Kinesio Tape's Effect on Musculature Associated with Upper Cross Syndrome

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BACKGROUND: Upper crossed syndrome is currently becoming more prevalent in today's population. The syndrome is expressed as a postural disorder presenting with over active pectoralis musculature and upper trapezius musculature. Also, there is an inhibition of lower and middle trapezius musculature causing a "winging of the scapula" presented by elevated and abducted scapular dyskinesia causing a rounding of the shoulders. Functional Kinesio taping techniques use sensory stimulation to either assist or limit a motion. It is applied to the skin with no tension during active movement. The tension created by the increased stimulation during active movement provides stimulation to the mechanoreceptors. The perceived stimuli are believed to be interpreted as proprioceptive stimuli, which act as a pre-load during end-of-motion positions[2].

OBJECTIVE: To evaluate the effects of Kinesio tape on the muscles which are actively involved with upper crossed syndrome, in live subjects by measuring surface EMG (sEMG) of the upper and lower trapezius during unassisted active abduction and then followed by abduction assisted with Kinesio tape (concentric and eccentric).

HYPOTHESIS: The experimental hypothesis is that Kinesio taping will result in significantly lower sEMGs for the upper trapezius and significantly higher sEMGs for the lower trapezius.

METHODS: A convenience sample of 20 Logan College of Chiropractic students of normal BMI were used for the purpose of studying the effects of Kinesio tape on upper crossed syndrome. A surface electromyography reading was taken on the upper and lower trapezius during arm abduction. The sEMG was retaken directly after the application of Kinesio tape and then taken again after the participant had worn the tape for 24 hours.

RESULTS: All data sets were complete and there were no dropouts. Eight of the twenty participants reported shoulder soreness in the shoulder that was Kinesio taped. Paired t-tests comparing differences between the three measurement times showed significant ($p<0.05$) sEMG increases in lower trapezius muscles and significant (p .05) decreases in upper trapezius muscles, supporting the experimental hypotheses.

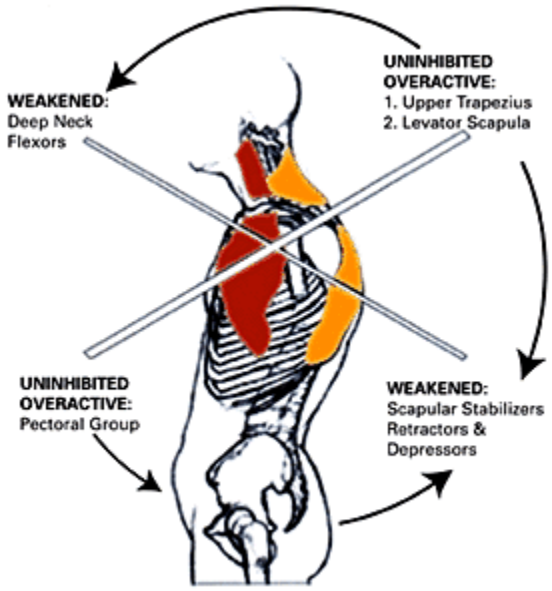
CONCLUSION: A one tail t-test revealed that there is a significant decrease in the sEMG of the upper trapezius from before the Kinesio tape was applied and the sEMG 24 hours later. Also, there is a significant increase in sEMG of the lower trapezius from before the tape was applied to 24 hours later and from directly after the tape was applied to 24 hours later.

Key Words: Upper crossed syndrome, trapezius, Kinesio tape, sEMG

Introduction:

Upper crossed syndrome (UCS) can have detrimental effects on anyone from an everyday blue collar worker to a professional athlete. Shoulder dysfunctions relate highly to the onset of UCS. Trauma to the shoulder complex is one known cause of UCS but understanding other mechanisms for acute shoulder injury and chronic pain patterns remains unclear. Physicians link the idea behind the cause of shoulder ailments to microtraumatic events occurring due to poor joint biomechanics and muscular movement imbalances[6]. Microtraumatic events leading up to UCS happen in the succession of: impingement, tendonitis, bursitis, and finally rotator cuff injury. Dr. Vladimir Janda was a pioneer to these patterns. He studied the patterns of muscular compensations and postural imbalances, meanwhile hypothesizing that faulty movement patterns on a poor postural base contributes to habitual overuse in isolated joints[6]. These overuses eventually lead to a perpetuating cycle of dysfunction and eventual injury[6].

Proper scapulothoracic muscle activation is necessary for controlling scapulothoracic function and is necessary for normal upper extremity function[7]. UCS involves weakened and uninhibited/overactive muscle groups. The weakened muscles include the deep neck flexors, scapular stabilizers, retractors, and depressors. The uninhibited, overactive muscles include the upper trapezius, levator scapula, and the pectoral group. The patterns above lead to forward head tilt causing strain to the muscular attachments of the shoulder and shoulder blade[6]. The shoulder blades "flare out" producing a rounded shoulder appearance. The rounded shoulder posture eventually alters the mechanical axis rotation of the glenoid fossa, and these altered mechanics now require additional stabilization for the humerus from the levator scapulae, upper trapezius, subscapularis, pectoralis minor, and suprapinatus muscles. There is also disruption of scapular motion. For example, a relationship exists between shortened posterior shoulder muscles and forward scapular motion[4]. The over-action of these muscles creates a deltoid shear, leading to shoulder impingement, tendonitis, bursitis and upper crossed syndrome[6].



Treatment of UCS begins with removal of trigger points and adhesions of the primary stabilizers of the shoulder (supraspinatus, infraspinatus, teres minor and subscapularis). The next step involves active and passive stretching. Four to six sessions of myofascial release and trigger-point therapy is commonly recommended before stretching. The treatment must involve all the muscles in UCS[6]. Bruegger's positioning has also become a popular

exercise as it can aid in the relaxation of hyperactive muscles of the upper torso[8].

Kinesio tape has been introduced in the world of medicine as an adjunct to many therapies and is mainly used for soft tissue syndromes[2]. KT uses its unique application to facilitate the body's natural healing process while providing support and stability to muscles and joints without limiting the body's ranges of motion[2]. It also benefits the soft tissue by extending the effects of the manipulation on the affected region outside the clinical setting. KT is safe for all patients seeking relief from orthopedic, neuromuscular, neurological and other medical conditions. It targets different somatosensory receptors and alleviates pain and facilitates lymphatic drainage by microscopically lifting the skin. When the skin is lifted the interstitial space is increased and the inflammation is reduced in the affected area[2].

First and foremost, proper evaluation of the patient must be performed prior to Kinesio tape application. Assessments should include manual muscle testing, range of motion, gait movements and other specific orthopedic tests deemed necessary by the practicing physician[2]. The findings dictate the specifics of the taping methods or any other treatments needed to be administered for exquisite care. KT can be applied in hundreds of ways and has the ability to re-educate the neuromuscular system, reduce pain, inflammation, enhance performance, prevent injury, and promote good circulation and healing. It has been proven to have positive physiological effects on the skin, lymphatic, circulatory system, fascia, muscles, ligaments, tendons, and joints. It is also a great pairing technique. KT can be added to other treatments and modalities in rehabilitative, chronic and preventative phases of care[2].

Methods:

Participants

Participants were selected from the Logan student body with an age range of 20-35. A questionnaire was used to ensure a normal population. Once the participant qualified with the questionnaire and signed consent, their posture was evaluated for signs of upper cross syndrome. These symptoms included pain between the shoulders, neck tightness, and occasional mild headaches. Posture included anterior rolled shoulders, winged scapula, and anterior head carriage associated with muscle imbalances described below.

1. Hypertonic – Pectoralis, levator scapulae, upper trapezius muscles, and sub occipital musculature
2. Inhibited - Lower trapezius, latissimus dorsii, rhomboids, and subscapularis muscles
3. Weakness - Deep neck flexors as a unit (since ability to evaluate individual muscles is difficult)

Subjects were screened with a goniometer and posturometer measuring anterior head carriage with a qualifying measurement being greater than ten degrees.

Exclusions included failing the postural screening, an anterior head carriage of <10°, previous shoulder surgery of any kind, muscular tears, muscular strains, or ligamentous sprains.

Procedure

A pretest/posttest repeated measures design was used to compare the effects of Kinesio taping. Surface EMG measurements were taken of the right upper and lower trapezius

muscles as the participant abducted the right arm three times. The subject was then taped with Kinesio tape for scapular protraction as seen in figure 1[2]. Ten minutes post - application of the tape, another sEMG was taken of the participants during right arm abduction for three repetitions. The participants were then instructed keep the tape on for 24 hours and at that time a sEMG was taken of the upper and lower trapezius muscle as the participant abducted their arm 3 times. Following the reading, the participants were removed from the study and the data was collected to be analyzed for the three sets of readings (Non-taped, post-taped, and 24 hours later).

Figure 1[2]

Measures and data analysis

The mean value over the time span of the three arm abductions was taken using the sEMG software. The reading on the top is of the upper trapezius and the reading below it is of the lower trapezius. Figure 2.1 is the reading before the application of the Kinesio tape, figure 2.2 is 10 minutes post-taping and figure 2.3 is 24 hours with the Kinesio tape still applied. Voltage readings for graphing the analog input ranged from 2.0 volts to -2.0 volts.

Figure 2.1

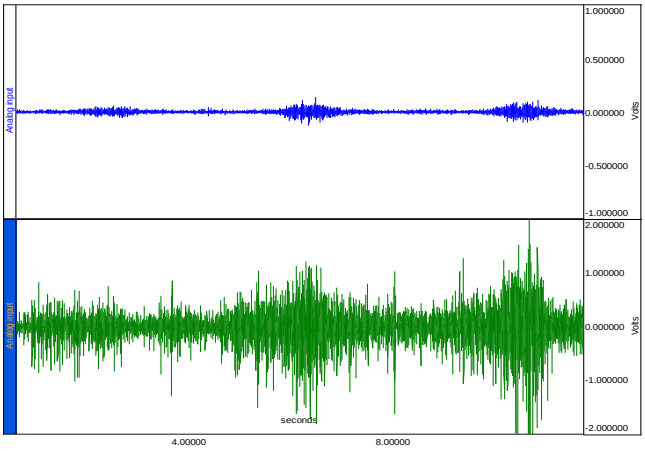


Figure 2.2

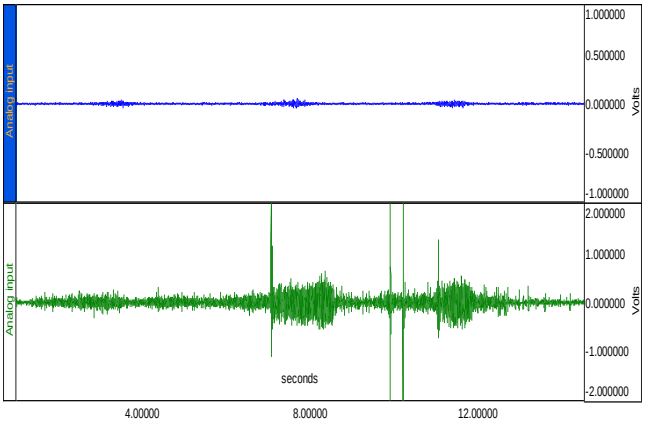
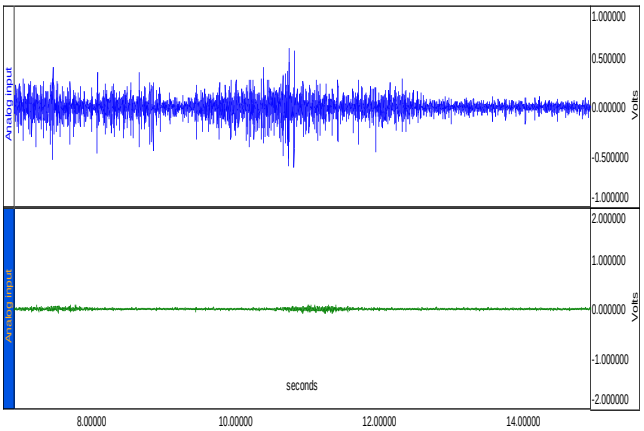


Figure 2.3



Statistical Analysis

A one tailed t-test was used to determine whether the mean values of the sEMG's between times and tape conditions were significant. The t-tests were applied to compare non-taped upper and lower trapezius measurements to 10 minutes post-taped readings, initial readings to 24 hours later, and 10 minutes post-taped readings to 24 hours later. A p-value <.05 was needed in order to deem that the results were statistically significant and if the results supported the hypothesis.

Results:

No significant decrease was found when comparing the non-taped readings of the upper trapezius to the post-taped readings or when comparing the post-taped readings to the 24 hour readings; however, there is a significant decrease in the sEMG readings for the upper trapezius when comparing the non-taped readings to the post-taped readings.. The measurements for the lower trapezius revealed no significant increase in the sEMG when comparing the non-taped readings to the post-taped readings, but there is a significant increase in the sEMG of the non-taped readings compared to the 24 hour readings. Also, a significant increase in the lower trapezius sEMG was found between the post-taped reading and the 24 hour reading.

Table 1.1 displays the mean values and the standard deviations of the three sEMG measurements for the upper and lower trapezius. Table 1.2 summarizes the findings of the one tailed t-tests. An asterisk denotes the p-values which were significant (p<.05)

Table 1.1 Mean and Standard Deviation

	Mean	ST Dev
UT Non-taped	0.004895	0.004564
UT Post-Taped	0.003946	0.005023
UT 24 Hours	0.002032	6.945E-05
LT Non-Taped	0.003063	0.000694
LT Post-Taped	0.003103	0.00049
LT 24 Hours	0.003363	8.37E-05

Table 1.2 One Tailed T-Test

	P-Value
UT Non/Post	0.2677
UT Non/24 Hours	0.0056*
UT Post/24 Hours	0.0524
LT Non/Post	0.4162
LT Non/24 Hours	0.0349**
LT Post/24 Hours	0.0151**

* < .01; ** < .05

Discussion

Kinesio tape is becoming increasingly more popular in the athletic arena and availability is more convenient as KT training is offered to individuals without the necessity of a graduate degree. Originally, the tape was designed to be similar to human skin. The benefits proposed include: providing positional stimulus through the skin, alignment of fascial tissue, increasing space by lifting fascia and soft tissue above areas of inflammation, sensory stimulation, edema removal via directing fluid towards lymphatic channels, and assisting or limiting motion of specific joints[3].

Although KT provided a significant benefit for the muscular imbalances associated with the upper and lower trapezius found with UCS, it seems that due to the complex nature of this disorder that there are several other components that must be addressed for maximum improvement of the clinical findings. Liebenson states that key elements to the treatment of UCS include restored joint mobility, normalization of muscle activity and endurance, and functional stabilization of cranio-cervical, scapula-thoracic, and glenohumeral mechanics[5]. Furthermore, since there was a significant decrease in upper trapezius activation and increase in lower trapezius activation seen after 24 hours of being taped, it would be

beneficial to continue the research of long-term KT application for UCS.

According to Craig Liebenson, upper crossed syndrome is due to muscular imbalances which cause postural overstress[5]. The upper trapezius is considered to be overactive/shortened, and the lower trapezius is underactive/inhibited. This study's taping protocol was designed to assist the lower trapezius and reduce activation of the upper trapezius. Eight of the twenty participants reported muscle soreness in their right trapezius after 24 hours of being taped. None of these subjects had recent soreness in the right trapezius before the application of Kinesio tape. This was an unexpected outcome of the study as previous studies done on Kinesio tape failed to mention possible negative outcomes to taping. The reported discomfort could be for several reasons. If the KT managed to increase activation of the lower traps, soreness can be attributed to the fact that these muscles are activated after a long period of hypoactivity. Another possibility is that the lower traps were further inhibited by the tape, causing a need for increased activity of the upper trapezius. Lastly, the KT could have limited the mobility of the shoulder causing further need for activation of the upper trapezius to regain lost mobility. All of these scenarios are plausible causes for the muscular discomfort.

Hsu et al studied the effects of taping on scapular kinematics in baseball players with shoulder impingement syndrome. The study states KT can assist or limit motion and the tape's ability to stretch can aid in correcting posture[1]. Kase and Hashimoto, in a study named Changes in the volume of the peripheral blood flow by using Kinesio tape, claim that Kinesio tape's elasticity can re-educate weakened muscles to strengthen during exercise. Continuous feedback 24 hours per day for 3-5 days per week, allows the tape to correct postural imbalances[3]. This statement may be the rationale for the lack of statistical significance in the three sEMG readings. The subjects were only taped once of a period of 24 hours. Upper crossed syndrome is often seen as a chronic problem and 24 hour application of KT is unlikely to be sufficient enough to cause significant changes in posture or significant changes in muscular activation/inactivation.

Conclusion

Kinesio Tape (KT) is acknowledged to be able to support musculoskeletal structures to enhance the body's ability to health itself[9]. Kinesio tape did seem to show favorable changes in the upper and lower trapezius, most notably after 24 hours of application. Liebenson and Janda state there are several components to the treatment of UCS, so the use of a single treatment modality is unlikely to have profound effects on clinical findings or outcome assessments. The use of KT may be an effective component of the treatment of UCS especially in lessening the effects of postural imbalances which lead biomechanical dysfunction and muscular microtrauma stress. Further investigation is needed to study the effects of KT on chronic issues such as UCS and should involve more frequent taping over longer periods of time.

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