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Effectiveness of Kinesiological taping and PNF stretching in students with forward shoulder posture

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Abstract
Background: According to several studies conducted, 58% of the students experience the protracted shoulder posture and about 47.6% of students have forward head along with protracted shoulder posture. The continuous long periods of sitting, studying, frequent use of smartphones and laptops and poor physical activity the students are more prone to adapt such posture. This results in pain and postural malalignment. Kinesiological taping is one of the frequently used technique. It has been effective in improving muscular imbalance and for mechanical correction. PNF stretching acts by reciprocal inhibition mechanism. PNF stretching causes isometric contraction of a muscle stretched thus creating a reduction in muscle tension.
Objective: This study aims to find out the effect of Kinesio Tape and PNF stretching in students with forward shoulder posture on carpenter try square scale.
Methodology: Thirty participants were selected by convenient sampling. This group received Kinesio Taping and PNF stretching technique. This was a three days intervention.
Outcome Measures: Carpenter try square scale.
Results: Study suggests that Carpenter try square scale Mean and Standard deviation value pre-intervention was 12.51±1.21 and post intervention was 11.37±1.13 ($p<0.0001$).
Conclusion: Study concluded that Kinesio Taping technique and PNF stretching technique significantly improves the try square scale measurements in patients with protracted shoulders($p<0.0001$).

Keywords: forward shoulders, PNF stretching, kinesio taping, carpenter try square scale

1. Introduction

The shoulder complex consists of four joints that function in a coordinated and synchronised manner. The movements occur as a result of the combined work of the sternoclavicular, acromioclavicular, and glenohumeral joints and the scapulothoracic joints [1].

Forward Shoulder Posture (FSP) is characterized by shoulders rotated downward, protracted along with upper thoracic kyphosis and increased lumbar and cervical lordosis [2]. In protracted shoulder posture (RSP), the scapular position changes and shoulder is placed anterior to the plumb line [5].

Postural alignment is said to be poor when the shoulders appear slouched forward with the head forward. Several postural correlates are such that a forward head is related to shoulder protraction and upper thoracic kyphosis [3].

Forward shoulder posture alters scapular kinematics and produces scapular muscle imbalances that result in rotator cuff injuries and shoulder impingement syndrome. Research shows that shoulder posture is linked with pectoralis muscle tightness and lower trapezius weakness. A poor posture is commonly seen in adolescence population using computers with prolong periods of sitting and long term and frequent use of smartphones thus, leading to cumulative trauma disorder (CTD) because of long periods of abnormal posture [4]. Forward shoulder posture leads to muscle imbalance and deficiency of scapulohumeral rhythm causing shoulder impingement, tendinitis, bursitis, shoulder pain and instability [5]. Forward shoulder posture characterized by protracted, downwardly rotated shoulder and anteriorly tipped scapula in a position with increased cervical lordosis and upper thoracic kyphosis [6].

Kinesiological Taping was originally developed in Japan and it has become popular since then [7]. Kinesiological taping does not have any undesired effects on body such as limiting a movement of joint or functional activities. It has been proved in many articles that kinesiological taping is effective to improve functional capacity and muscular imbalance [8] Kinesio taping is considered one of the most useful method as it gives proper alignment during dynamic movements and by providing continuous proprioceptive feedback. Various researches have proved that Kinesio taping improves postural alignment, thus reducing pain and increasing the joint ROM [9].

Kinesio tapes have elastic properties similar to the epidermis that helps to limit the body's perception of weight and avoid sensory stimuli if properly applied. It helps to "re-educate the neuromuscular system. It helps in reducing pain, prevent injury and promote improved circulation and healing thus optimising performance. Kinesio Taping Method can be used as a treatment intervention in subjects with forward shoulder posture. It could benefit clinicians in treating the resting position of scapular protraction which limits scapular posterior tilt or scapular retraction predisposing patients to injuries [10]. Moreover, it allows patients to learn the correct movement patterns and helps them to avoid kyphotic posture thus improving mechanical correction. Studies indicated that scapula and thoracic taping decreased the amount of FSP immediately in shoulder pathology [5].

Proprioceptive Neuromuscular Facilitation (PNF) stretching technique application causes reciprocal inhibition mechanism. PNF stretching causes isometric contraction of a muscle stretched thus creating a reduction in muscle tension.

Proprioceptive Neuromuscular Facilitation stretching is a method of stretching that is helpful in increasing the muscle flexibility for rehabilitation purpose. Proprioceptive neuromuscular facilitation (PNF) stretching techniques are commonly used to enhance both active and passive range of motion (ROM) with a goal to optimise the motor performance and muscle rehabilitation. PNF stretching is considered as the most effective stretching technique with the aim to reduce the muscle tightness and increase ROM. As per the studies an 'active' PNF stretching technique achieves the greatest gains in ROM, e.g. utilising a shortening contraction of the opposing muscle thus putting the target muscle on stretch, followed by a static contraction of the target muscle. While performing a static contraction of the target muscle, it needs to be held for approximately 3 seconds at no more than 20% of a maximum voluntary contraction. PNF stretching have been effective in improving active and passive flexibility [11].

2. Methodology

2.1 Source of Data

The source of data will be collected from students in the age group of 20-25 with forward shoulder posture of Pravara Institute of Medical Sciences, Loni, Tal. Rahata, Dist. Ahmednagar

2.2 Method of collection of data

- **Type of Data**: Data will be primary collected by the principal investigator
- **Study Design**: Pre and post experimental study (three days intervention)
- **Sample size:** 30
- **Participants:** The sample includes students in the age group of 20-25 with forward shoulder posture who fulfill the inclusion and exclusion criteria and willing to participate.
- **Sampling Method:** Convenient sampling.
- **Study Duration:** 3 days intervention

3. Procedure

The ethical clearance form registration no. BPT/INT/2018/05. The participants were screened and after finding suitability according to the inclusion and exclusion criteria, they were requested to participate in the study. Exclusion criteria consisted of history of pain, pathology or trauma in shoulder, cervical and thoracic region, absence in assessment session and skin abnormal reaction to Kinesio tape. The sample size of the study was 30 participants(22 females and 8 males). The postural assessment was done using carpenter try square scale measurements. Study included pre and post posture assessment readings of the subjects.

Carpenter Try Square Scale

The subjects were asked to stand erect and look ahead. The subject was asked to stand in front of the wall, slightly in contact, in a comfortable posture with feet slightly apart, looking ahead. The calcaneum of both the feet should touch the wall. Using carpenter try square method, the following landmarks were marked in the subject 1) 1 cm anterior to the posterior aspect of the lateral malleolus, 2) 2 cm inferior to the angle of the acromion (considered the shoulder axis), 3) the most posterior aspect of the tragus of the ear. The experiment used the tri- square to take the following linear measurements: 1) from the wall to the mark on the lateral malleolus 2) from the wall to the mark on the shoulder and 3) from the wall to the mark on the tragus of the ear. The distance of the shoulder, lateral malleolus and tragus of ear was measured for each subject before the interventions.

Skin Sensitivity Test: After the pre-assessment readings, skin sensitivity test was done. A small patch (1x1cm) of Kinesio tape was applied on the subjects at the cubital fossa for 24 hrs to check for any skin abnormal reactions and allergy. Few subjects showed positive reaction to the tape with erythema over the cubital fossa. These subjects were excluded from the study. The subjects were made to sit comfortably in the chair. A 15x5cm tape was cut with rounding of the edges of the tape. The subjects were asked to actively retract the shoulders. The therapist was standing on the side of the subject. After the subjects retracts the shoulder actively, the therapist depressed and retracted the shoulder. The initial 4 small 1cm blocks were kept as base with 0% stretch. The base was applied just below the clavicle. By maintaining this position, after applying the base, one the tape was stretched up to 75% and applied over the acromion process and the humeral head taking it towards the spine of the scapula. The other tape was applied by reinforcing it over the base of the first tape and turning it the lateral side of the shoulder neck angle towards the inferior angle of the scapula. The same procedure was carried on the other side. The tape was kept for 3 days on the subject and was removed on the third day. Following taping, PNF stretching was given for three days. The subject was in supine line on the edge of the bed. For stretching of left shoulder muscles, the subject was made on the edge of left side of the bed and vice versa. Using hold relax technique, from D1 flexion to D1 extension of upper extremity the PNF stretching was given. The stretch was held for approximately 3 seconds at no more than 20% of a maximum voluntary contraction. Three sets were given for three session for three days. The participants were assessed on the third day again using the carpenter try square scale measurements.

Fig 1: Assessment of posture

Fig 2: Application of KT

Fig 3: PNF stretching

4. Results

Various statistical measures such as mean, standard deviation (SD) and test of significance such as student's paired 't' test were analysed in the data. The results were concluded to extremely significant with the p value <0.0001

The pre-intervention mean average score and Standard deviation (SD) for Carpenter try square scale was 12.51±1.21. The post intervention after 3 days, the mean average score and Standard deviation for these participants was 11.37±1.13

Table 1: comparing the mean and SD for the pre and post intervention result

Carpenter try square scale	Pre- intervention	Post intervention
Mean	12.52	11.38
SD	1.19	1.11

Table 2: Showing values of 'p'

	Pre/Post Intervention
't' value	21.0
'p' value	<0.0001
Result	Highly significant

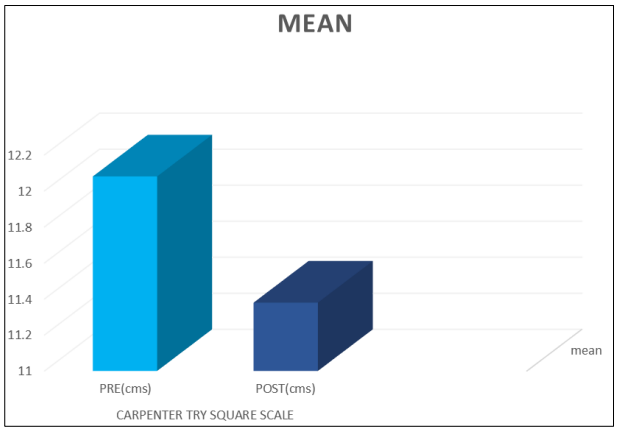

Fig 4: Pre and Post values of carpenter try square scale

Table 3: Presentation of carpenter try square scale on rounded shoulders

Parameters	Pre-values (Mean±SD)	Post values (Mean±Sd)	T value	P value
Carpenter try square scale	12.51±1.21	11.37±1.13	21.0	<0.0001

5. Discussion

The study evaluated the effectiveness of Kinesio Taping and PNF stretching in students with rounded shoulders**.** The sample size of the study was 30 participants (20 females and 10 males). They were explained about the study and the intervention

This interventional study examined the effect of Kinesio tape and PNF stretching on forward shoulder. The postural assessment was done using carpenter try square scale measurements. Study included pre and post posture assessment of the subjects. The subjects were asked to actively retract the shoulders. After the subjects retracts the shoulder actively, the therapist depressed and retracted the shoulder. Holding this position Kinesio tape was applied bilaterally. After 3 days, the tape was removed, and the subject was given PNF stretching for 3 days. The post readings were measured. The result of the study showed significant postural changes. After the post assessment readings, there was difference seen in the measurements. The study conducted showed the mechanical correction of FSP was achieved by the application of kinesiology tape, with up to 75% stretch in the shoulder retraction position, to the dominant as well as the non-dominant shoulders as this induced resistance to the FSP due to the reduction of the elasticity to recoil. Kinesiological taping has been effective to increase circulation of a local part of body affected by facilitating the muscles, to reduce localized oedema, limit the affected tissues range of motion and also provide positional stimulus to fascial and muscular structures. Kinesio tape stimulate cutaneous mechanoreceptor and provide feedback for the patient about his/her posture continuously, thereby improving postural awareness during daily activity. Due to the sessions of PNF stretching, the shortened pectoralis minor was lengthened and helped in improving and maintaining ROM, increasing muscular strength and power.

A research conducted by Jin-Tae Han on the mechanical effect of kinesiology tape on rounded shoulder posture in seated male workers: a single-blinded randomized controlled showed that round shoulder taping using kinesiology tape with stretch produces immediate mechanical correction of Round shoulder posture in seated male workers. It was a Single-blinded randomized controlled pilot study. The study aimed to examine the changes in pectoralis minor length, the supine measurement of rounded shoulder posture, and the total scapular distance in seated male workers with RSP, after rounded-shoulder-taping using kinesiology tape with experimental taping and without stretch placebo taping. 14 men with Round shoulder posture, who worked for at least 7 h/d in a seated position, were selected for taping, with the shoulders assigned to two kinesiology taping methods: (1) with 35–40% stretch of its original length; and (2) without stretch. The Pectoralis minor length, supine measurements of Rounded shoulder, and total scapular distance, before and after kinesiology taping, with and without stretch, were assessed. So according to the study Kinesiology taping with stretch significantly increased the pectoralis minor and decreased the supine measurement of round shoulder posture and total scapular distance. Kinesiology taping without stretch did not increase the pectoralis minor length significantly and did not decrease the supine measurement of rounded shoulder posture and total scapular distance.

Another research conducted by P.V Decicco on the effects of proprioceptive neuromuscular facilitation stretching on

shoulder range of motion in overhead athletes. The subjects were male and female within the age group of 25-50 years old. There were 30 participants who were assigned to group 1,2 and 3. Subjects were selected only if they were involved in at least one overhand throwing sports such as tennis, baseball, quarter-back in football. These participants were assigned to one of the three groups either contract-relax-contract (CRC), hold-relax contract (HRC) and PNF stretching group. ROM for shoulder external rotation was taken before and after 6 weeks of training. The study concluded that CRC, HRC and PNF stretching were effective in increasing the ROM of shoulder.

6. Conclusion

Study concluded that Kinesio Taping technique and PNF stretching technique significantly improves the try square scale measurements in students with forward shoulder posture ($p<0.0001$)

7. Acknowledgement

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