THE EFFECT OF TAPING ON SHOULDER KINEMATICS AND POSTURE IN PATIENTS WITH SHOULDER IMPINGEMENT SYNDROME

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SUMMARY

Taping is commonly used in the conservative treatment of shoulder impingement syndrome. However, the underlying mechanism of taping and its effect on kinematics are not yet understood and there is little evidence to support its use. There are two main taping techniques used in physical rehabilitation, Rigid and Elastic taping. In this study, a motion capture system was used to track reflective markers attached to the thorax, humerus, the scapula locator and to two clusters attached to the thoracic and lumbar spine. An observer used the scapula locator to track the movement of the scapula whilst maintaining low pressures on the three scapular landmarks. Bilateral elevation and lowering in the scapular and sagittal planes were measured before taping and after the application of the Rigid and Elastic taping techniques, Visual Analogue Scale was used as a measure of pain intensity during motion. The results showed that both taping techniques had similar effects on the shoulder kinematics although the magnitude of these changes varied between techniques and across subjects. Rigid taping in particular increased the glenohumeral rotation and reduced upward rotation leading to an increase in the scapulothoracic rhythm. Pain intensity was more reduced by Elastic tape application in both planes but this did not seem to be correlated to the changes in kinematics.

INTRODUCTION

Shoulder impingement syndrome (SIS) is associated with a reduction in the subacromial space which is the space between the acromion process and the head of the humerus. This causes a compression on the soft-tissues in-between and results in pain during motion, reduction in the range-of-motion, altered scapular kinematics and muscle weakness. One aim of physiotherapeutic rehabilitation for patients suffering from SIS is to increase the subacromial space. To this end, the application of tape is widely used, but surprisingly the principle underlying mechanism of taping is not well understood. Furthermore, the effectiveness of taping in improving posture and restoring scapular kinematics has not been clearly documented and there is minimal evidence to support the use of taping.

There are two main taping techniques in the literature; Rigid taping and Elastic taping. The rationale behind Rigid tape application is to correct posture and it is often applied bilaterally [1]. Elastic taping is believed to provide support to the joint and ease pain [2] and is commonly used in Athletic populations.

Recently a scapula locator method has been developed which allows the observer to track the scapula during motion whilst maintaining ranges of low pressures on the scapula, the method proved to be more reliable than other scapular measurement techniques and the previous use of the scapula locator [3,4]. Hence it is now possible to quantify the effect of these tapes appropriately.

The aim of this study is to test the effect of taping on shoulder kinematics and posture in patients with SIS, as well as investigate the effectiveness of two taping techniques in reducing pain, increasing the range-of-motion and restoring shoulder kinematics. This will facilitate the development of the conservative management of SIS and in the understanding of the underlying mechanism of tape application.

METHODS

Five subjects (4 males and 1 female) with SIS and a mean age of 40.8 ± 10.3 years participated in the study. Subjects were included if they experienced pain in flexion or abduction of the symptomatic side and if they tested positive to at least 4 of the following tests: (1) Neer impingement sign (2) Hawkins sign (3) pain during supraspinatus empty can test (4) painful arc between 60° to 120° and (5) tenderness when palpating the greater tuberocity of the humerus. In order to have a homogenous study group; subjects with pain with cervical spinal tests, history of spinal or upper limb fractures and systemic illnesses were excluded from the study.

An optical motion tracking system was used to track reflective markers attached to the humerus, thorax and the scapula locator. A single observer used the scapula locator to track the movement of the scapula during motion whilst maintaining low pressures on the landmarks [3,4], measurements of the symptomatic shoulder were obtained or in the case of bilateral shoulder impingement measurements were obtained for the worst side. Two clusters of markers were attached to the seventh thoracic vertebra and the first lumbar vertebra.

Subjects performed bilateral elevation and lowering in the scapular and sagittal planes. The first three trials were measured when no taping was applied, the second set of three trials was measured with the application of one of the taping techniques and the final set of three trials was measured with the application of the other taping technique, the order of which was randomized. Visual Analogue Scale (VAS) was used to assess the intensity of pain during motion in the
scapular and sagittal planes for no taping, Rigid taping and Elastic taping.

In Rigid tape application; subjects were asked to extend their thoracic spine then one strip of tape was applied just lateral to the spinous processes from the first thoracic vertebra to the twelfth thoracic vertebra. Subjects were then asked to position the scapula from a protracted and downwardly rotated position to a neutral position on the chest wall. The second strip of tape was applied from the centre of the scapular spine to the twelfth thoracic vertebra diagonally (Figure 1-A). This was done bilaterally. In Elastic tape application; a Y-strip was applied from the insertion to the origin of the supraspinatus with paper-off tension, another Y-strip was applied from the insertion to the origin of the deltoid with paper-off tension and a final I-strip was applied from the coracoid process to the posterior deltoid with a 75% stretch and a downward pressure (Figure 1-B).

Figure 1: (A) Rigid tape application to correct posture (B) Elastic tape application to support the glenohumeral joint.

Co-ordinate frames for the humerus, scapula and thorax were defined [5]. Glenohumeral and humerothoracic rotations were calculated using Euler rotations in the sequence of x-z'-y'' (abduction, flexion, axial rotation) and scapulothoracic rotations in the sequence of y-x'-z'' (internal, upward, tilt). The thoracic spine flexion/extension angle was calculated from the angle between the two spinal marker clusters.

RESULTS AND DISCUSSION
In this study the effects of two taping techniques commonly used in the rehabilitation of SIS patients on variables related to posture, shoulder kinematics and range-of-motion as well as pain intensity were studied. The results showed that both Rigid and Elastic tape application had a significant effect on the scapulothoracic and the glenohumeral kinematics in the scapular and sagittal planes. There was also a significant difference between the effects of the two techniques on kinematics. However, it was generally found that the direction of the changes imposed by both taping techniques on the kinematics was similar but Rigid taping had a greater magnitude of change.

In general, the resting position of the scapula after tape application was more internally rotated and posteriorly tilted. On the other hand, the upward rotation particularly in the sagittal plane was reduced with both taping techniques and the range of the glenohumeral elevation was increased by approximately 9-10° but the full range of humeral elevation was not significantly affected. The scapulohumeral rhythm when Rigid taping was applied was higher than with no taping and with Elastic taping. Rigid taping had a significant effect on the spinal flexion-extension angle at the start of motion; this change could reach up to 15°. The direction of this change was not consistent with all subjects and seems to be affected by the original posture of the subject.

Pain intensity during motion varied between the two planes of elevation and the two taping techniques. In the scapular plane, Rigid taping was found to increase pain slightly while Elastic taping was found to reduce pain compared to when no taping is used. In the sagittal plane, both taping techniques reduced pain significantly with Elastic taping having the greater effect on pain reduction from 45.1mm to 21.8mm on VAS. These results did not seem to be correlated to the kinematics measured.

The reduced upward rotation and the higher posterior tilt are two important clinical variables in increasing the subacromial space. The findings suggest that both Rigid and Elastic tapings are potentially beneficial in restoring the scapular kinematics in people with SIS. However, it is important to note that large variations in shoulder kinematics between the participating subjects were found and the effect of taping on these kinematics were not always consistent across subjects. Therefore, inclusion of a greater number of subjects is necessary because of the large variations in the kinematics between the subjects as well as large differences in the effects of the two taping techniques on these kinematics.

CONCLUSIONS
Both taping techniques appear to have positive effects on the kinematics of the scapula but differences between the two techniques were found. Elastic taping is also found to reduce pain significantly in both planes compared to when no taping is used and when Rigid taping is used.

ACKNOWLEDGEMENTS
This study is sponsored by Imperial College Healthcare Charity.

REFERENCES