Research Report

EFFECT OF TAPING ON PAIN AND RANGE OF MOTION OF ATHLETES WITH SHOULDER IMPINGEMENT SYNDROME: A PILOT STUDY

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ABSTRACT

Objectives: The purpose of this study is to investigate the effect of a taping technique on pain and ROM of shoulder on athletes with impingement syndrome. ***Methodology*:** Nine subjects each went through three different testing days: experimental, controlled and sham days. Pain Visual Analog Scale (PVAS), a tape measure and a still digital photo measurement was used to measure the outcome before and after the taping technique. ANOVA was used to test the homogeneity of the pretest results and t-test was used to test the correlation of the pre and post test values for pain and ROM. ***Results***: There was a statistically significant decrease in pain, as well as in ROM in the experimental test. No significant effect was seen in the sham and controlled test. ***Conclusion***: Results suggest that the taping technique can significantly decrease the pain of the athlete; however, a concomitant decrease in ROM was noted.

Keywords: Shoulder *pain, Range of Motion, Shoulder Impingement syndrome, Shoulder.*

INTRODUCTION

The shoulder plays a vital role in many overhead activities and athletes engaged in these activities place their shoulder in a position for higher risk for impingement. Athletes are commonly diagnosed with shoulder impingement syndromes which are considered a common overuse injury of the shoulder. There are 2 kinds of impingement syndromes – primary and secondary. Primary impingement is an impingement caused by the shape of the anterior slope of the acromion. The supraspinatus is impinged against the anterior, inferior aspect of the acromion and/or the coracoacromial ligament during repetitive overhead activities. Secondary impingement is an impingement of the rotator cuff muscles due to instability because there is an increased demand on the rotator cuff muscles to center the head of humerus in the glenoid fossa during repetitive overhead movements. As a result, fatigue ensues which in turn leads to a dynamic cephalic migration of the head in relation to the glenoid fossa leading to a secondary impingement of the rotator cuff under the coracoacromial arch[1]. In general, patients with impingement syndromes may complain of pain which is possibly caused by pinching of the tissues between the greater tuberosity of the humerus and the undersurface of the acromion[1]. Clinically, athletes with impingement syndromes have difficulty with shoulder elevation and present a painful arc in addition to a positive Neer Impingement Sign and Hawkins Kennedy test. Neer Impingement and Hawkins-Kennedy tests have been proven to be reliable and valid tests[2].

Taping techniques have been advocated for various musculoskeletal conditions. Taping has been used for over a decade now and has been proven to cause significant effect on pain and range of motion (ROM). McConnell advocated the use of tapes for patients with patellofemoral pain syndrome (PFPS) and sciatica, which resulted to a 50% decrease in pain of symptomatic individuals[3]. As for the shoulder, there are some studies regarding the use of tape on hemiplegic patients, taping significantly

reduced pain and relieved excessive tension on the involved structures[4].

The purpose of this study was to examine the effect of taping on pain and range of motion in athletes with impingement syndromes.

METHODOLOGY

This study was a double blind, placebo-controlled repeated measure crossover design. Eighty-six participants were recruited from various varsity teams from University of the Philippines, De La Salle Dasmarinas and the University of Santo Tomas. The participants were given pre-participation questionnaires, which were used to select potential participants for the study. These participants were included based on the selection criteria (Table 1) set for the study. From among these 86 initial participants, 22 potential subjects were tested by a researcher trained in the technique for signs and symptoms of shoulder impingement syndrome using the Neer Impingement Test and the Hawkins-Kennedy test.

Nine tested positive to one or both orthopedic tests and then were asked to read and sign the Participants Consent Form, which was approved by the Research Coordinator of the College of Rehabilitation Sciences, University of Santo Tomas. Participants were then scheduled for three separate testing days, one each for the experimental tape, the sham tape and the control.

Inclusion Criteria

- 15-40years old
- Male and female
- Involved in overhead sports (tennis, volleyball, badminton, basketball)
- Has been engaged in their specific sport for at least 3 months
- No resting pain, shoulder pain elicited during shoulder movements of flexion and external rotation
- (+) Neer Impingement Test
- (+) Hawkins Kennedy Test

Exclusion Criteria

- History of any of the following:
    - o shoulder dislocation
    - o fractures
    - o neural injuries such as CPS, CRPS
    - o cancer, cardiovascular disease, pulmonary disease, breast disease, abdominal organ pathologic condition
    - o shoulder surgery
    - o cervical radiculopathy
    - o rotator cuff tears, glenoid labrum tear
    - o osteoarthritis and rheumatoid arthritis

On the day of testing each participant was asked to pick a number from a container; the number corresponds to a randomized table indicating the sequences of the interventions (control, sham taping or experimental). They were then scheduled for the particular intervention assigned to the number they picked.

Subjects were asked to wear a black shirt in order to blind the 2nd examiner (PT2) as to the given intervention and also to make reflective markers more visible on the digital picture. Reflective markers were placed on specific landmarks for measurement, depending on which movement was painful (Table 1 and Figure 1). Initial measurements of shoulder ROM and pain were performed by the 1st examiner (PT1), with landmarks specified in Table 1.

A. Range of Motion using Stand and Reach Test

A standard tape measure was secured to a wall. The subject was asked to stand in front (for forward flexion, external rotation or abduction) with the tape measure occluded from their vision. The examiner's instructions were, "Good day, kindly move your shoulder into _____ (flexion, abduction, external rotation) and stop once pain is felt and don't go further. Please be reminded that it is important that you try to recall and remember the level of pain that made you stop from moving your shoulder further. Once you have reached the point in the range, kindly hold the position for 4 seconds. Thank you. Would you like me to repeat the instructions?" Instructions were repeated if the subject was not able to understand or if questions were raised. After

Table 1. Specific Landmarks for Measurements

Painful Movement	1st marker	2nd marker	3rd marker
Forward flexion/Abduction	Posterolateral Acromion process	Lateral epicondyle	mid-axillary line (end of 12th rib)
External Rotation	Marked on the tape measure inline with longitudinal axis of the forearm	Ulnar styloid	Olecranon process

Figure 1. Placement of Markers for external rotation (A) and forward flexion (B)

making sure that the instructions were clear, the subject was asked to move his shoulder up to the onset of pain, when the subject begins to feel pain and refrain from moving any further. The height of the motion of the shoulder was recorded. The test was done three times and the average was recorded for both the pre-test and post-test measurements for each of the test conditions.

B. Angular Range of Motion Using Still Photography

A Sony TRV50E Digital Video Camera (Sony Corporation,Japan) was placed 162.5 cm away from the standard tape measure used in the Stand and Reach Test. A still photograph of the subject at the height of shoulder movement where there was onset of pain was taken by the 2nd examiner (PT2). Photographs were then developed and angular range of motion measured using a goniometer with the appropriate landmarks used as guide. The test was done three times and the average was recorded for both the pre-test and post-test measurements for each of the test conditions.

Still photography and stand and reach test for movements of shoulder flexion, abduction, external rotation and overhead reach in patients with orthopedic shoulder disorders has a fair to good reliability[5].

C. Pain Scale

A Pain Visual Analogue Scale, a 10-cm line drawn on a piece of paper, was used to determine the participant's perception of pain. PT1 then told the subject, "Good day, this time you will place a mark on the line which represents the amount of pain that you felt while moving your shoulder. The right end of the line represents the worst possible pain that you can experience and the left end of the line represents no pain at all." Subject then made a mark on the 10-cm line and the distance from the left end of the line to the mark was measured by PT1 and recorded. The procedure was done three times both for the pre-test and post-test measurements for each of the test conditions. Gridley and Van den Dolder showed an excellent inter-rater reliability with use of the PVAS[6].

After pre-test evaluation of pain and ROM, the subject then entered an enclosed room where a third investigator (PT3) performed the assigned treatment (control, sham taping or experimental) depending on the randomized table. Ten minutes was allotted for PT3 to perform the intervention to prevent any clues for the blinded examiners (PT1 and PT2) and the subjects on what intervention was actually done. In the experimental condition, PT3 applied the two strips of Urgoderm tape (Laboratories Urgo Healthcare Products, France) on the anterior aspect of the head of the humerus while a posterior glide was applied and maintained ending the tape at the medial border of the scapula (Figure 2), with the subject in the sitting position. A reinforcing strip using a Mueller tape (Mueller Sports Medicine Inc, USA) was applied in the same manner as the Urgoderm.

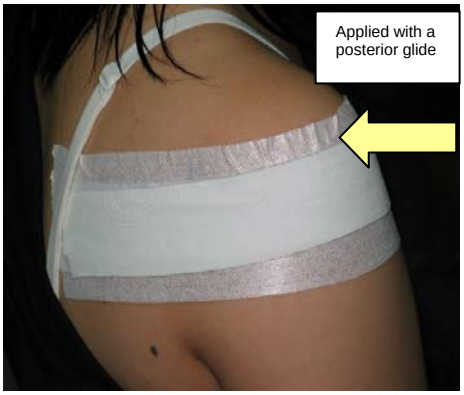


Figure 2. Experimental Taping

In the sham taping condition, PT3 applied two strips of Mueller tape without a posterior glide on the affected shoulder. In the controlled condition, no taping was done. The subjects then left the room wearing the same shirt provided by the researchers to cover their shoulders and to prevent bias of other investigators. PT1 measured pain and ROM of the shoulder again using the same procedure as that of the pre-test and the results were recorded as post-test results. The subject was then instructed to take

off the tape after post test measurements were taken.

Post-test questionnaires were administered on the last testing day to ensure that participants remained blinded to the interventions.

The ANOVA procedure was used to test the differences between the three conditions. T-test was used in this study to know if there was a significant difference in pre-post test values both in pain and ROM of the athletes. For all tests a *p* value of 0.05 was used to determine significance.

RESULTS

Pretest pain scores, height of the reach and angular measurement using still photographs were all similar at the baseline measurement, signifying that the participants were homogenous in these variables.

A summary of results is shown in Table 3 and Figures 3, 4, and 5. At post-test, pain scores diminished in both the experimental and the sham but the improvement in the experimental group was greater and was statistically significant. There was no change in the pain score in the control group.

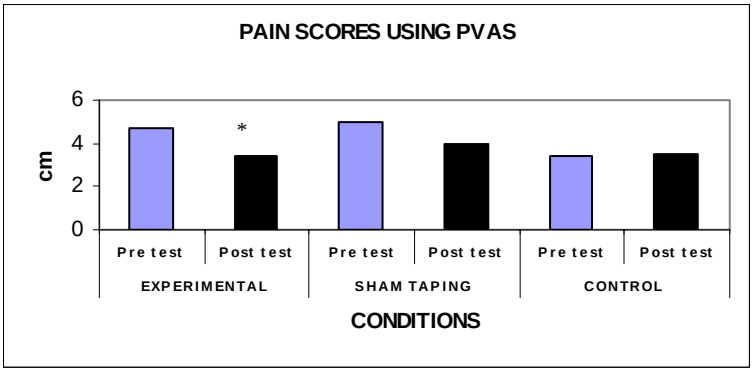
For range of motion using height of reach, post-test results showed decreased ROM in all groups; however only the experimental group showed a statistically significant decrease in ROM. Post-test results of angular measurements using still photos showed a statistically significant decrease in ROM in the experimental group compared with the sham and controlled groups.

DISCUSSION

The most important finding of this study was that shoulder taping significantly improves pain. The relief from pain utilizing taping is very consistent with other studies on the knee[7,8], elbow[9], ankle[8] and shoulder[6,8]. The relief from pain utilizing taping technique will allow early compliance and pain-free exercise rehabilitation for patients with shoulder

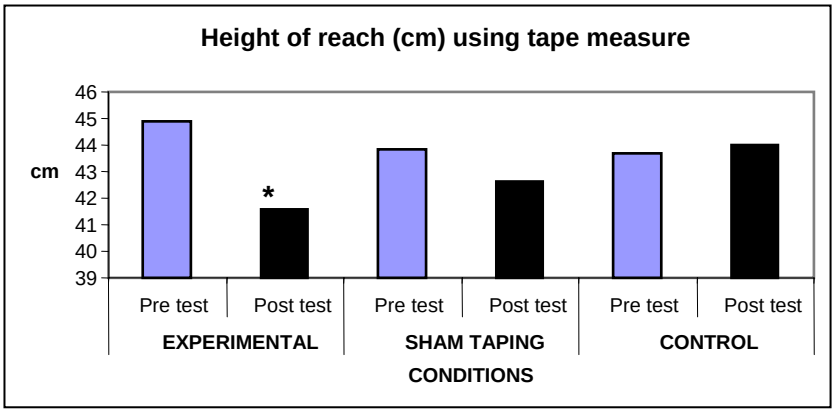
Table 3. Summary of Results

	EXPERIMENTAL		SHAM TAPING		CONTROL	
	Pre test (Mean ±SD)	Post test (Mean ±SD)	Pre test (Mean ±SD)	Post test (Mean ±SD)	Pre test (Mean ±SD)	Post test (Mean ±SD)
Pain scale (cm)	4.73 ± 2.4	3.46 ± 2.75*	4.94 ± 1.33	3.93 ± 2.22	3.43 ± 1.89	3.54 ± 2.05
Height of reach (cm) using tape measure	44.92 ± 0.82	41.56 ± 4.71*	43.84 ± 1.96	42.65 ± 3.9	43.69 ± 2.96	43.98 ± 2.29
ROM (deg) using still photos	118.13 ± 11.8	114.82 ± 12.67*	119.83 ± 14.58	116.34 ± 15.62	114.22 ± 13.81	115.93 ± 13.84
Values with (*) are significant at p<0.05						



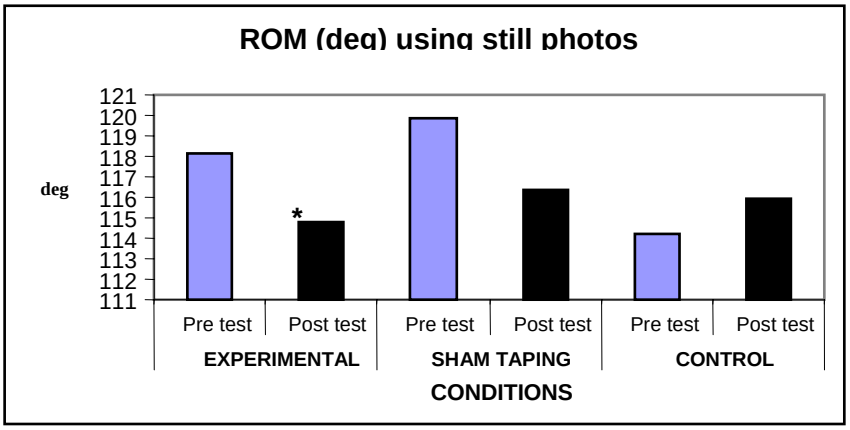
(*) are significant at p<0.05

Figure 3. Pain Scales using PVAS



(*) are significant at p<0.05

Figure 4. Height of reach using tape measure



(*) are significant at p<0.05

Figure 5. Angular ROM measurement using still photos

impingement in order to avoid faulty biomechanics brought about by the injury.

The pathomechanics of shoulder impingement may be an inhibition of the lower trapezius muscle and subscapularis muscles, which will cause the scapula to migrate towards the posterior aspect of the head of the humerus. This leads to scapular winging whereby it approximates the glenoid fossa to the posterior aspect of the head of the humerus. As a result, there is tightening of the posterior capsule and shortening of the infraspinatus and teres minor muscles. The tightening and shortening of these structures have a direct relationship with shoulder impingement[10]. The tightness will cause further anterior translation of the humeral head, leading to impingement and then to more pain. This vicious cycle of altered movements, instability, impingement and pain continues and aggravates the condition. Through application of the taping technique, the cycle is ceased through the correction of the faulty biomechanics resulting in the decrease pain that will allow us to concentrate on motor control exercises in improving the stability of the shoulder[6]. Motor control exercises have been shown to relieve back pains, neck pains[11,12] and shoulder pains[6]. Repositioning of faulty biomechanics has been proven to significantly decrease pain in the thumb[13], wrist[14], and elbow[9]. Correction of the faulty biomechanics by an external force either through the application of the tape or the use of muscular motor control, will both result in a significant decrease in pain.

On the other hand, the ROM of the shoulder after the application of the tape decreased in both the experimental and sham taping groups, but was

significant only in the experimental group. This is inconsistent with other studies that looked at pain and ROM using taping techniques on the ankle[8] and wrist[14].

It may be hypothesized that that taping may have restricted shoulder movement such that subjects may not have been able to reach the point of onset of their pain. However, majority of the subjects had consistently identified the specific intervention day (1st, 2nd or 3rd day) in the post-test questionnaire as the day that had the most significant relief of pain during shoulder movements. Six out of the 9 subjects claimed that the experimental day had the most significant effect on their pain and in the ROM of their affected shoulder. One subject claimed that he felt more pain after the application of the tape. However, the subject failed to mention which taping technique (sham or experimental) brought more pain. The other 2 subjects also claimed a decrease in pain, however they failed to identify the day that had the most significant decrease in their shoulder pain. This subjective report of improvement supports the possible benefits of taping in reducing pain.

LIMITATIONS AND RECOMMENDATIONS

The investigators tried to control a number of potential biases by blinding both subjects and investigator. Moreover, randomization was also employed to avoid influencing the subjects and investigator. Regardless of these, a number of limitations may have affected the results of this study and addressing these in future studies may enhance validity. Firstly, there was lack of extensive training on the application of the taping techniques. Though only one investigator applied the tapes, there may have been variability in the way the technique was done. Secondly, the method of measuring ROM may have been a potential source of error. More accurate measurements could have been obtained had a Digital Motion Analyzer System been available at the time of the study. Thirdly, the presence of resting pain in the subjects could have provided the investigators with an added variable to consider when measuring for shoulder ROM.

At present, there are few high-level studies supporting the effects of taping on pain and ROM especially on the shoulder. This study has shown positive results in decreasing pain for patients with shoulder impingement. Clinically, the use of the tape can allow patients to perform their stability exercises for the shoulder early in the rehabilitation without pain impairing their performance.

CONCLUSION

The experimental shoulder taping technique used in this study significantly decreased the pain felt by the subjects. However, it is interesting to note that the tape decreased the ROM of the shoulder but the decrease may have been due to restrictions brought about by a flaw in tape application or measurement procedures.

Clinically, the immediate effects of the use of the tape in decreasing pain in patients with shoulder impingement can be utilized early in the rehabilitation phase of these patients. The decrease in pain will allow the muscles of the glenohumeral joint to work efficiently with a reduction of pain and reflex inhibition.

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