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Impact of Neurophysiological Facilitation (Pnf Strech) of Pectoralis Major and Minor Muscle: A Noval Approach to Improve Pulmonary Function in Copd Patient

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Abstract:

Background: Chronic Obstructive Pulmonary Disease (COPD) is a progressive respiratory condition characterized by airflow limitation, leading to reduced pulmonary function and impaired quality of life. Effective rehabilitation strategies to enhance respiratory function and muscle strength are critical in managing COPD symptoms. Proprioceptive Neuromuscular Facilitation (PNF) stretching techniques have been widely used in physiotherapy for improving flexibility, muscle strength, and neuromuscular function. Among various muscle groups, targeting the pectoralis major and minor muscles through PNF techniques may play a significant role in enhancing respiratory mechanics and pulmonary function in COPD patients.

Objective: This systematic review aims to evaluate the impact of PNF stretching on the pectoralis major and minor muscles as a novel approach to improving pulmonary function in individuals with COPD.

Methods: A comprehensive search of relevant databases (PubMed, Scopus, Cochrane Library, etc.) was conducted for studies published between 2000 and 2024. Studies assessing the effects of PNF stretching specifically targeting the pectoralis major and minor muscles in COPD patients, with a focus on pulmonary outcomes such as Forced Expiratory Volume (FEV1), Forced Vital Capacity (FVC), peak expiratory flow (PEF), and oxygen saturation, were included. Both randomized controlled trials and observational studies were considered for review.

Results: Initial findings suggest that PNF stretching of the pectoralis muscles may contribute to improved thoracic mobility, enhanced diaphragm function, and reduced respiratory muscle fatigue in COPD patients. Additionally, a number of studies demonstrated a positive impact on pulmonary function parameters such as FEV1, FVC, and oxygen saturation levels. The PNF technique was found to improve postural alignment, chest expansion, and muscle flexibility, indirectly contributing to better respiratory function.

Conclusion: PNF stretching of the pectoralis major and minor muscles shows promise as a novel approach in pulmonary rehabilitation for COPD patients. This review highlights the potential benefits of incorporating PNF techniques into standard COPD management, suggesting improvements in pulmonary function and overall respiratory performance. However, further large-scale randomized controlled trials are needed to conclusively establish its effectiveness and long-term benefits for COPD rehabilitation.

Keywords: Chronic Obstructive Pulmonary Disease, Proprioceptive Neuromuscular Facilitation, Pectoralis Major, Pectoralis Minor, Pulmonary Function, Respiratory Rehabilitation.

INTRODUCTION

Respiratory conditions that impair breathing, like asthma, pulmonary fibrosis, and chronic obstructive pulmonary disease (COPD), limit everyday activities and lower quality of life in general. Chronic Obstructive Lung Disease (COPD) is a lung disease characterized by chronic obstruction of lung air flow that interferes with normal breathing and it is not fully reversible. GOLD (Global initiative for Chronic Obstructive Lung Disease) A prevalent, treatable, and avoidable condition known as chronic obstructive pulmonary disease (COPD) is characterized by airflow restriction and enduring respiratory symptoms. Constant dyspnea, coughing, sputum production, and systemic effects are caused by airway blockage [1].From Emphysema at one end of the range to Chronic Bronchitis at the other, it includes a variety of illnesses [2].As a key component of integrated patient treatment, pulmonary rehabilitation (PR) has been demonstrated to be an effective therapeutic technique to improve shortness of breath, health status, and activity tolerance in COPD patients [1]. Owing to its high incidence, COPD ranks among the world's main causes of morbidity and death. Regarding age-standardized mortality rates COPD has the third-highest incidence for both sexes. World-wide, with around 3.2 million deaths due to the illness in 2015[3]. The lung parenchyma is harmed in chronic obstructive pulmonary disease, which leads to structural alterations and airway collapse. The restriction of expiratory airflow causes lung hyperinflation because the alteration in the mechanics of the chest wall combined with the air trapping, reduction in the diaphragm muscle fibers zone of opposition that Diaphragm movement is decreased by hyper inflated lungs (main inspiratory muscle) through lowering it [4] Due to the diaphragm's malfunction, the accessory breathing muscles, including the Pectoralis major, Pectoralis minor, serrates anterior scalene, and sternocleidomastoid will be crucial. These muscles raise the shoulder girdle, and during the inspiratory phase, rib cage motion increases the vertical diameter. Also auxiliary respiratory muscles (including the sternocleidomastoid, trapezius, Pectoralis major), the continuous tension, etc. will directly affect the breathing movement[10] The chest wall's soft tissue and muscles retract, which limits the chest's ability to expand. The Pectoralis major muscle will shorten as a result of the enlarged chest. This increases the resistance to the chest wall expanding, which makes breathing harder and puts more strain on the respiratory muscles to get through the wall's resistance. In addition to their function as accessory muscles, the Pectoralis major and scalene muscles are necessary for neck and upper limb movement [4] Stretching is a commonly used technique to relax the tense muscles, joints and soft tissue in both clinical scenarios or the athletic training [15]. It includes passive stretching and active stretching. As the name suggest, the passive stretching depends on external force from other people, while the active stretching relax the aimed muscle through the antagonist muscle contractile activities [11] For afflicted individuals with underlying respiratory conditions, proprioceptive neuromuscular facilitation (PNF) stretching and chest mobility exercises seem safe and effective in enhancing chest mobility, pulmonary function, and reducing fatigue and dyspnea symptoms [12]Lung function frequently declines as a result of these illnesses, which impacts muscular strength and athletic performance. The importance of stretching exercises, especially those that target the pectoralis major and minor muscles, in enhancing lung function and general muscle strength has drawn attention.They can exacerbate the symptoms of respiratory disorders by contributing to bad posture, decreased chest expansion, and compromised respiratory function when they are weak or tight.It has been demonstrated that stretching workouts,

especially those that focus on the pectoralis muscles, can enhance pulmonary function and muscle strength. By improving lung expansion, decreasing muscle tension, and increasing chest flexibility, these workouts can improve air intake. Incorporating these kinds of exercises into a patient's treatment plan can help them achieve better posture, more oxygenation, and improved chest mobility—all of which are vital for respiratory health.

Additionally, stretching on a regular basis can improve blood flow and flexibility, which may enhance muscle endurance and general physical performance. Furthermore, it is thought that stretching and muscle strength training increase respiratory muscle function, which helps regulate breathing patterns and promote oxygenation.Stretching exercises have the potential to be a straightforward yet powerful way to enhance pulmonary function and muscle strength in individuals with respiratory disorders undergoing rehabilitation. This strategy might be used into a comprehensive treatment program to address the various difficulties that people with respiratory illnesses encounter. With an emphasis on data from current research and clinical procedures, this article will examine the possible contribution of pectoralis major and minor muscular stretching exercises to improving pulmonary function and muscle strength in patients with respiratory disorders.

METHODOLOGY

The Review of the Literature has been made with the help of all those articles containing the words “Neurophysiology facilitation of Pectoralis major and minor muscle” and “Multiple Respiratory disease”.Google scholar, Research gate, PubMed, and science direct databases have been used for the articles between 2019 and 2024. The articles drawn focused on the feasibility and different type of technologies used in treatment respiratory disease patients. The use hold relax stretch technique in pulmonary patients and articles focusing on how they perceive physiotherapy and techniques and exercises for the treatment of respiratory disease were taken into consideration.

INCLUSION CRITERIA

- Articles published in the last 5-6 years
- Age ≥ 40 years old
- Diagnosis of COPD confirmed by spirometry (FEV1/FVC ratio < 0.7)
- Stable respiratory disease patients for at least 4 weeks prior to enrollment
- Able to perform activities of daily living (ADLs) independently
- Ability to walk for at least 10 minutes without resting

EXCLUSION CRITERIA

- Systemic Reviews
- Case control study
- Articles without abstract or full English text
- Uncontrolled comorbidities (e.g., heart failure, unstable angina, uncontrolled diabetes)
- Any neurological condition like Spinal cord injury, Multiple sclerosis,parkinsons disesases,Dementia etc.

REVIEW OF LITERATURE

1.(Siva Jyothi, N., Senthil Selvam et al., 2022) They conducted a systemic review and meta-analysis of randomized controlled trial (RCTs) review; and the objective was to compile data regarding the impact

of the Pectoralis major PNF stretch on pulmonary function in patients with COPD. We conducted a 6-week study with 30 participants in which we trained the Pectoralis major muscle using the Hold Relax PNF stretch technique. The study discovered that after six weeks of holding down the relax PNF stretch of the Pectoralis major muscle in COPD patients, there is an increase in the chest expansion and FEV1/FVC values ss[4].

2.(Mehta GP, Babu V) Combined effect of PNF stretching with cheat mobility exercises on chest expansion and pulmonary function for elderly. A design for an experimental study 30 subjects were randomly assigned to the study and control groups, each with 15 subjects. Both before and after a week of treatment, outcome measures like chest expansion at the axilla and xiphisternal as well as pulmonary function tests like FEV1, FVC, and FEV1/FVC were measured. The study comes to the conclusion that improving chest expansion and pulmonary function test results can be achieved in just one week by combining chest mobility exercises with Hold-relax PNF stretching for the Pectoralis muscle [5]

3.(Putt MT et al). Patients with chronic obstructive pulmonary disease benefit from increased range of motion and vital capacity when using muscle stretching techniques. A total of fourteen participants were recruited, and the hold-relax technique of the Pectoralis major was examined in conjunction with a sham technique. When the hold and relax technique was applied to the Pectoralis major, compared to the sham technique, there were notable changes in the upper-limb range of motion of the right (P<.01) and left (P<.05) limbs as well as the VC (P<.01).Patients with COPD experience shorter-lasting benefits from the hold and relax technique, which merits more research [6].

4.(Swapna M et al)Thirty participants in all were used to examine the effects of myofascial release and chest mobility exercises on expansion and dyspnea in COPD subjects. For eight weeks, the experimental group's patients received myofascial release therapy and chest mobility exercises; the control group received standard physiotherapy, which included the same exercises. According to the study, there are few benefits to using the myofascial technique with chest mobility exercises for the Pectoralis major muscle [7]

5.(Liu, Kai et al.) They conducted the Randomized controlled trial study design. There are 55 subjects in total, of which 28 belong to the PNF group and 27 to the control group. The PNF group added 10 minutes of PNF stretching three times per training day, while the control group engaged in 30 minutes of treadmill aerobic training. According to the findings, PNF stretching along with aerobic exercise lessens dyspnea and enhances certain aspects of pulmonary function [8]

6.(Rafaela Barros de Sá et al) This study evaluated the immediate effects of respiratory muscle stretching on chest wall kinematics and electromyography activity in COPD patients. Randomization was used to split the 28 COPD patients into two groups: 14 were assigned to the treatment group (TG) and 14 to the control group (CG). According to the study, stretching can help with COPD chest wall mobility and has a positive impact on volume distribution, electromyography, and chest wall mechanics [9]

7.(Mistry HM et al) They conducted a Qausi experimental study design,65 participants were observed to observe the immediate effects of chest proprioceptive neuromuscular facilitation on peak expiratory flow rate, chest expansion, and respiratory rate in patients with COPD. The immediate effects of chest PNF on a significant increase in PEER and chest expansion were examined. The immediate effects of intercostal stretching on three levels of respiratory rate, chest PNF, and chest expansion were shown in this study. After intercostal stretching, there was also an instantaneous change in PEER, chest expansion, and respiratory rate [13]

8.(Parkavi kumaresan et al) Effect of short term respiratory proprioceptive neuromuscular facilitation on peak expiratory flow rate and six –minute walk test in patients with stable chronic obstructive pulmonary disease. Twelve male COPD patients were recruited for the study. The six-minute walk test, PNF stretch methods, intercostal stretch, high vertebral pressure, and anterior stretch were the outcome measures. According to this study, patients with stable COPD have optimally improved functional exercise capacity and PEFR when short-term respiratory PNF techniques are implemented [14]

9.(Heshan ezzat et al) Forty-five asymptomatic female students were recruited for a randomised control interventional trial and split into three groups: a control group (n = 15) and two groups of dynamic and static stretching.Pre-post intervention pulmonary function test using a chest graph.Thus, the findings indicate that, with the exception of the static stretching group, stretching the pectoralis major has no effect on the pulmonary function test for asymptomatic female student participants [17]

10.K.Thongchote et al) Effects of rounded shoulder reduction exercises on respiratory muscle strength, pulmonary function, and chest expansion in patients with COPD by using the technique. They recruited forty male COPD patients, ages sixty to ninety, and randomly assigned them to exercise (20) and control (20) groups.The current study found that the implementation of exercise programmes could lower functional service provider (FSP) in COPD patients. As a result, lowering FSP could increase chest wall mobility, which in turn affected increases in respiratory muscle strength and chest expansion in COPD patients [18]

11.(KC Seo et al) For four weeks, twenty-eight healthy adults were randomised into two groups: the experimental group (n = 14) and the control group (n = 14). The experimental group underwent three times a week, for a total of thirty minutes, of PNF respiration pattern exercises. The aim of the research was to ascertain whether PNF respiration exercise improves normal adult pulmonary function consequently, the data demonstrate that the experimental group's expiratory reserve volume and vital capacity significantly improved. The analysis concludes that the experimental group's improvement in pulmonary function was greater than that of the control group. Exercise has been shown to be beneficial in improving pulmonary function [19]

12.(AD Sam et al) 40 subjects with chronic asthma were subjected, which they divided in control and experimental group with 20 patients each. The outcome measurement is done by peak expiratory flow meter (PEEM) and Borg dyspnea scale (MRC) and inch tape. The results shows the significant improvement in lung function after the therapy program. The conclusion tells the treatment with PNF along conventional physiotherapy showed a significant improvement in thoracic expansion, PEFR and dyspnea than control group [20]

13.(A Anand et al) 30 Moderate and Severe staged COPD patients in 40-60 years age were divided into two groups: conventional chest physiotherapy (CPT) and conventional chest physiotherapy with MET (CPT+MET) group**.** The conclusion demonstrates that MET proved to be an extremely valuable technique in improving the pulmonary function in COPD patients. The significant improvement shows that both groups on three days with greater improvement in CPT with MET group in the form of increased chest expansion, reduced dyspnea, increased exercise tolerance, and improved quality of life [21]

14.(JK Patel et al) 50 participants with Pectoralis minor tightness—25 men and 25 women—were the subjects of an interventional study. The exam served as an outcome measure for tightness in the Pectoralis minor. The study concludes that the application of muscles energy technique can effectively

reduce the tightness in the Pectoralis minor muscle. There was a statistically significant ($p<0.05$) difference in the pre- and post-treatment values of the Pectoralis minor length test [22]

15.(Thongchote, K., et al 2024)They carried out the randamized control trial in which they took 40 male patients of aged 60-90 years & divide into two groups. For eight weeks, each session was conducted three times a week.so Exercises that combine self-stretching of the pectoral muscles with strengthening of the serratus anterior and lower trapezius muscles for eight weeks may be a useful treatment or preventative measure for FSP. decrease, improving respiratory performance in people with COPD who are male.

RESULTS

Pectoralis major and minor muscle stretching exercises have shown promising results in improving muscle strength and pulmonary function in patients with respiratory diseases. These exercises enhance chest expansion, reduce muscle tightness, improve posture, and support better lung ventilation, contributing to overall respiratory health and FEVI/FCV values to rise & improving exercise tolerance.

CONCLUSION

Incorporating pectoralis muscle stretching exercises into respiratory disease management can significantly improve both muscle strength and lung function, promoting better respiratory efficiency and overall health outcomes for patients. These exercises help to alleviate muscle tightness, improve chest expansion, and enhance the flexibility of the upper body, all of which are crucial for effective breathing. By improving posture and reducing chest wall stiffness, pectoralis stretching also optimizes respiratory muscle function, facilitating better air intake and oxygenation. Regular stretching routines are a simple, accessible, and non-invasive approach that can enhance the physical well-being of individuals with respiratory diseases, ultimately leading to improved clinical outcomes and greater overall functionality.

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