Effect of taping on the shoulders of Australian football players

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ABSTRACT

Background: Taping of the shoulder is common in many sports, particularly Australian football, a contact sport that often involves marking (catching) the ball overhead and has a high incidence of shoulder instability.

Hypothesis: Taping of the shoulder reduces glenohumeral joint laxity and improves proprioception without impairing function.

Study design: Crossover study design.

Methods: 33 male players aged 18–31 years were recruited from a local Australian football club. The dominant shoulder of each player was tested with and without taping in a randomised fashion by an examiner blinded to the presence or absence of taping. The tests were (1) inferior glenohumeral joint laxity (the Orthopaedic Research Institute laxometer), (2) shoulder joint position sense accuracy using an optical tracking system, and (3) handballing accuracy.

Results: The methods for testing laxity and joint position sense had good intraobserver reliability and sensitivity. All subjects tolerated the taping and testing. Glenohumeral joint laxity ($p = 0.75$), joint position sense ($p = 0.56$) and handballing accuracy ($p = 0.6$) were not changed by taping.

Conclusions: Taping of the shoulder joint in uninjured and non-symptomatic Australian football players in a pattern that attempted not to restrict their range of overhead movement did not significantly affect the accuracy of joint position sense, inferior laxity or handball accuracy.

Clinical relevance: These data suggest that taping of the shoulder is unlikely to decrease the incidence of injury—specifically dislocation—of the shoulder in Australian football players.

Taping of the shoulder is common in many sports, particularly Australian football, a contact sport that often involves marking (catching) the ball overhead and has a high incidence of shoulder instability.[1] The shoulder is most prone to dislocation in the overhead position that occurs during marking.

Taping of the shoulder in Australian football players is speculated to increase stability of, and proprioceptive accuracy in, the shoulder. Stability of the shoulder may be enhanced if the strapping prevents excessive movement of the humeral head. Proprioception (the ability to sense the position of one's body and its parts) is enhanced by taping in the ankle in asymptomatic people[2] and may do the same in the shoulder.

The aim of this study was to determine if the application of tape in a standard pattern used in Australian football on injured shoulders enhances proprioceptive ability, stabilises the glenohumeral joint, or improves shoulder function.

METHODS

Study design

After approval from our local ethics committee, subjects were recruited from a local community level Australian football team who met the following inclusion criteria: male sex, age over 18 years. Exclusion criteria included current shoulder injury or pain, shoulder surgery in the preceding 12 months, or other current injury that would affect any of the testing, such as being unable to stand without crutches. The subjects were tested at random during a biweekly practice session. Before testing of each subject, the testing procedure was explained, any questions were answered, and the subject signed a consent form.

Three tests (laxity, position sense, function) were performed on the dominant shoulder of each subject. Each set of tests was performed with the shoulder taped or untaped. The order of taping was determined by flipping a coin. The shoulder was then taped or not taped according to the result. The subject then put on a t-shirt so that the examiner would be blinded to the taping status. After the tests were completed, the subject returned to the physical therapist for the tape to be removed or tape to be applied. The t-shirt was then replaced, and the same three tests were carried out by the same examiner.

Taping

The shoulder taping was performed by a single physical therapist experienced in taping injuries in Australian football players. Taping was performed with 50 mm fabric rigid strapping tape (Leukoplast, Beiersdorf AG, Germany) with 75 mm elastic overwrap (Elastoplast, Beiersdorf AG, Germany). The pattern consisted of the first rigid tape "anchor" from ~3 cm above the nipple over the top of the clavicle and to the same level on the back (fig 1). A second anchor extended perpendicular from the ends of the first anchor around the torso below the axilla. A third anchor was placed around the upper arm at the lateral edge of the deltoid insertion. After the three anchor strips had been placed, the three support strips were placed. The arm was held in 30° of abduction of the shoulder. The first strip was placed from the over-the-shoulder anchor out to the arm anchor halfway between the top of the shoulder and the second anchor to the lateral insertion of the deltoid. The second strip was placed over the acromion–clavicular joint following the anterior edge of the trapezius from the over-the-shoulder anchor to the same point as the first at the lateral insertion of the deltoid. The third strip was started one-third of the distance between the second

support strip and the second anchor out to the same point at the lateral insertion of the deltoid approximately along the spine of the scapula. None of the strips were placed under tension. Two final anchoring strips were placed over the first anchor and the around-the-arm anchor to lock the tape in place. Elastic overwrap was placed over the three straps and then over the three anchor straps to finish the taping (fig 1).

Shoulder laxity testing

Inferior laxity testing was performed with an Orthopaedic Research Institute laxometer,[3] an instrumented sulcus sign, designed by us and previously shown to be valid and reliable.[3 4] The laxometer consisted of four pieces: (1) a moulded plastic shoulder cuff with hook and loop strapping that wrapped around the torso to hold it in place; (2) an angled metal ballast which attached with hook and loop strapping to the superior forearm and arm to hold it in 90° flexion; (3) a metal frame that connected to the shoulder cuff and then wrapped around the upper arm to hold an electronic plunger under the tip of the olecranon using hook and loop strapping to hold it in place; and (4) a weight stack of 15 kg connected to a pulley and cable with a handle on one end and a clip on the other that connects to the ballast. Testing over three cycles was performed as previously described.[3 4]

Joint position sense

The ability of the subject to replicate a point in space was determined with the aid of an optical tracking system (Optotrak Certus, Northern Digital Inc, Waterloo, Ontario, Canada). Initially the subject's arm was placed into a position. The subject then attempted to actively replicate this position. This replication position was then compared with the original position, and the deviation was determined. Three positions were tested on each arm (fig 2). These positions were selected on the basis of previous reliability testing. Each position was replicated three times, with the optical tracking system recording each replication.

The optical tracking system was a three-dimensional optical tracking device that used a three video camera array with light-emitting diode (LED) markers and a computer interface to determine the position of the LEDs in space with high precision (fig 3). The subject was seated and blindfolded in an armless rigid steel chair 3 m in front of the camera of the Optotrak. A

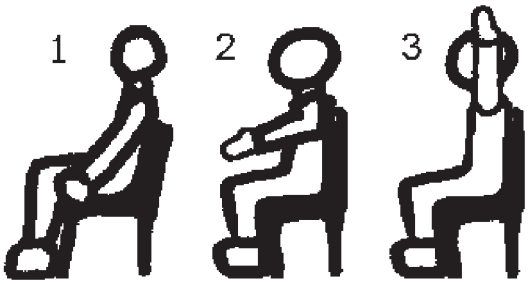


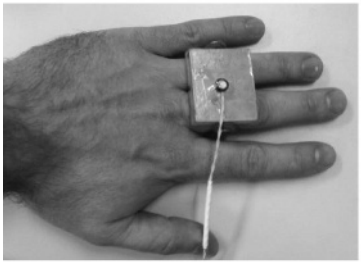
Figure 2 Positions in joint position sense testing. Position 1: 30° forward. Position 2: shoulder abducted to 90°, elbow flexed to 90°, 30° internal rotation at shoulder. Position 3: same as position 2, but with 90° external rotation at the shoulder.

LED (Northern Digital Inc) on a "ring" was positioned on the back of the long and ring finger proximal phalanxes of the subject (fig 3), and data (1 s of capture at 30 frames/s) were collected on the position of the LED. The subject was then asked to "let your arm hang relaxed by your side" and "relax". After 3 s the subject was told to "repeat the position". When the subject said "OK", the position of the ring LED was recorded. The investigator then told the subject "relax." The subject repeated the position two more times for a total of three repetitions per position. The same procedure was repeated for position 2 (shoulder abducted to 90°, elbow flexed to 90°), and position 3 (as position 2, at shoulder externally rotated to 90°).

Each time the Optotrak recorded a position, it recorded 1 s of 30 frames/s data in a three-dimensional xyz position format in millimetres. The mean xyz position for the 30 frames was determined to give a single xyz coordinate. For each position, four sets of xyz data were recorded. The first set was that of the initial positioned placement of the arm, and the second to fourth were the replications of the position. For each replication, the deviation was calculated by taking the difference of each of the xyz coordinates and calculating the deviation value ($a2 + b2 + c2$), where a, b and c are the difference in millimetres. The three deviations from the three replications were then averaged to produce a single deviation value for that position. Each half of the test resulted in three deviation values. Lastly, the mean of the deviations of the three positions was calculated.



Figure 1 Taping pattern of rigid strapping tape. (a) A, first anchor; B, second anchor; C, third anchor; 1, first support strip; 2, second support strip; 3, third support strip. (b) Taping pattern of elastic overwrapping.





(a) (b)

Figure 3 Optical tracking system. (a) Light-emitting diode ring for optical tracking system in place on hand. (b) Optotrack video sensor array.

Functional assessment

A global functioning test was devised to test whether taping had an effect on the use of the shoulder in a specific skill involved in the game of Australian football. Many skills were considered, from accuracy of marking the ball to catching the ball. The motion of handballing is limited by the rules of Australian football to motion of just the "punching" arm and is largely a shoulder movement, as the hand is clenched into a fist and the elbow is flexed. Contact with the ball can only be made with the outside of a clenched fist. The handballing accuracy test was performed using an Auskick handball target, which consisted of a free-standing metal tube frame 110 cm square within which a canvas target was stretched with a hole in the middle with a 30 cm diameter (fig 4). The subject stood behind a line 4 m away from the target and attempted to "handball" pass a regulation Australian football through the centre hole of the target activity, which involved "punching" the end of the ball with the dominant hand out of the other flat hand. If the ball passed through the hole in the target, the subject was awarded one point. At the subject's first handballing session, he was given three warm-up tries that were not scored. The subject was then given 10 tries to get the ball through the target. The final score was the number of balls passing through the target.



Figure 4 Auskick target.

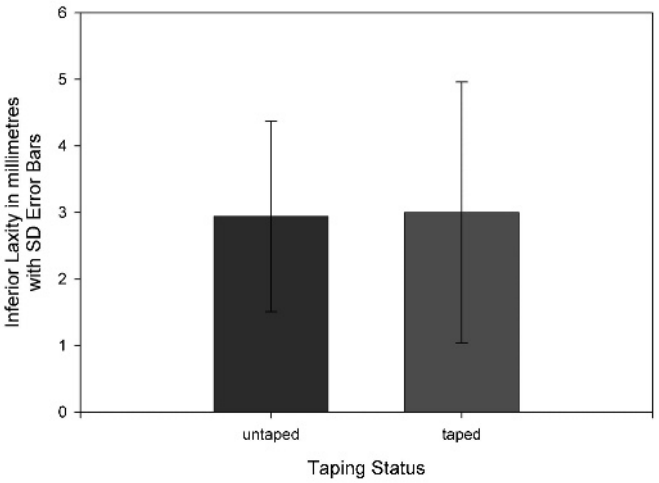


Figure 5 Effect of taping on inferior glenohumeral joint laxity as assessed with the Orthopaedic Research Institute laxometer. Values are mean (SD) (n = 33). There was no significant difference (p = 0.794) using the paired Student t test.

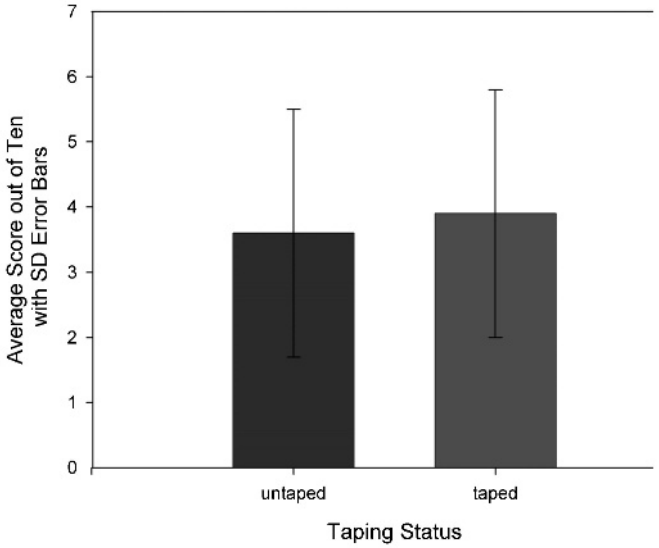


Figure 6 Effect of taping on handball score. Values are mean (SD) (n = 33). There was no significant difference (p = 0.599) using the paired Student t test.

Table 1 Effect of shoulder taping on joint position sense accuracy (mm)

	Deviation position 1	Deviation position 2	Deviation position 3	Average position 123
Untaped	82 (53)	109 (51)	88 (38)	93 (30)
Taped	73 (38)	103 (51)	92 (48)	89 (29)
p Value	0.196	0.556	0.56	0.348
Upper limit of detection of significant difference with power = 0.8	22	24	20	12

Values are mean (SD) (n = 33).

Statistical analysis

Paired t tests were used to determine if order of testing or taping caused a significant difference in handball score, inferior laxity or joint position sense accuracy.

RESULTS

Thirty-eight subjects participated in the study. Thirty-three were able to complete all components of testing. Five were not able to be tested for inferior laxity, as their arms were too long to fit in the laxometer frame. Thirty-six subjects were right hand dominant, and two were left hand dominant. The mean (SD) age of the subjects was 22 (3.6) years (range 18–31). No subjects withdrew from the study.

Taping order was determined by flipping a coin, resulting in 25 subjects being taped for the first half of the testing and 13 subjects being taped for the second half of the testing. Inferior laxity, handball score and joint position sense accuracy were not significantly affected by the order of testing.

Inferior laxity

The range of inferior laxity as assessed with the Orthopaedic Research Institute laxometer was 0.66–8.04 mm (median 2.66). Taping had no effect on inferior glenohumeral joint laxity measurements (fig 5). Post hoc analysis based on the current variation indicates that, even with very large sample sizes, the effect of taping would be less than 1 mm. A change in glenohumeral joint laxity of less than 1 mm is not likely to be clinically significant.

Joint position sense accuracy

Subjects were more accurate in repositioning their arm to position 1 and 3 than to position 2. Taping did not affect the accuracy of repositioning the arm in space in position 1, position 2 or position 3, or using the mean of those three positions (table 1). A post hoc analysis indicated that, even with larger sample sizes based on the current data, the effect of taping or joint position accuracy would be less than 12 mm.

Handballing accuracy

On average, the Australian footballers achieved four accurate handballs out of 10. Taping did not improve the accuracy of handballing (fig 6).

DISCUSSION

Taping of the shoulder is common in our community. However, we could find no evidence in the literature to support the use of shoulder taping. In this study, taping the shoulder had no effect on shoulder function, position sense or inferior laxity.

Our handballing test was an attempt to find if there was an "overall" effect of taping the shoulder. We did not find a significant effect of taping on the handball score. Our theorised mechanisms of affecting handball score were both positive (increase in score resulting from increased proprioceptive feedback from the skin) and negative (reduction in score resulting from restriction of motion). Taping neither improved nor impaired handballing accuracy.

In this study, testing joint position sense with the optical tracking system revealed no significant change in joint position sense accuracy between the taped and untaped condition. Testing joint position sense accuracy with the optical tracking system was reliable. Intraclass correlation coefficient (ICC) calculations found the three positions we used to have good reliability (ICC 0.65–0.77), and the mean of the three values to have excellent reliability (ICC 0.87), therefore the optical tracking system should pick up significant differences between the groups. These results are in contrast with those of a similar study evaluating the effects of taping on joint position sense in the ankles of 24 asymptomatic athletes.[2] In that study, taping significantly improved foot position awareness ($p<0.001$) in asymptomatic volunteers.

There are some limitations to consider in our study. The study showed no benefits of taping the shoulder in asymptomatic people; however, it is possible that taping may be of benefit to symptomatic shoulders. We measured inferior glenohumeral joint translation, not anterior translation. However, our previous study showed that inferior translation is enhanced in shoulders that have had an anterior dislocation.[3] Thus we would expect that measures to limit anterior shoulder translation would reduce inferior translation. Taping did not do this.

CONCLUSIONS

This study shows that taping of the shoulder joint in asymptomatic Australian football players in a pattern that does not restrict their range of overhead movement does not significantly affect the accuracy of joint position sense, inferior laxity or handball accuracy. Taping of the shoulder in this type of pattern is not likely to decrease the incidence of injury—specifically dislocation—or protect against reinjury of the shoulder in Australian football players.

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