprioceptive and tactile stimulation produces a reflexive movement that helps in assisting the breathing [9].

According to the American College of Sports Medicine by William R Holcomb, PNF Stretching techniques are effective treatment explained by the effect of PNF stretching on the proprioceptors within muscle and tendon. One of the proprioceptors, the Golgi Tendon Organ (GTO) is sensitive to increasing tension within muscle. When stimulated, the GTO causes muscular relaxation. If this relaxation occurs in same muscles experiencing the increased tension, the result is called autogenic inhibition. If relaxation occurs in the muscle opposing the muscle experiencing the increased tension, the result is reciprocal inhibition [10].

There is dearth of studies done to evaluate the effect of Hold and Relax technique on pectoralis major muscle on the pulmonary parameters in COPD patients and this study thus aims to evaluate the effect of hold relax on pectoralis muscles.

MATERIAL AND METHODS

An experimental study was conducted on 25 subjects suffering from COPD based on the inclusion criteria. Prior to the participation, all patients signed the Informed consent, reiterating the basic procedure and intent of the study, as well as warning of any potential risks Involved as a result of participation.

The ethical clearance was attained. Detailed subjective assessment of the subjects was done preoperatively to rule out any other abnormalities. Both Male and female patients in the age group of 40 to 65 were included in the study. The patients excluded were the ones suffering from acute exacerbation of the disease, mastectomy patients with removal of pectoralis major muscles, recent rib or upper limb fracture and restrictive lung disease patients.

PROCEDURE: Pre-test: Prior to the test the subjects were taken pre-test measure on chest expansion (axillary, nipple and xyphisternum level), PEFR and Dyspnoea scores (Borg's Scale).

Hold relax technique of pectoralis major muscle: The subject was made to sit on a chair with a back support for the neutral positioning of the spine. The subjects were asked to move their arm in the agonist direction (glenohumeral extension, glenohumeral abduction and external rotation with elbow bent). Then the subject was asked to contract the pectoralis major muscle by moving the hand in the antagonistic direction (glenohumeral horizontal flexion in the maintained position of 80 to 90 degree of glenohumeral abduction and external glenohumeral rotation with elbow bend) and the therapist applies the pressure. The isometric contraction was maintained for 6 seconds. The patient then relaxes and a passive stretch was applied in the opposite direction. Intervention was repeated 6 times on each arm with a rest period of 30 seconds. The treatment was given everyday for a period of 6 weeks.

The outcome measures, PEFR, chest expansion and dyspnea grades were calculated pre intervention and after 6 weeks of intervention.

The collected data were tabulated using descriptive and Inferential statistics. To assess all the parameters, Mean and Standard deviation were used. To find out the effectiveness of Hold and Relax Technique from pre-test, student's test was used.

RESULTS AND DISCUSSION

Table 1: COMPARISON OF PRE AND POST VALUES FOR PEFR(PEAK EXPIRATORY FLOW METER

Sl. No.	Details	N	Mean	S . D	Std.Error Mean	t value	significance
1	Pre PEFR	25	133.6	26.596			
2	Post PEFR	25	242.4	27.731	1.763	61.728	0.000

From the above table , pre test PEFR mean value is 133.60 and post-test PEFR mean value is 242.4 and gives a 't' value of 61.728 thus giving a significant result of ($p<0.001$).

Thus from the above statistical analysis, Proprioceptive Neuromuscular Facilitation of Hold and Relax on Pectoralis major muscle has shown significant effectiveness.

Table 2: COMPARISON OF PRE AND POST VALUES OF CHEST EXPANSION:

S No.	Chest expansion	Details	Mean	S.D	Std error mean	t – test value	significance
1	Axilla	Pre	0.900	.2887	0.0200	26.000	0.000
		Post	1.420	.2769			
2	Nipple	Pre	1.160	.3452	0.0289	17.321	0.000
		Post	1.660	.3452			
3	Xyphisternum	Pre	1.780	.3559	0.0200	26.000	0.000
		Post	2.300	.3536			

From the above table, the pre-test value of chest expansion at axilla, nipple and xiphisternum are 0.900, 1.160 and 1.780 respectively and post-test shows chest measurement at axilla, nipple and xiphisternum are 1.420 , 1.660 and 2.300 respectively, thus giving a significant result ($p<0.001$).
From the above analysis, it is proved that Proprioceptive Neuromuscular Facilitation has effectiveness on chest expansion

Table 3: COMPARISON OF PRE AND POST TEST VALUES OF BORG SCALE

Sl no.	Details	Mean	S.D	Std error mean	t test value	significance
1	Pre BORG	13.4	1.915	0.212	23.399	0.000
2	Post BORG	8.44	1.805			

From the above table, the pre-test value of BORG scale mean value is 13.40 and post-test BORG scale mean value is 8.44 and gives a 't' value of 23.399, thus giving a significant result of ($p<0.001$).
Thus, from the above statistical analysis, Proprioceptive Neuromuscular Facilitation on Pectoralis major muscle has effectiveness over the BORG scale measures.
The results of this study indicate that Hold and relax technique to the pectoralis major is capable of improving pulmonary parameterslike PEFR, chest expansion and reducing dyspnoea, thus improving the restrictive component of COPD.
Many studies have proved the effect of Proprioceptive Neuromuscular Facilitation stretching. Wang [11] found that the cumulative effect of Proprioceptive Neuromuscular Facilitation was more beneficial than immediate effects. This obviously suggests thatthis study should be repeated over a longer time period and musculoskeletal management of this type should be continuous in order to see clinically significant benefits.
Sharman, Melanies and *et al* [12] have stated that Proprioceptive Neuromuscular Facilitation stretching techniques are commonly usedin the athletic and clinical environment to enhance both active and passive range of motion with a view to optimising motor performanceand rehabilitation. Flexibility has been defined as the "intrinsic property of the body tissues which determines the range of motion achievable without injury at a joint or a group of joints [13]. Professionals commonly try to increase aperformers range of motion by prescribing stretching exercises designed to length then the muscle tendon unit s of a muscle group. The significance of the results suggest that this more targeted specific treatment is needed for tight chest wall and upper limb muscles.
Proprioceptive Neuromuscular Facilitation stretching has also been characterized in biomechanical terms in which the muscle tendon unit is considered to respond viscoelastically during stretching [14].Important components to a stretch programme are the frequency of stretching sessions performed per week , the duration or time a stretch is held for and therepetition or number of stretches performed in a session. To achieve the optimal outcome from stretching the most effective frequency, duration and repetitions of stretch must be determined. The effect of more than one more session per day has been examined [15]. The frequency of stretch used in the literature ranges from twice per week [10-14] to seven times /week [9].
Tanigawa [15] examined long term changes in hamstring range of motion over three-week period stretching comparing Proprioceptive Neuromuscular Facilitation and passive stretching technique. Previous studies have found that a hold and relax technique in normal subjects can produce statistically significant increases in hemodynamics namely, heart rate and systolic and diastolic blood pressure. In this population, oxygen saturation and a score of dyspnoea are more relevant monitoring tools so these were used to monitor the treatment. Perception of dyspnoea, respiratory rate and oxygen saturation were not adversely affected in any subject after intervention, this implies the treatment isa safe method of treatment in chronic respiratory patients like COPD. Adaptive shortening and stiffness around the upper limb muscle quadrant increase chest wall resistance and work of breathing, a method of reversing these changes is important to include in a management plan for these patients.

Hence, the active method of treatment included in this study appears to be safe and effective in COPD patients. This study has provided evidence that hold – relax techniques can improve the restrictive component of chronic obstructive pulmonary disease.

CONCLUSION

In this study, 25 patients were selected according to the selected criteria for treatment of Hold and Relax technique to improvethe pulmonary parameters in Chronic Bronchitis. It compares the pre and postt est values of PEFR, chest measurement and Borg Scale. Based on statistical analysis, there was significant improvement in pulmonary parameters for study group between the pre and post test treatment . Hence , this study concluded that Hold and Relax technique on Pectoralis major muscles is effective in improving in pulmonary parameters in Chronic Obstructive Pulmonary Disease patients.

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