

Effect of taping technique Vs proprioceptive neuromuscular facilitation stretching to improve lung expansion in elderly: A randomized clinical trial

Virendra Meshram K^{1*}, Dhakate Darshana S²

^{1,2}Associate Professor, Modern College of Physiotherapy, Pune, Maharashtra, INDIA.

Email: drvirubpth@gmail.com

Abstract

Aim: To compare the effectiveness of PNF stretching technique versus Taping technique on chest expansion in elderly. **Objectives:** To Find an effect of PNF stretching on chest expansion in elderly. To Find an effect of Taping Technique on chest expansion in elderly. To compare an effect of PNF stretching versus Taping technique on chest expansion in elderly. **Procedure:** 30 Samples were collected according to inclusion and exclusion criteria. Then Consent was taken from the respective subjects to conduct the study. Respective protocol was followed for Group A and Group B; and treatment protocol was followed on daily basis up to 1 week. Pre and post values of an elderly subjects was assessed by using chest wall expansion technique. Data was collected and analyzed statistically. **Result:** t value for axilla level is 6.65 with 28 degrees of freedom. At p value <0.0001, shows extremely significant. t value for nipple level is 5.42 with 28 degrees of freedom. At p value <0.0001; considered extremely significant. t value for at xiphisternal level is 7.09 with 28 degrees of freedom. At p value <0.0001, shows extremely significant. Thus, we are accepting alternate hypothesis and rejecting null hypothesis. **Conclusion:** After comparing the results, we can conclude that PNF stretching technique is more effective treatment than Box taping technique on chest expansion in elderly subjects. **Key Word:** Elderly, PNF stretching technique, Taping technique, chest expansion

*Address for Correspondence:

Dr. Virendra Meshram K, Associate Professor, Modern College of Physiotherapy, Pune, Maharashtra, INDIA.

Email: drvirubpth@gmail.com

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INTRODUCTION

Ventilation is the movement of the gases into and out of the lungs. Although the movement of gases in the lungs and tissues is by diffusion, their transport to and from the environment and throughout the body requires work by the respiratory and cardiac pumps. The respiratory pump is comprised of the muscles of respiration and the thorax, which is made up of the ribs, scapulae, clavicle, sternum and the thoracic spine. This musculoskeletal pump

provides the necessary pressure gradients to move the gases into and out of the lungs in order to ensure adequate diffusion of oxygen and carbon dioxide within the lungs.¹ The work of breathing performed by respiratory muscles in overcoming lung, chest wall, and airway resistances normally occurs only during inspiration. Muscular effort is required to enlarge the thoracic cavity and lower intra thoracic pressure. There are more than 20 primary and accessory muscles and almost all of them have a postural function. Only the diaphragm and the anterior intercostals muscles are purely respiratory. Also during forced or deep breathing some accessory muscles help in respiration. The sternocleidomastoid draws the sternum superiorly, serratus anterior and pectorals assists in raising the ribs and the scalene helps in raising the first two ribs. Rhomboids have a role in stabilizing the scapula to assist the serratus in forced inspiration.² The elderly is a population group with specific characteristics due to lifetime accumulated disease burden, particularly cardiopulmonary diseases, Cardiovascular and respiratory diseases stand out as major causes of mortality among the

elderly. The proportion of deaths from pulmonary diseases increased among the elderly compared to all deaths. Aging is associated with a significant decrease in chest wall compliance includes decrease compliance of rib cage (upper thorax) and compliance of the diaphragm-abdomen compartment (lower thorax).¹ Compliances of the respiratory system is 20% less in a 60-year-old geriatric subject compared with a 20-year-old adult.¹ Age-associated alterations in skeletal muscles also affect respiratory muscle function. Decrease in muscle strength results from a decrease in cross-sectional muscle fibers area, a decrease in the number of muscle fibers especially type II fast twitch fibers and motor units, alterations in neuromuscular junctions, and loss of peripheral motor neurons with selective denervation of type II muscle fibers. Respiratory muscle function also is dependent on energy availability.¹ Movement of the chest wall is a complex function within the rib cage, sternum, thoracic vertebra, and muscles. Suitable lengthening of soft tissue around the chest wall and respiratory muscles is related to the efficiency of contraction force and chest movement. Increasing chest movement with stronger contraction of respiratory muscles can help in gaining lung volume, breathing control and coughing efficiency, and reducing symptoms by improving aerobic capacity, endurance, functional ability, and quality of life.¹ Proprioceptive neuromuscular facilitation (PNF) stretching techniques are commonly used in the athletic and clinical environments to enhance both short term active and passive range of motion (ROM). PNF stretching for subject with adaptive shortening and stiffness around the upper limb muscle quadrant found to be effective. And this method of treatment appears to be safe and effective in chronic respiratory patients.³ However, evidence has provided reference that hold and relax techniques can improve the restrictive component of COPD, improve ROM of the pectoralis major and possibly overcome some of the postural changes of COPD.³ Taping Technique improves the biomechanics of chest movement by enhancing direction of anterior-upward of upper costal and lateral outward of lower costal movement and by facilitating the thoracic extension in elderly for improvement of chest expansion.⁴ In geriatrics adaptive shortening and stiffness around the upper limb muscle quadrant and around the chest wall increases chest wall resistance and work of breathing, a method of reversing these changes is important to include in a management plan for these patients. There are no studies found in the literature that aim to improve the upper limb muscle quadrant and chest wall mobility and flexibility for elderly subjects.¹ Literature's have suggested that the

effect of PNF stretching improves adaptive shortening and stiffness around the upper limb muscle quadrant^{3,5} and Taping Technique improves the biomechanics of chest movement by enhancing direction of anterior-upward of upper costal and lateral outward of lower costal movement and by facilitating the thoracic extension in elderly for improvement of chest expansion.⁴ Hence, the purpose of this study is to compare the effect of PNF stretching versus Taping technique on chest expansion for elderly.

METHODS

A pre and post experimental study was conducted in an outpatient department in Pune, Maharashtra, India. Male Individuals were included with age between 65-75 years. Subjects who are having chest expansion at apex level less than 0.5 inches, at nipple level less than 1 inches and at xiphisternum level less than 1.5 inches.⁴ Subjects who were willing to participate. Subjects who had an ability to communicate and follow command. Subjects who were independent in mobility. Additional conditions restricting chest expansion. (Eg. obesity, scoliosis, ankylosing spondylitis) Chest or abdominal surgery. Exclusion criteria was if Any musculoskeletal disorders affecting upper limb. Any pathological condition affecting muscle, joint and bone Such as rheumatoid arthritis. Cardiovascular dysfunction (Eg. ischemic heart disease, uncontrolled hypertension) Pathology of spine such as disc protrusion, spondylolisthes. Ethical clearance was taken from the ethical committee of Modern college of physiotherapy, Pune. Total 30 Samples were randomly allocated in respective Groups i.e Group A and Group B. Subjects were collected according to inclusion and exclusion criteria. Then Consent was taken from the respective subjects to conduct the study. Respective protocol was followed for Group A and Group B; and protocol was followed on daily basis up to 1 week. Pre and post values of an elderly subjects was assessed by using chest wall expansion technique. Data was collected and analyzed statistically.

RESULT

Data was analyzed by using paired' test and unpaired 't' test. In between group (Group A and Group B comparison) significance was calculated by using unpaired't' test and within the group (pre and post treatment comparison of Group A and B) significance was calculated by using paired 't' test to compare the effectiveness of PNF stretching and Taping technique on chest expansion in elderly subjects. There was no drop out of the patients from the study.

Table.1 Comparison of chest wall expansion at axilla level Within and In between Group A and Group B

Outcome	Group	Treatment	Mean ±SD	Paired 't' value	Unpaired 't' value	Significant
Chest wall expansion (at axilla level)	A	Pre	0.28±0.051	16.83	6.653	<0.0001
		Post	0.46±0.048			
	B	Pre	0.31±0.07	9.53		
		post	0.4±0.06			

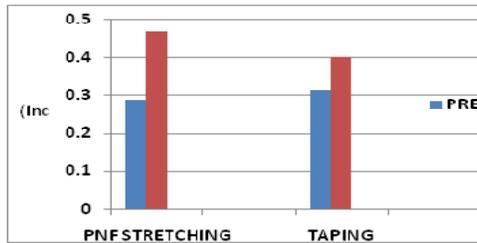


Figure 1: at axilla level

Table 2: Comparison of chest wall expansion at nipple level Within and In between Group A and Group B

Outcome	Group	Treatment	Mean ±SD	Paired 't' value	Unpaired 't' value	Significant p value
Chest wall Expansion (at nipple level)	A	Pre	0.68±0.08	9.26	5.42	<0.0001
		Post	0.91±0.07			
	B	Pre	0.76±0.08	4.78		
		post	0.8±0.07			

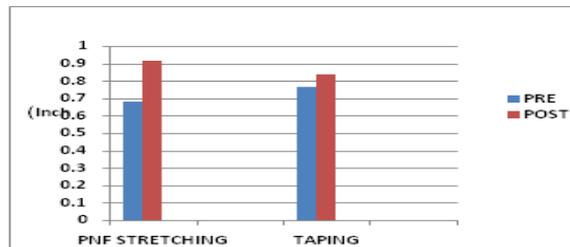


Figure 2: At Nipple Level

Table 3: Comparison of chest wall expansion at xiphisternal level Within and In between Group A and Group B

Outcome	Group	Treatment	Mean ±SD	Paired 't' value	Unpaired 't' value	Significance p value
Chest wall expansion (at xiphisternal level)	A	Pre	1.06±0.14	15.838	7.099	<0.0001
		Post	1.38±0.091			
	B	Pre	1.04±0.12	5.95		
		post	1.18±0.09			

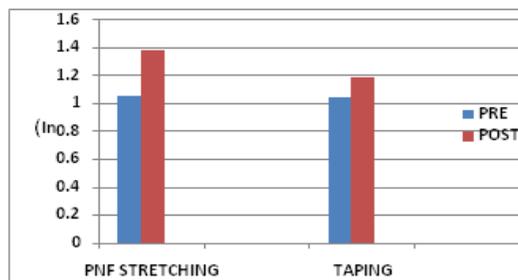


Figure 3: At Xiphisternal Level



Figure 4



Figure 5



Figure 6

Legend

Figure 4: Pnf stretching; Figure 5: outcome measures; Figure 6: chest wall expansion technique with non-elastic inch tape.

DISCUSSION

This study was carried out From January 2015 to March 2015 and it was conducted between the age group of 65 - 75 years old normal elderly to compare the effectiveness of PNF stretching and taping on chest expansion in elderly subjects. 30 subjects were chosen according to inclusion and exclusion criteria. Protocol was followed on daily basis for one week by the therapist. Study were carried out on 30 subjects and subjects were divided into two groups i.e. group A and Group B. In which PNF stretching was given to 15 subjects and Box taping was given to another 15 subjects. Chest wall expansion was assessed using chest wall expansion technique in which chest circumference was measured at three level viz., at axilla level, at nipple and at xiphisternal level. To compare effectiveness of PNF stretching and taping, graphs were made which showed difference at each level before and after intervention period. The present study was designed to investigate the effect of PNF stretching and taping technique on chest expansion in elderly subjects. There was statistical significant changes was seen in the chest wall expansion values for group A patients with PNF stretching technique in pre and post treatment values. The data was analyzed statistically and both the groups showed significant changes in between the groups but there was no significant difference. When chest wall expansion values were compared in between the groups, i.e. group A (PNF stretching technique) showed significant increase in chest wall expansion in post treatment values at axilla (mean 0.46+0.04) from pre treatment values at axilla (0.28+0.051) and group B (Taping) showed significant increase in chest wall expansion in post treatment values at axilla (mean 0.4+0.06) from pre treatment values at axilla (0.31+0.07). When chest wall expansion values were compared in between both the groups, i.e. group A (PNF stretching technique) showed significant increase in chest wall expansion in post treatment values at nipple level (mean 0.91+0.07) from pre treatment values at nipple level (0.68+0.08) and group B (Taping) showed significant increase in chest wall expansion in post

treatment values at nipple level (mean 0.8+0.07) from pre treatment values at nipple level (0.76+0.08). When chest wall expansion values were compared in between both the groups, i.e. group A (PNF stretching technique) showed significant increase in chest wall expansion in post treatment values at xiphisternal level (mean 1.38+0.09) from pre treatment values at xiphisternal (1.06+0.14) and group B (Taping) showed significant increase in chest wall expansion in post treatment values at xiphisternal level (mean 1.18+0.09) from pre treatment values at xiphisternal level (1.04+0.12). When data was analyzed statistically within the group; Group A showed significant difference as compared to group B. When chest wall expansion values compared within both the groups, group A showed significant increase in post treatment chest wall expansion at axilla (mean 0.18+ 0.04), at nipple (0.23+ 0.09) at xiphisternal level (0.33+ 0.07) than group B post treatment chest wall expansion at axilla (mean 0.08+0.03), at nipple (0.07+0.05) at xiphisternal level (0.13+0.08). In elderly subjects, PNF is an effective way of using reflexes to assist muscular relaxation. The basis for PNF stretching is theorized to be through neural inhibition of the muscle group being stretched. The proposed neural inhibition reduces reflex activity, which then promotes greater relaxation and decreased resistance to stretch, and hence greater range of movement (Hutton 1993). Autogenic inhibition (historically known as the inverse myotatic reflex or autogenic inhibition) refers to a reduction in excitability of a contracting or stretched muscle, which in the past has been solely attributed to the increased inhibitory input arising from Golgi tendon organs within the same muscle.⁶ The reduced efferent (motor) drive to the muscle by way of autogenic inhibition is a factor believed to assist target muscle elongation. Most of the PNF stretches include a static contraction of the lengthened target muscle in order to take advantage of autogenic inhibition. A maximal contraction has historically been used because it was thought that golgi tendon organ only respond to high forces but in fact golgi tendon are also sensitive to very

low forces. The Hold-relax method of proprioceptive neuromuscular inhibition technique facilitates golgi tendon organ; which allows reflexive relaxation of the muscles. Muscle recruitment enhanced through the use of appropriate reflex and a proprioceptive stimuli. Resistance applied to muscle contraction may facilitate a smooth motor response through optimal muscle contraction and relearning. The stretch reflex is a stimulus that increases the state of responsiveness of a motor unit to cortical stimulation. The reflex is stimulated by the quick elongation of the muscle. The stretch stimulates extrafusal and intrafusal muscle spindles to create a contraction. The muscle spindle and its reflex constitute a feedback device that operates to maintain a muscle length. This reflex might produce a brief isolated contraction; however, with resistance may facilitate a muscular response.⁶ Taping Technique helps to improve the biomechanics of chest movement by enhancing direction of anterior-upward of upper costal and lateral outward of lower costal movement and by facilitating the thoracic extension in elderly for improvement of chest expansion.⁴ The increase in chest expansion values showed statistical significant change for group A patients with PNF stretching technique in pre and post treatment values. There was statistical significant increase in change was seen in the chest expansion values for group B patients with box taping technique in pre and post treatment values. Future scope of the study will be; same study can be conducted on large scale. Improvement in quality of life can be noted after intervention period. Females can also be included. Limitations of the study were Study was conducted in limited area. Sample size was less. Only male subjects were included.

CONCLUSION

After comparing the results, we can conclude that PNF stretching technique and Box taping technique are equally effective treatment on chest expansion in elderly subjects. Significant improvement was found in chest wall expansion in subjects with box taping technique but more significant improvement was seen with the PNF stretching technique. PNF stretching technique provides more benefits to subjects with reduced chest wall

expansion than box taping technique in terms of improvement in chest wall expansion.

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