The Effects of Kinesio Ankle Taping on Postural Stability in Semiprofessional Rugby Union Players

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Abstract. [Purpose] Kinesio taping has been postulated to reduce injuries by improving proprioception. To date there remain few studies that have assessed the impact of Kinesio taping on postural stability and by inference proprioception in team sports. The aim of this study was to establish if bilateral application of Kinesio taping of the ankles would improve postural stability in rugby union players. [Subjects] The participants were 31 healthy semiprofessional rugby players (age 19.57 ± 0.76 y; body mass 91.87 ± 11.81 kg; stature 1.82 ± 0.08 m). [Methods] Postural stability was measured using an experimental crossover study design. [Results] Significant improvements in overall stability, anterior-posterior stability, and medial-lateral stability were observed under the taped versus non-taped conditions. A secondary finding was that differences in postural stability may be associated with playing position, in that backline players exhibited significantly better overall stability under the non-taped condition compared with forward players. [Conclusion] These results suggest that Kinesio taping may enhance postural stability in a position-dependant manner in semiprofessional rugby players. From a mechanistic point of view, these findings may help to explain why Kinesio taping may be beneficial; however, the impact that the tape may have in contributing towards the prevention of ankle injuries is yet to be established.

Key words: Ankle injuries, Taping, Proprioception

INTRODUCTION

The health benefits associated with regular participation in sports are well known, however; there is inherent risk associated with participation, and a number of studies have documented the incidence and prevalence of injuries across a wide range of sports1–5). Epidemiological evidence indicates that sports injuries are a major contributor to injuries in general and are associated with significant cost implications6). When looking at the incidence of sport injuries by anatomical site, injuries to the ankle joint have been reported to be amongst the most common injuries7, 8), and there is evidence that the re-injury prevalence of the joint may be as high as 34%9). In addition, chronic musculoskeletal ankle disorders are commonly reported in individuals having suffered a previous injury to the ankle10). It is also documented that team sports, including rugby, are more likely to experience higher incidences of ankle injuries7). To this end, ankle taping and bracing has received a considerable amount of attention within the literature, and it is fair to say that it is more commonly being recognized as an important component of sports injury and re-injury prevention strategies.

Kinesio taping has gained significant popularity over the last few years and is now widely utilized across the world by sports medicine and rehabilitation practitioners as a taping modality that is believed to provide protection to injured joint complexes and muscles. Its role in improving sports-related functional performance has also been investigated in non-injured populations11–13). The protective action afforded by Kinesio tape (KT) is purportedly related to its “ability” to improve proprioception by stimulating mechanoreceptors and thus muscle activation patterns. Studies have revealed inconsistent findings with these mechanisms14), and a recent review concluded that ankle proprioception is not influenced by the application of KT15). It must be noted, however, that the authors drew this conclusion from the available evidence, which included only 2 studies. Clearly the topic warrants further scrutiny. In rugby union, performance and physiological characteristics differ between backline players and forward players16). The backline players are required to exhibit speed, agility, acceleration, and skill. Their positions dictate that they attack the defensive line of the opposition by attempting to avoid the opponents in order to score tries. In contrast, the forward players are usually stronger, heavier players that produce a greater number of tackles and are involved in more collisions as they attempt to obtain possession of the ball and set the backline players up in an attacking position. It could be argued that enhanced agility is in part a function of the greater proprioception exhibited in the backline players, however, to the best of the authors’ knowledge, differences in postural stability between backline and forward playing positions in rugby union have not been documented. Therefore, it was the primary aim of this study to determine the effects of Kinesio ankle taping on postural stability in semiprofessional rugby union players; and the
secondary aim to determine if differences exist between forward and backline players.

SUBJECTS AND METHODS

Thirty-one healthy male, semiprofessional rugby players (Table 1) voluntarily took part in this study. All participants were match fit, and were excluded if they had a current, or recent (12 weeks), lower-limb musculoskeletal injury (ligament sprain, muscle strain, swelling, or soft tissue damage that prevented them from playing rugby). Participants were also excluded if they had any neurologic condition effecting balance and/or vision.

Prior to participation, written informed consent was obtained from the participants. This study was approved by the Faculty of Science and Agriculture’s Ethics Committee and was conducted in accordance with the Declaration of Helsinki.

Body weight was recorded on a calibrated scale, and stature was measured from the floor to the vertex of the head after a deep inhalation using a Leicester height measurer (Invicta Plastics, England) and recorded to the nearest millimeter17). Skinfold measurements were performed with the Slim Guide skinfold caliper (Creative Health Products, Inc., Ann Arbor, MI, USA) at four different anatomical sites (biceps brachii, triceps brachii, subscapula and suprailiac). The testing order was determined by randomly selecting players from the teamsheet, with the first group (group A; n=15) completing the postural stability test first without KT applied and the second group of players (group B; n=16) completing the postural stability test first with the KT applied. This design was employed to eliminate the risk of a training effect. Figure 1 represents the study procedure.

The familiarization session consisted of the participants performing a “drill” simulating that which they would perform during the actual test as well as a one minute maze control game on stability level one (most unstable). Participants were allowed 60 min rest between their taped and non-taped postural stability assessments.

Postural stability was assessed utilizing the Biodex Balance System (Biodex Medical Systems, Shirley, NT, USA). The system consists of a circular, flat platform that randomly tilts up to 20° in any direction [anterior-posterior (AP) and medial-lateral (ML)]. The participant was required to maintain his balance by attempting to keep a cursor on a screen as close as possible to a specific marker. The Biodex Balance System (BBS) is utilized to objectively evaluate static (deviation of the center of pressure − COP) and dynamic conditions (calculating degree of axis tilt from the level). The COP is the point where the foot makes contact with the floor and experiences ground reaction force; it can be used to quantify the amount of movement in the foot during postural changes. The evaluation assesses the overall stability (OS), anterior-posterior stability (APS), and the medial-lateral stability (MLS)18).

The participants’ foot position coordinates were recorded for consistency between the two trials, and these positions were maintained for the duration of the tests. Participants held their arms freely at their sides and were barefoot. The participants completed three 20-second trials, with a 10-second rest between each trial. The postural stability tests were performed on level, which is the most unstable level in which the platform tilts 20° in any 360° ROM (level 12 is the most stable). The three scores were calculated automatically and averaged by the BBS software. Lower scores represent better postural stability performance. Reliability of the BBS in determining APS, MLS, and the overall stability index has been reported as R=0.95, R=0.93, and R= 0.95, respectively19).

Pre-cut KT (SpiderTech, Nucap Medical Inc., Toronto, ON, Canada) was applied to the players by the same individual in a standardized manner and as per the manufacture’s instructions. The researcher applying the tape attempted to apply the same amount of stretch for each application. The participant lay prone with the knee flexed to ± 45°. The tape was placed through the toes with one strip between the big toe and second toe and the second strip between the third/fourth or forth/fifth toes, depending on foot size. The leg was then fully extended, and the foot was placed into dorsiflexion. In this position, the tape was applied to the plantar

<table>
<thead>
<tr>
<th>Table 1. Participant characteristics (n=31)</th>
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<tr>
<td>Forward Players (n=15)</td>
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<tr>
<td>Age (y)</td>
</tr>
<tr>
<td>Height (m)</td>
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<tr>
<td>Weight (kg)</td>
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<tr>
<td>Body Fat (%)</td>
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surface of the foot/calcaneus and up to the distal segment of the gastrocnemius on either side of the calcaneal tendon. The knee was then flexed to 90°, and the foot was placed into planter flexion. The tape was then applied along the dorsum of the foot on the anterior shin along tibialis anterior without stretching the tape. The ankle spider was applied bilaterally.

Data are expressed as means and standard deviations (SD). A dependent t-test was computed to determine if differences existed between the two “treatments” (i.e., taped versus non-taped). When comparing backline versus forward players under taped and non-taped conditions, the Mann-Whitney U test was utilized to compare measurements between the two groups, and the Wilcoxon signed-rank test was used to compare within-group measurements. Significance was set at p≤0.05.

RESULTS

The overall stability index is calculated by the Biodex balance software and comprises information obtained from anteroposterior and mediolateral tilt/deviation. From Table 2 it is evident that the overall stability index of the players was significantly (p<0.01) lower under the taped condition. A lower overall stability index is associated with a lower degree of movement during the test and as such is representative of better postural stability. When analyzing the subcomponents of the overall stability index, anterior-posterior stability and medial-lateral stability (Table 2), it is apparent that the taped condition showed improved postural stability compared with the non-taped condition.

Table 2 shows the overall stability index results for the backline versus forward players under taped and non-taped conditions. Interestingly, the forwards showed significantly (p<0.01) less postural stability compared with the backline players under the non-taped condition. In addition, the forwards showed significant (p<0.01) improvement in postural stability when the tape had been applied; however, the backline players showed no change (p=0.84).

DISCUSSION

The purpose of this study was to determine if bilateral application of Kinesio taping of the ankle would affect postural stability in semiprofessional rugby players. A second aim was to determine if postural stability scores would differ between forward and backline players. The results would tend to suggest that postural stability was enhanced when the players wore the Kinesio taping and that the effect seemed to be multi-directional; that is, improvements were noted for anterior-posterior as well as medial-lateral scores. From a functional perspective this would seem to be advantageous, as postural stability was certainly not impaired. The “no negative effect” of Kinesio taping on functional performance has also been reported in basketball players with chronic inversion ankle sprains. So whilst there does not appear to be adverse effects associated with Kinesio ankle taping, there is still much controversy regarding its efficacy in improving functional performance and more importantly reducing injury risk. Kinesio tape is different from “traditional tape” in that it is designed to stretch. Once applied to the skin, it is this continual stretch on the skin itself that is said to stimulate cutaneous mechanoreceptors that in turn relay information to the central nervous system.

The enhanced feedback to the central nervous system is said to improve the ability of the neuromuscular system to control movement in part by improving joint position sense. Halseth et al. have shown that Kinesio tape does not improve ankle joint position sense in healthy individuals; however, the authors did not rule out the possibility that the tape may stimulate cutaneous receptors. In contrast to these findings, ankle position awareness does seem to improve in injured athletes that have had their ankles taped with traditional adhesive tape. This raises two questions. Firstly, is traditional taping as effective as Kinesio taping in enhancing proprioception? Secondly, do the benefits that underlie the taping differ in injured and non-injured populations? In reference to the latter, Olmsted et al. have proposed that ankle taping and bracing are most beneficial in athletes having sustained a previous ankle injury versus those that have not. The efficacy of Kinesio taping in supporting this view is yet to be established. As to the first question, very little information is available on whether Kinesio tape is superior to nonelastic tape. Briem et al. proposed that whilst nonelastic tape may enhance dynamic stability of the ankle, Kinesio tape does not offer the same protection. In that study, the investigators based their conclusion on the finding that fibularis longus activity was significantly greater under the nonelastic tape condition compared with the Kinesio tape. Electromyography studies have produced conflicting results, making it difficult to say definitively that the elastic tape does indeed enhance muscle activation. A recent study has shown that Kinesio tape may

<table>
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<th>Variable</th>
<th>Combined Group</th>
<th>Forward Players</th>
<th>Backline Players</th>
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<tr>
<td></td>
<td>Taped</td>
<td>No Tape</td>
<td>Taped</td>
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<tr>
<td>Overall Stability Index</td>
<td>3.5 ± 1.4 (3.0 – 4.1)</td>
<td>4.2 ± 1.5** (3.6 – 4.7)</td>
<td>3.8 ± 1.6 (2.9 – 4.8)</td>
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<td>Anterior / Posterior Stability</td>
<td>2.6 ± 1.1 (2.2 – 3.0)</td>
<td>3.0 ± 1.2* (2.6 – 3.5)</td>
<td>2.9 ± 1.3 (2.3 – 3.5)</td>
</tr>
<tr>
<td>Medial / Lateral Stability</td>
<td>1.8 ± 0.6 (1.5 – 2.0)</td>
<td>2.2 ± 0.7** (1.9 – 2.5)</td>
<td>1.9 ± 0.3 (1.5 – 2.3)</td>
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*p<0.05 combined group taped vs. no tape. **p<0.01 combined group taped vs. no tape. †p<0.01 no tape forwards vs. no tape backline players.
attenuate benign vibration-induced muscle weakness around the knee by reducing the decline in Ia afferents—the feedback that would be responsible for increasing input to gamma motor neurons.12) This study was conducted on healthy individuals; however, it does raise a very important point that supports the notion that Kinesio tape may inherently be most beneficial under conditions where normal neuromuscular activity is impaired such as following injury or when muscle joint complexes are fatigued. This does not preclude the tape from imparting benefits in healthy athletes, as Chang et al.12) have shown that improvements in force sense and pain but not strength are associated with Kinesio tape application in healthy athletes as well as baseball players with medial epicondylitis. Indeed, we observed the same phenomenon in the current study, with improved postural stability being associated with Kinesio tape in injury-free rugby union players. Our results however should be interpreted with caution as discussed below.

In rugby union, the backline players are by in large the faster more agile players.15, 28) It may be that these position-specific requirements of the backline players have resulted in them developing greater proprioception and thus postural stability. Under the no tape condition, the forwards exhibited significantly (p≤0.01) higher scores for the overall stability index, indicating reduced proprioceptive function. This finding has important implications for the current study. The first of these relates to how we interpret the overall results: that postural stability was enhanced under the Kinesio tape condition. The forward players showed significant (p<0.01) improvements in postural stability when the Kinesio tape was applied (Table 2). The backline players showed no change in postural stability between the taped and non-taped conditions. So whilst the grouped data would lead us to believe that the Kinesio tape did indeed impart beneficial effects, deconstructing the findings allows us to conclude that this benefit only manifested in the forward players. This finding, as previously mentioned, may be related to the position-dependant requirements of the forwards. These players generally do not accelerate, decelerate, and change direction as rapidly as backline players. The lack of this stimulus may result in the forward players inherently having “poorer” proprioception which may translate into a reduction in postural stability. From a practical point of view, this supports the statement made previously that taping may be most beneficial when the pre-taping postural stability indicates that players/athletes are below the average (perhaps because of injury or other intrinsic factors) and that Kinesio tape may not be as beneficial in athletes that exhibit normal or greater than normal postural stability. This is speculative, as it was not measured in the current study, but based on the lack of consensus from well controlled randomized trials it is certainly an area requiring further research.

REFERENCES