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THERAPEUTIC EFFECTS OF KINESIO TAPE ON A GRADE-I LATERAL ANKLE SPRAIN IN ATHLETES

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ABSTRACT

Study Objectives: To determine if there are therapeutic effects of Kinesio tape on a grade I lateral ankle sprain, using an ASO as the control group.
Design: comparative study.
Setting: Subjects were taken from 9 different high schools in 2 sister counties
Methods: All 25 subjects are athletes, who suffered a grade I lateral ankle sprain. 12 athletes were in the Kinesio tape group and 13 of the athletes were in the ASO brace group (control group).
Outcome Measure: Single Leg Stance, Single Leg Squat, Single leg Hop, Box Drill , and the Illinois Test, at each of the three sessions 0, 4, and 8 weeks.
Result: The result of the study shows that there was no significant difference between the Kinesio tape group and the ASO ankle brace group when it came to pain level, single leg hop for distance, the box drill or the Illinois test, when tested at three different times; week 0, week 4, and week 8. However, results showed that there was a significant difference between the two groups on the single leg squat test. It was determined that the control group also known as the ASO ankle brace group, were able to perform more squats at week 4 and week 8, than the treatment groups also known as the Kinesio Tape group.
Conclusion: The finding of present study supports that both the Kinesio Tape and the ASO ankle brace are useful therapeutic methods when dealing with a grade I lateral ankle sprain. Athletic Trainers and Physical Therapists alike can use either tool in treating and rehabilitating a grade I lateral ankle sprain.

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INTRODUCTION

An athlete (American and British English) or sportsman (British English) is a person who is good at a sport and competes in one or more sports that involve physical strength, speed or endurance. The term's application to those who participate in other activities, such as horse riding or driving, is somewhat controversial. Athletes may be professionals or amateurs. Most professional athletes have particularly well-developed physiques obtained by extensive physical training and strict exercise accompanied by a strict dietary regimen. Injuries to lateral ligaments of the ankle complex are among the most common injuries incurred by athletes, over 23,000 a year (Hertel 2002).

It is estimated that out of that 23,000, 55% do not seek medical treatment. The ligaments that are compromised during a lateral ankle sprain include the anterior talofibular ligament and the calcaneofibular ligament. In order to have a lateral ankle sprain the primary mechanism of injury must be inversion. Inversion is described as a motion of the foot so as to turn the sole of the foot inward (Bernier 2002). There are 3 grades that are used to determine a lateral ankle sprain. Grade I consists of stretching or slightly tearing of the ligament with mild tenderness, swelling and stiffness (Bernier 2002). The ankle feels stable, and it is usually possible to walk with minimal pain. Grade II is a larger but incomplete tear with moderate pain, swelling, and bruising (Bernier 2002). The ankle sometimes feels stable, but the damaged areas are tender to touch and walking is painful. Grade III is complete tear of the affected ligament or ligaments with severe swelling and bruising (Bernier 2002). The ankle is unstable and may feel "wobbly". Walking is usually not possible, because the ankle gives out and there is intense pain although initial pain may quickly subside. Ankle sprains are also classified as an acute ankle sprain or a chronic ankle sprain. An acute ankle sprain refers to brief exposure, sudden, of short duration. This can be better described as short-term ankle injury. One who is playing basketball and suffers a first time ankle sprain. Chronic ankle sprains are described as gradual onset, an injury with long duration. For instance someone who suffers ankle sprains often is described in the medical field as having chronic ankle instability. In recent history, ankle taping has been the principal means of preventing ankle sprains in sport (Robbins 1995). Despite the fact that ankle bracing is growing in popularity, anecdotal evidence suggests that ankle taping with white athletic tape is still very popular among athletes, athletic trainers, and physicians. For those ankle injuries that are evaluated and are determined to need treatment, there are multiple options to choose from. Studies compare the use of ace bandages; debate the use of cryotherapy, rehabilitation options, and bracing versus taping. When one in the athletic world mentions tape they think of white tape, but now athletic trainers options have expanded. Not only do they have white tape to work with, but they also have Kinesio tape.

There are a few differences between the two different types of tape. White athletic tape is primarily used for prevention of ankle injuries. There is limited wear time with this tape. In most cases white athletic tape only lasts the length of a practice or a game. With this tape an athletic trainer also applies skin adherent and pre-wrap prior to applying the tape. There is no stretching in white athletic tape. It is a firm tape that a person can tear with the appropriate force. Most importantly white athletic tape is used to limit or assist range of motion. Kinesio tape on the other hand is primarily used for rehabilitation. It has a wear time of 3-5 days depending on the activity and the purpose. This tape includes tape only; the only prep that is used is an alcohol wipe in case the patient or athlete has lotion on the skin. Kinesio Tape unlike white athletic tape is applied with the intent of the tape working with body to allow normal range of motion. Kinesio Tape is a stretchy tape. This tape has paper on the back that must be removed prior to application. This tape is applied with specific tensions. Depending on the area being taped and the purpose of the tape determines the tension of the tape during application. Kinesio Tape can be applied using four different cuts; X, Y, I and Fan. These all describe the type of cut you perform with the scissors. The choice of cut depends on the practitioner's goals and purpose of the tape.

Generally the tape is applied to stretch tissue, with appropriate tension added to the tape. The tension percentage guidelines are as follows: Paper off (this means as soon as you remove the paper off the back of the tape) 10-15%, Light 15-25%, Moderate 25-50%, Severe 50-75%, and Full 75-100%. It is important to note that a practitioner will almost never use the Full application. Once you decide the tension of the tape the next goal is to decide whether to facilitate or inhibit the target area. Facilitation is defined as enhancement or reinforcement (Bernier 2002). To facilitate the area it is important to tape proximal to distal or origin to insertion. To inhibit the target area is to curb or restrain (Bernier 2002). In order to inhibit the area one must tape distal or proximal or insertion to origin. Few studies have been done on the use of Kinesio Tape in response to an ankle sprain. Kinesio Tape was invented in 1973 by Dr. Kenzo Kase in Japan. 85% of applications are non- athletic. Studies on Kinesio tape have found that it can add muscle tone in the vastus medialis muscle (Hertel 2002), decrease pain and increase functional activity in various limbs after injury, decrease lymph and swelling such as that of breast cancer.

Keri Walsh, Olympic Beach Volleyball player, wore Kinesio Tape on her shoulder to help assist the shoulder muscles that were deemed unstable by her orthopedic surgeon. When it comes to professional athletes the most common treatment area for Kinesio Tape is the shoulder. It is important to research the effects on other areas as well. Current treatments of a lateral ankle sprain generally start with a regimen of cryotherapy, ace bandaging, elevation, and rest from activity. It is generally followed closely and in conjunction with therapeutic exercises. A return to play protocol is then activated as the athlete becomes more comfortable with the activity. Throughout this typical protocol, very often some swelling remains as well as instability. Perhaps an added protocol utilizing Kinesio tape, with the benefits it has shown on other injuries, will bring this lingering instability and swelling out at a quicker pace. Knowing this information, is there a difference between Kinesio Tape when used as a therapy from a grade I ankle sprain and an ASO ankle brace? Can it exume the post-injury lymph and swelling at a faster rate? As Kinesio Tape is becoming more popular, it is important to evaluate its clinical and therapeutic effects on different injuries to allow appropriate use. The purpose of this study was to determine how the use of Kinesio Tape will affect the therapeutic recovery from a Grade I lateral ankle sprain. The specific research questions are: a) Is there a difference between Kinesio Tape and an ASO ankle brace when used as therapy with an acute ankle sprain? b) At the completion of the rehabilitation sessions involving the functional testing did the study group feel that the Kinesio Tape helped their progression in anyway? c) Can it exhume the post-injury lymph and swelling at a faster rate?

Definition of Terms

The purpose of this section is to clarify significant terms used in this study. The following is a list of such terms and their definitions.

- *Assessment* refers to appraisal, evaluation, or measurement, particularly by objective means (Steadman).

- *Lateral* refers to being on the side, farther from the median or midsagittal plane of the body. In this study it refers to the outside of the ankle (Steadman).
- *Acute* refers to treatment or exposure, brief, intense, short-term. It is often used to describe an injury that will not take long to heal (Steadman).
- *Functional Testing* refers to assessment of an individual's ability to move a body part actively, against resistance, and in a specific movement pattern (Steadman).
- *Edema* refers to an accumulation of an excessive amount of watery fluid in cells, tissues, or serous cavities. This term is defining the swelling that the subjects have after suffering a Grade I lateral ankle sprain in this study (Steadman).
- *Sprain* refers to an injury to a ligament when the joint is carried through a range of motion greater than normal, but without dislocation or fracture (Steadman).
- *Chronic* refers to a health-related state, lasting a long time. The United States National Center for Health Statistics defines a chronic condition as one of three month's duration or longer (Steadman).
- *Laxity* refers to looseness or freedom of movement in a joint (Steadman).
- *Subjective* refers to symptoms that are perceived by the individual only and not evident to the examiner; pain (Steadman).
- *Instability* refers to the abnormal tendency of a joint to subluxate or dislocate with normal activities and stresses (Steadman).

In general many athletes who sprain their ankles once go on to have chronic instability. It is important to evaluate if the use of Kinesio Tape in therapy after an initial acute ankle sprain would decrease the chances of chronic instability to let clinicians know if there is a better option available.

METHODS

An comparative study was conducted on total of 25 high school athletes with a Grade - I lateral ankle sprain, ranging in age from 14-18yr. who were included from hospitals and physiotherapy centers in Jaipur and high school based on the inclusion and exclusion criteria and they were divided into 2 group. A. Control group not using Kinesio Tape, and B. Study group using Kinesio Tape. Determination of the ankle sprain was initially assessed by the certified athletic trainer at their high school, or a physiotherapist. Athletes assessed to have a Grade I lateral ankle sprain were then referred to the investigator for a re-evaluation within 24 hours of the injury to determine if in agreement with the assessment. The special tests that were used during the initial evaluation of the ankle injury to determine the degree of the lateral ankle sprain were the anterior drawer test and the talar tilt. The anterior drawer test is testing the anterior talofibular ligament laxity. Once it is determined by the investigator that the athlete is suffering from a Grade I lateral ankle sprain the subject was then given a consent form to take home to be signed by their parents in order to have permission to participate in the study. The subject also signed a consent form to participate in the study. The functional test that the subject was asked to perform was given at two different stages of the study. The basic-intermediate functional tests included the single leg stance and single leg squat test.

Once the subject was screened to progress from those two tests the intermediate-advanced tests included the single leg hop for distance test, box drill and the Illinois agility test. Before the test was implemented, the investigator ensured readiness to safely execute the test, ensured the joint is able to tolerate forces applied, and minimized the risk of re-injury or aggravation (Barber 1992). The single leg stance was performed with the athlete standing on the involved ankle, and without holding onto any object stand for as long as they can (Flynn 2008). An ideal result involved the subject performing the single leg stance for at least 45 seconds. The quantitative measurements included the subject's pain and the length of time he/she was able to stand on the involved leg. The single leg squat was performed with the athlete once again balancing on the involved ankle, and this time performing a squat. During this test it is important for the investigator to assess the squat to make sure that the technique is done correctly. The investigator assessed the range of motion involving the hip, knee and ankle; alignment involving the lumbar spine, hip, knee, and ankle; shoulder position, and center of gravity (Flynn 2008). All of this was done to minimize the risk of injury due to improper technique. Once the test was performed the data that will be collected includes the pain, the number of squats performed.

Once the subject has performed the prior two tests they progressed to the intermediate-advanced functional tests. The first test was the single leg hop for distance test. The subject stood on one limb and then hopped a distance of 6 meters. The measurements included the subject's pain, the time that it took the subject to complete the test. During this test the investigator also documented a reproducible measurement when the subject was asked to perform the test on the uninvolved ankle, and then on the involved ankle, the two times will be divided and then multiplied by 100 to get the percent healthy of the injured ankle. The next test to be performed by the subject was the box drill. There were four marker cones placed 10 yards apart in a square configuration, the subject started by getting down in a three-point stance next to Cone 1. On command "GO" the subject sprinted to Cone 2, then shuffled sideways to Cone 3. From there the subject backpedaled to Cone 4, and finishes by turning and sprinting through and finishing at Cone 1 (NFL Combine Testing). The measurements that were taken were the subject's pain, and the time that the test was completed in. The final test that the subject was asked to perform was the Illinois Agility Test. The subject's started by lying on their front (head to the start line) and hands by their shoulders.

On the command "GO" the stop watch was started, and the subject got up as quickly as possible and ran around the course in the direction indicated, without knocking the cones over, to the finish line, at which the timing was stopped. The measurements that were taken were the subject's pain, and the time that the test was completed in (NFL Combine Testing). A pain scale assessment was also used as a measuring tool. The subject rated their pain before the functional testing and after the functional testing each time. At any time during the testing the subject was able to stop the tests for any reason, especially for pain. The investigator also had the authority if necessary to stop a test based on the athlete's performance, and based on observation of the athlete. Once the consent form was signed by the parent or legal guardian, and the subject consent forms signed by the subjects, the subjects were then randomly chosen to be in the test or control group.

All ankle measurements on all subjects were assessed using the circumference measurement at the ankle joint. This is done by take a tape measure and measuring around the ankle joint from the lateral malleolus to the medial malleolus. This measurement was taken before and after the functional tests were performed. Subjects in the test and control groups reported for rehabilitation appointments three times per week for 4 weeks with their certified athletic trainer at the therapeutic setting. The subjects worked with their certified athletic trainer to rehabilitate their ankle, utilizing only ice and compression for modalities. Subjects chosen for the test group had Kinesio Tape applied at the start of each rehabilitation session as well as at the start of each testing session; the investigator met the subject for application. The functional tests were administered three times for each patient. At the time of the initial evaluation, 4 weeks post injury, and 8 weeks post injury. The results taken at these times were the only recorded results for this study. It is important to note that the Kinesio Tape was reapplied prior to each rehabilitation visit and testing session by the investigator. The tape was applied on the lateral aspect of the ankle. The tape inhibited the ligaments involved in the lateral ankle sprain. The taping method used was a criss-cross fan. This gave the optimal reduction of edema for that target area. The student-athletes were taped on the lateral side of the ankle, being that it was a grade I lateral ankle sprain. The Kinesio tape group performed each functional test with the tape applied by the investigator.

Data Analysis

The analysis used to gather data in this study was the 2x3 ANOVA. The 2 being Kinesio Tape or an ASO ankle brace and the 3 being the time; 0, 4, and 8 weeks. This was run on each of the five dependent variables. Those variables included: pain level, single leg squat, single leg hop, box drill, and the Illinois test.

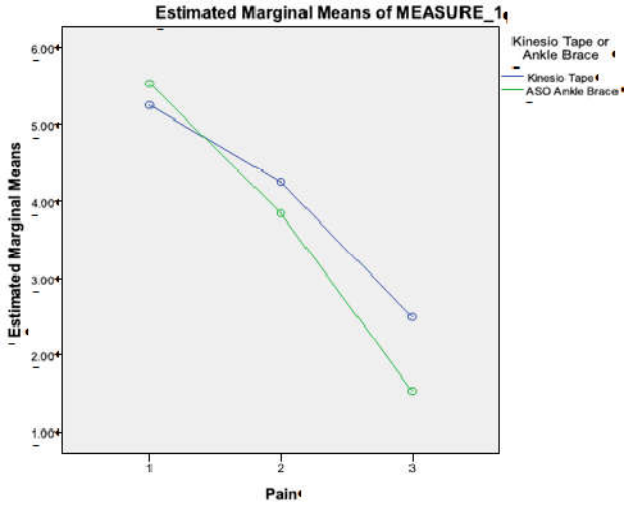
RESULTS AND DISCUSSION

The data that was collect on each subject was based on 5 variables; pain level, single leg squat, single leg hop, box drill, and the Illinois test. Each subject has three different measures for each variable. The participant sample was 25 high school student-athletes from 9 high schools. The first analysis looked at the differences between Kinesio Tape and an ASO ankle brace and the difference in pain level before therapy and functional testing and after. The pain level is the difference of the two numbers at each session. The second looked at the difference between Kinesio Tape and an ASO ankle brace and the single leg squat functional test. The third analysis focused on the difference between Kinesio Tape and an ASO ankle brace and the single leg hop functional test. The next analysis looked at the difference between Kinesio Tape and an ASO ankle brace and the box drill. The last analysis looked at the difference between Kinesio Tape and an ASO ankle brace and the Illinois agility test. Analysis were done utilizing 2 (Treatment: Kinesio Tape, ASO Ankle Brace) x3 (Time: 0,4,8) ANOVA ($p < .05$).

Pain Level

The results indicate that there is no statistical difference between the effect of Kinesio. Tape on pain, and an ASO ankle brace on pain with an F-value of 0.312, and the p-value of .582.

The estimated margin of means for the Kinesio Tape group being (M=4.0) and the estimated margin of means for the ASO ankle brace group being (M=3.641). Regarding the subject's pain level throughout the study, it was determined that there was a significant decrease in the subject's pain across time (F= 75.300, p= .000)

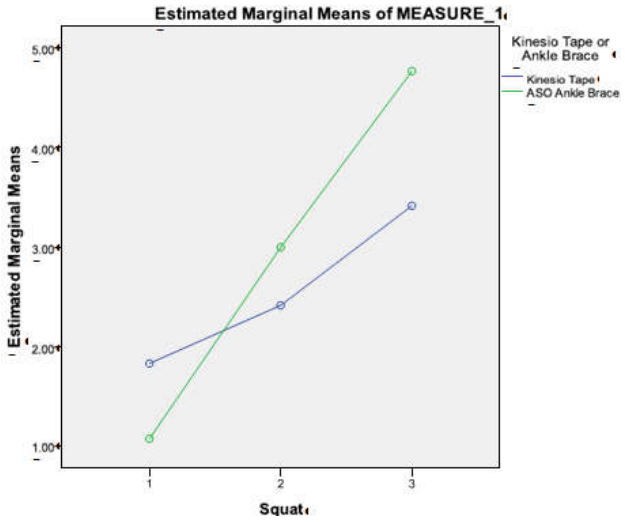


Graph 1. Estimated Marginal Means of measure

The pain level was a subjective measure in that, before and after the tests the subject's were asked their pain level, and the data was recorded based on the response. There is no real way for the investigator to measure their pain other than subjectively. The decrease in pain over time occurred with both the treatment group being Kinesio Tape and the control group being ASO ankle brace, making time a significant factor with the pain variable.

Single Leg Squat

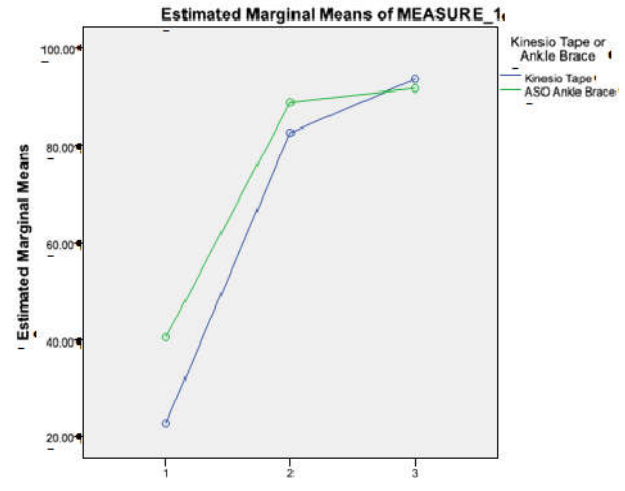
The same analysis was used to determine the difference between the Kinesio Tape and the ASO ankle brace and the single leg squat was not significant. The single leg squat treatment main effect included an F-value of .250, and a p-value of .622. The Kinesio Tape group had a mean of 2.556, and the ASO ankle brace group had a mean of 2.949. The amount of squats performed by each subject increased significantly over time with both the Kinesio Tape and the ASO ankle brace (F= 26.791, p= .000). Some were unable to perform the task but most were able to perform at least 1. At week 0 a total of 11 subjects were unable to perform the test; 7 in the ASO™ ankle brace group, and 4 in the Kinesio Tape group. By week 4 only 3 subjects were unable to perform the test; 1 in the ASO ankle brace group and 2 in the Kinesio Tape group. There was no change between week 4 and week 8 as all of the subjects were able to perform the test by week 8. There was a notable difference between the two treatment groups at weeks 4 and 8. The ASO ankle brace groups were able to perform more single leg squats as compared to the Kinesio Tape group. The ASO ankle brace group's outcomes sky rocketed over the Kinesio Tape group over the life of the study. It is noted that over time both groups increased the number of squats performed. The ankle brace group performed better than that Kinesio Tape group at both weeks 4 and 8. Regarding the subject's number of single leg squats performed throughout the study, it was determined that there was a significant interaction of treatment by time (F= 4.382, p= .018).



Graph 2. Estimated Marginal Means of measure 2

Single Leg Hop for Distance

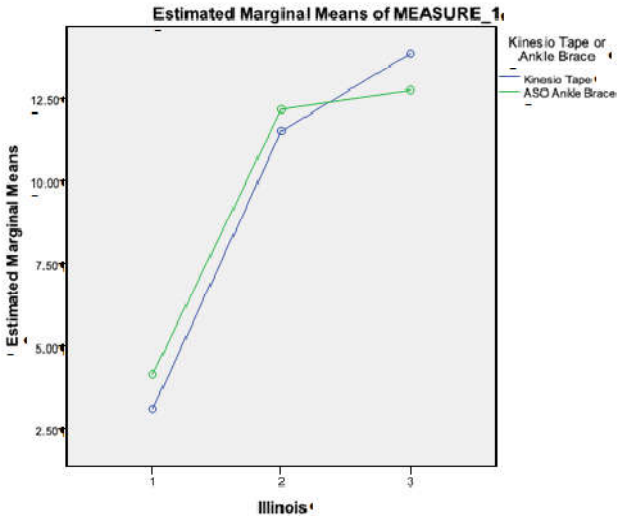
The data collected was the time the subject took to complete the single leg hop for distance test. The measurement was reproduced when the subject was asked to perform the same test on the uninvolved ankle and the two times were divided and multiplied by 100 in order to get the percent health of the injured ankle, as compared to the uninjured ankle. The results indicate that there is no statistical difference between the effect of Kinesio Tape on the single leg hop for distance test, and the ASO ankle brace on the single leg hop for distance test with an F-value was 1.166, and a p-value of.291. The estimated margin of means for the Kinesio Tape was 66.378, and for the ASO ankle brace was 73.718. At week 0, 9 subjects; 6 in the ASO ankle brace group and 3 in the Kinesio Tape group were unable to perform the single leg hop for distance test due to the amount of pain, as well as the amount of discomfort coming from landing on the involved ankle. This test involved critical thinking when it came to leading with one foot and landing on the other. Many subjects were hesitant to land on their involved (injured) ankle. Regarding the subjects performance with the single leg hop for distance test there was a significant increase in performance across time (F= 39.105, p= .000). In comparing the data between weeks 4 and 8, only 1 subject was unable to perform the test at week 4, out of the Kinesio Tape group, and all of the subjects were able to perform the test by week 8. Noting that most grade I lateral ankle injuries have healed by week 4.



Graph 3. Estimated Marginal Means of measure 3

Box Drill

The results indicate that there is no statistical difference between the effect of Kinesio Tape on the box drill, and an ASO ankle brace on the box drill with an F-value of .879, and the p-value of .358. The estimated margin of means for the Kinesio Tape group being (M=6.818) and the estimated margin of means for the ASO ankle brace group being (M=7.478). The box drill was determined to be a great introduction to the Illinois test. Regarding the subjects performance throughout the study, it was determined that there was a significant increase over time (F= 37.528, p= .000). Only 7 subjects; 4 in the ASO ankle brace group and 3 in the Kinesio Tape group, were able to perform this test at week 0 due to the amount of cutting involved. With a grade I lateral ankle sprain, the inversion and eversion movements will cause the subject the most discomfort. In order to functionally cut on the field, inversion and eversion are the main range of motions. Comparing the data between weeks 4 and 8, there was only 1 subject unable to complete the test at week 4, out of the Kinesio Tape group, all subjects were able to complete the test at week 8. However, due to the subjects being unable to perform the task at week 0, there was a notable difference in the data between week 0 and week 4 as well as between week 0 and week 8, being that week 4 and week 8 were very similar.



Graph 4. Estimated Marginal Means of measure 4

Illinois Agility Test

The final analysis looked at the difference between the Kinesio Tape and an ASO ankle brace and the Illinois Agility Test. Once again at week 0, most subjects in both the Kinesio Tape group and the ASO ankle brace group were unable to perform this test. Only 7 subjects were able to perform the test at week 0; 4 in the ASO ankle brace group and 3 in the Kinesio Tape group. Although there is a jump between week 0, and week 4, due to the fact that most of the subjects were unable to perform this test at week 0, there was no apparent improvement between week 4 and week 8. Only 3 subjects; 2 in the Kinesio Tape group and 1 in the ASO ankle brace group, were unable to perform the test at week 4, and all of the subjects were able to complete the test at week 8. The results indicated that there was no statistical difference between the Kinesio Tape on the Illinois test and the ASO ankle brace on the Illinois test with an f-value of .024, and a p-value of .878. This test was found by the subjects to be most difficult out of the functional test implemented.

Not only is speed a factor, but remembering the path, was an obstacle for the subjects. It was observed that the subjects performance of the box drill throughout the study, increased over time (F= 33.208, p= .000). There was not a large difference in times between week 4 and week 8, although the subjects were familiar with the path by week 8.

Conclusion

In conclusion, based on the findings of the study, the only difference between Kinesio Tape and an ASO ankle brace is the single leg squat functional tests. It is also been determined by this study that the subject's in the Kinesio Tape group were unable to determine if the tape helped or hindered their progression in any way throughout the 8 week study. It was interesting that all the subjects lacked swelling. One of the main claims of Kinesio Tape is that the tape will increase interstitial lymphatic fluid flow and reduce edema. This study was unable to determine that with such an acute injury being studied. This opens the door for future research. With the ASO ankle brace, the same brace can be used throughout one season. It is applied by the athlete, or patient. Once it starts to wear down depending on the purpose of the ankle brace, one can purchase another brace. The ASO ankle brace is thirty dollars per brace. When it comes to the Kinesio Tape at this point in time it is not available in stores. People must go through a physical therapy clinic, chiropractor, etc. in order to purchase the tape. Kinesio Tape must be applied by a professional. Some physical therapists will have three to four sessions with a patient, educate the patient and then allow the patient to purchase the tape and apply it to themselves. With the Kinesio Tape the most important part is the patient education. It is important to educate the patient on the application process, what not to do while the tape is on the skin, and the proper steps in the tape removal process. The patient must understand the indications and contraindications as well. The cost of the Kinesio Tape for 1 small roll is eleven dollars. Per box it can range from sixty to seventy dollars. Not only is a patient paying for the tape application they are also paying for the practitioner's time and ability to apply the tape.
It seems that both the Kinesio Tape and the ASO ankle brace are useful therapeutic methods when dealing with a grade I lateral ankle sprain. Athletic Trainers and Physical Therapists alike can use either tool in treating and rehabilitating a grade I lateral ankle sprain.

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