The purpose of this research was to evaluate the effects of three Kinesio® Tape applications to correct Forward Shoulder Posture (FSP), a common postural alteration. A randomized pre-/post-test study included thirty, (f= 15, m= 15) recreationally active individuals or current competitive athletes (age: 23.5 ±5.036) diagnosed with FSP. Musculoskeletal diagnostic ultrasound was used as the objective tool to quantify FSP: measurement from the anterior humerus to coracoid process. Based on randomized group assignment, participants were taped following Kinesio® Tape guidelines (5 males and 5 females per group): (1) inhibition of the pectoralis minor; (2) facilitation of the lower trapezius; and (3) combination of both techniques resulting in the inhibition of the pectoralis minor and facilitation of the lower trapezius. Participants wore the respective taping technique for 24 hours and were re-measured after the tape had been removed, each participant serving as his/her control. Neither the interaction nor the overall effect between each taping technique was statistically significant ($p>.05$). Participants who met the inclusion criteria of FSP did not have a statistically significant effect after wearing the respective Kinesio® Tape application. Therefore, the results of this research do not support Kinesio® Tape as a mechanism for treating Forward Shoulder Posture.
Introduction

Individuals who participate in overhead activities, including overhead athletes, typically perform motions which cause muscles in the front of the shoulder to contract. Frontal, overhead activities, such as throwing, cause muscles on the anterior aspect of the shoulder complex to pull on the scapula causing humeral head rotation and ultimately a postural condition known as Forward Shoulder Posture (FSP) (Magee, 2002). FSP is a common postural adaptation which can alter shoulder movements and can produce shoulder and back muscle imbalances (Borstad & Ludewig, 2005; Magee, 2002). Past research confirms that FSP is associated with a tight pectoralis minor (chest) and weakness of the lower trapezius (back) (Laudner et al., 2010; Ludewig & Cook, 2000; Page, Frank, & Lardner, 2009). The associated pathomechanics of the muscle imbalance can lead to alterations in throwing, swimming, spiking, running, or even activities of daily living (Magee, 2002). Individuals who suffer from chronic shoulder injuries are at risk for pain and decreased performance potentially removing an athlete from competition. In addition, FSP has been linked to secondary shoulder injuries such as subacromial impingement, bicep tendonitis, rotator cuff pathology, and glenohumeral joint instability (Wilk et al., 2009).

There are various treatment interventions for rehabilitating FSP including stretching tight muscles and strengthening weak musculature to correct the modified shoulder position (Lee et al., 2015). Although exercises that promote scapular retraction have been shown to aid in the correction of FSP, positive outcomes of rehabilitation are typically slow to achieve (Lee et al., 2015). Clinicians have attempted to assist rehabilitation efforts through bracing (Cole et al., 2013). However, wearing a brace is not practical for those individuals who perform overhead
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movements. Therefore, conducting research on an alternative measure which allows for complete motion during activity is critical to the development of evidence-based treatment options for FSP.

Kinesio® Tape, unlike traditional white tape, allows joints to perform full range of motion (Kase, Wallis, & Kase, 2003). Kinesio® Taping methods have increased in popularity because individuals have reported pain reduction for various musculoskeletal conditions (Donec & Krisciunas, 2014; Kaya, Zinnuroglu, & Tugcu, 2011). Claims made by the manufacturer that the tape can inhibit or facilitate skeletal muscle based on the direction of tape application have been largely uncorroborated. While there is some research which supports inhibition of muscles (Simsek, Balki, Keklik, Ozturk, & Elden, 2013; Subasi, et al., 2014; Thelen, Dauber, & Stoneman, 2008) and facilitation weak muscles (Hsu, Chen, Lin, Wang, & Shih, 2009; Slupik, Dwornik, Bialoszewski, & Zych, 2007), no research has been conducted studying the effects of the tape on individuals suffering from FSP.

The primary purpose of this project was to investigate the physiological effects of Kinesio® Tape on Forward Shoulder Posture (FSP). This study is one of the few existing pieces of original research using Kinesio® Tape which required an inclusion criteria of unhealthy tissue, i.e., FSP, as determined by two certified athletic practitioners.

Methods

Subjects

Volunteer participants were recruited from a large United States university whose Institutional Review Board approved the research protocol. The sample consisted of 30 participants (15 males, 15 females) who ranged in age from 18 to 50 (M=23.5 ± 5.036). Inclusion criteria for this study were participants had FSP as determined by two certified athletic
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trainers (ATC) with more than 10 years of clinical experience. In addition, participants were screened for past and current activity levels, which are reported in Table 1. Participants were excluded from the study if they had past shoulder surgery on their non-dominant arm, a non-surgical shoulder injury within the last year, contraindication to Kinesio Tape®, or lack of recreationally active status as determined by the American College of Sports Medicine Health History Questionnaire (Premier Performance, Inc.).

Table 1

<table>
<thead>
<tr>
<th>Demographic Characteristics of Activity Level of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>DI Cheerleader</td>
</tr>
<tr>
<td>DI Football</td>
</tr>
<tr>
<td>DIII Hockey</td>
</tr>
<tr>
<td>DI Soccer (retired)</td>
</tr>
<tr>
<td>DI Volleyball</td>
</tr>
<tr>
<td>DI Volleyball (retired)</td>
</tr>
<tr>
<td>DI Volleyball (Club)</td>
</tr>
<tr>
<td>DI Wrestling (retired)</td>
</tr>
<tr>
<td>Recreational Golf</td>
</tr>
<tr>
<td>Recreational Runner</td>
</tr>
<tr>
<td>ACSM Recreationally Active</td>
</tr>
<tr>
<td>n=15</td>
</tr>
</tbody>
</table>

Procedures

Forward Shoulder Posture (FSP) was diagnosed if participants had a postero-lateral acromion process of greater than or equal to 2.54 cm measured by a tape measure (Sahrmann, 2002). Once FSP was confirmed by two certified athletic trainers using the Sahrmann Technique, an image of the internal shoulder anatomy was obtained via musculoskeletal diagnostic ultrasound (Teratech Corporation, Burlington, MA). Diagnostic ultrasound was chosen as the imaging tool in order to observe the real-time physiological effects of Kinesio® Tape. The ultrasound transducer was placed in a sagittal position over the anterior shoulder of the self-
reported dominant arm. Once the humeral head and coracoid process were observed, the screen was frozen and the distance between the anatomical landmarks was measured with the caliper function (Bdaiwi, Harrington, Almangoush, Mackenzie, & Porter, 2014).

Participants (n=30) were given random-number allocations into one of three groups for the application of the Kinesio® Tape: (1) inhibition of the pectoralis minor; (2) facilitation of the lower trapezius; or (3) application of both the inhibition of the pectoralis minor and the facilitation of the lower trapezius. Each group had the same number of males and females.

The application of Kinesio® Tape was conducted by a Certified Kinesio Taping Faculty (CKTF) member with over 10 years of formal training and experience. The Kinesio® Tape paper was torn back from the tape to create an anchor and was applied without tension. For the application of the inhibition of the pectoralis minor, the tape was anchored in a Y-strip without tension on the insertion site of the anterior surface of the coracoid process of the scapula (Kendall, McCreary, Provance, Rodgers, & Romani, 2005). The patient was positioned in 90° shoulder flexion, horizontal abduction and external rotation with slight elbow flexion for the application of the superior tail. For the inferior tail, the patient was repositioned with 110-135° shoulder flexion with external rotation and full horizontal abduction. Kinesio® Tape was pulled with a tension of 15-25% (Kase et al., 2003) and ending without tension on the origin of pectoralis minor: superior margins of the outer surfaces of the third, fourth, and fifth ribs near the cartilage (Figure 1) (Kendall et al., 2005).
Figure 1. Application of Kinesio Tape® inhibiting pectoralis minor.

For the facilitation of the lower trapezius, the tape was in a Y-strip with the tails splayed with no tension on the origin of the muscle, spinous processes of the T6 to T12 vertebrae (Kendall et al., 2005). The participants were positioned into scapular decompression, external rotation and trunk lateral flexion by having the participant hug themselves and then bend forward to the side to place the tissue on a stretch. Kinesio® Tape was pulled with a 15-35% tension (Kase et al., 2003), and the tails were anchored to tubercles of the apex of the scapular spine where the lower fibers of the trapezius insert (Figure 2).

Figure 2. Application of Kinesio Tape® facilitating lower trapezius.
All participants were asked to wear the Kinesio® Tape application assigned to them for
24 hours as they performed normal activity levels. Participants were asked to refrain from
vigorous activity (e.g. maximal weight lifting); however, participants were encouraged to
perform all activities of daily living (ADL). All participants (n=30) returned to the laboratory 24
hours later to have the tape application removed. Following tape removal, participants waited
two minutes and then were re-measured by the primary investigator of the project again using
musculoskeletal diagnostic ultrasound.

Results

Descriptive statistics appear in Table 2. The results indicate that the greatest decrease occurred
when both taping techniques were applied. The inhibition taping technique resulted in the
smallest average difference between the pre- and post-taping measurements. In all cases, the
standard deviation was substantially larger than the average, and the average change did not
differ from zero at a statistically significant level. Descriptive statistics indicate the greatest
decrease in FSP occurred when both taping techniques were employed, with a mean difference
of 0.180 cm (SD=0.493). The decrease for the facilitating and inhibiting tape applications were
0.101 cm (SD=0.401) and 0.054 cm (SD=0.530), respectively.

Table 2

Descriptive Statistics

<table>
<thead>
<tr>
<th>Taping technique</th>
<th>Mean difference</th>
<th>Standard deviation</th>
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<tbody>
<tr>
<td>Combination</td>
<td>0.180</td>
<td>0.493</td>
</tr>
<tr>
<td>Facilitation</td>
<td>0.101</td>
<td>0.401</td>
</tr>
<tr>
<td>Inhibition</td>
<td>0.054</td>
<td>0.530</td>
</tr>
</tbody>
</table>
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The data were analyzed using a repeated measures ANOVA with taping technique as the between-subjects factor. Results of this analysis appear in Table 3. The interaction effect was not statistically significant, allowing interpretation to focus on the main effects. The overall effect due to the application of tape (in other words, the effect of time in the repeated measures model) was not statistically significant. Furthermore, the main effect due to taping technique was also not statistically significant. There is not enough evidence in the data to conclude that the application of tape resulted in substantial decrease in FSP nor that the choice of taping technique is a significant factor in changing FSP.

Table 3

Results of Repeated Measures ANOVA

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tape</td>
<td>2</td>
<td>0.0910</td>
<td>0.0456</td>
<td>0.18</td>
<td>.84</td>
</tr>
<tr>
<td>Time</td>
<td>1</td>
<td>0.1870</td>
<td>0.1870</td>
<td>0.74</td>
<td>.39</td>
</tr>
<tr>
<td>Interaction</td>
<td>2</td>
<td>0.0410</td>
<td>0.0203</td>
<td>0.08</td>
<td>.92</td>
</tr>
<tr>
<td>Residual</td>
<td>53</td>
<td>13.4120</td>
<td>0.2531</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Discussion

Forward Shoulder Posture (FSP) predisposes individuals to secondary shoulder pathomechanics and potential injury due to unique musculoskeletal contraction to execute sport-specific demands and activities of daily living (Sahrmann, 2002; Wilk et al., 2009). Though quantitative research is limited regarding the use of Kinesio® Tape, specifically with the facilitation and inhibition application methods, the findings of this study do not support the use of Kinesio® Tape to decrease FSP. While the differences between the three taping techniques do not result in a statistically significant difference in the decrease in FSP, the summary statistics are suggestive of the general direction of the influence. Inhibiting the pectoralis minor has the
least impact, while facilitating the lower trapezius changes the mean measurement nearly twice as much. Therefore, this pilot study might be useful and suggestive for future studies.

Although the anatomical area differs, similar results by Fu, Wong and Pei (2008) indicate that facilitation of the quadriceps muscles do not change immediate or delayed muscle strength. Fourteen healthy athletes were recruited and assessed by an isokinetic dynamometer under three conditions: (1) without taping; (2) immediately after taping; and (3) 12 hours after taping. The results of the comparison of peak torque and total work revealed no significant interaction effect between conditions and assessments ($p>0.05$). Correspondingly, Vercelli, Francesco, and Calogero (2012) investigated isokinetic quadriceps strength and functional performance with facilitation and inhibition with Kinesio® Tape applications in 36 healthy adults. The researchers’ incorporated three different taping conditions: (1) facilitation; (2) inhibition; and (3) no-tension sham application on the anterior thigh. Researchers concluded Kinesio® Tape had short-term effects on maximal muscle strength, but the results revealed there were no significant differences ($p>.05$) related to the type of Kinesio® Tape application (Vercelli et al., 2012). Thus, the concept of direction of tape application, i.e., facilitation and inhibition, remains controversial and may not produce a clinical or performance effect.

One issue to consider when reading Kinesio® Tape research is poor methodology incorporated in studies. The previously mentioned studies both report findings that kinesiotaping facilitation and inhibition applications did not positively affect performance (Fu, Wong, & Pei, 2008; Vercelli, Francesco, & Caogero, 2012). However, there were discrepancies in the tape application. The previously mentioned studies did not follow the Kinesio Tape Association International (KTAI) taping guidelines (Kase et al., 2003). For example, Fu et al. (2008) applied the tape application with 120% stretch rather than the correct tension of 15-35% for facilitation.
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(Kase et al., 2003). Similarly, Vercelli et al. (2012) reported a facilitation with 25-50% tension. Too often lay public rely on internet searches as the source for medical advice. Approved Kinesio Tape Methods® require an appropriate, individualized assessment followed by specific application procedures such as tension and direction of pull.

Although the results of this project suggest Kinesio® Tape does not significantly decrease FSP, every individual’s musculoskeletal system is different and responds differently to treatment interventions. The inclusion criteria for the current study involved participants who clinically suffered from FSP; however, none of the participants reported pain due to the postural alteration. The skin’s sensory input from the application of tape alters the motor-neuron output which innervates the skeletal muscle’s activation allowing an alteration of pain receptors (Alexander, Stynes, Thomas, Lewis, & Harrison, 2003). Therefore, future research should be conducted on athletes who suffer from FSP and also have corresponding shoulder or back pain.

Conclusions

One goal of health and wellness associations is to present evidence-based material to coaches, physical educators, and recreational enthusiasts regarding interventions which could provide treatment strategies for musculoskeletal conditions. Forward Shoulder Posture (FSP) is a common postural condition which can alter the mechanics of overhead activities. The findings of the current research should be viewed as a pilot study and can guide other researchers to investigate taping options for FSP. Specific to the competitive athletic population, coaches may want to consider having conversations with allied health care professionals who have training and certification in Kinesio® Tape to ensure athletes are receiving optimal treatment for shoulder pathomechanics and postural alterations.
References


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