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The Effect of Two Types of Ankle Tape on Ankle Range of Motion and Running Speed

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THE EFFECT OF TWO TYPES OF ANKLE TAPE ON ANKLE RANGE OF MOTION AND RUNNING SPEED

BY

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To the Dean of the School of Human Performance and Leisure Sciences:

I am submitting herewith a thesis written by Samuel J. Eisen entitled “The Effect of Two Types of Ankle Tape on Ankle Range of Motion and Running Speed." I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science with a major in Movement Science and specialization in Athletic Training.

_____
Dr. Sue Shapiro, Thesis Committee Chair

We, members of the thesis committee,
have examined this thesis
and recommend its acceptance:

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Accepted:

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Chair of Department of Sport and Exercise Sciences

Accepted:

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Dean of School of Human Performance and Leisure Sciences

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Be Happy and Have Fun In Life

Samuel Joseph Eisen, LAT, ATC

ABSTRACT

The purpose of this study was to determine if a closed basket weave ankle taping decreases running speed in college athletes. It also identified if there is a difference in running speed when using stretch tape for the heel locks and figure eights in lieu of 1.5 inch white tape. Finally, this study identified the differences in range of motion between the two types of tape. Twenty-eight participants took part in the study. Each participant had three conditions of sprinting, baseline, white tape, and stretch tape applications for a closed basket weave ankle tape. A repeated measures MANOVA was performed to determine statistical significance with three conditions: baseline application (BL), white tape application (WT), and stretch tape application (ST). Results indicate that both white tape ($p<0.001$) and stretch tape ($p<0.001$) significantly decreased bilateral ankle plantar flexion and dorsiflexion. White tape also significantly increases sprint time ($p=0.004$) when applied whereas stretch tape did not have a significant increase on sprint time ($p>0.05$). When white tape was compared to stretch tape, the decrease in ankle range of motion was significantly greater in white tape than stretch tape ($p<0.001$) but did not significantly increase sprint time ($p>0.05$). It can be concluded that if support is needed for the ankle joint then white tape should be chosen over stretch tape. White tape provides significantly greater support than stretch tape but does not inhibit sprinting performance significantly more than stretch tape. Which ever taping application is used, the athlete will be slower than without tape. Even though sprint time using stretch tape was not significantly slower than no tape, it is not significantly faster than white tape. Therefore if ankle support is required, white tape is suggested to provide the greatest support and protection for the ankle joint.

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CHAPTER ONE

INTRODUCTION

Statement of Problem

Ankle sprains are one of the most common injuries associated with softball. They make up forty three percent of injuries while sliding.[1] In order to allow athletes to return to participation with less probability of reinjury, many athletic trainers use a number of supportive devices such as tape and braces.[2] Both have been shown to decrease ankle range of motion in all directions immediately following application. According to Paris, Vardaxis, and Kokkaliaris,[2] plantar flexion decreased by 20° at the time of tape application. Dorsiflexion decreased by 6° at the same measurement time. Metcalfe Schlabach, Looney, and Renehan[3] found a decrease of 7° of plantar flexion and 8° of dorsiflexion following a tape application. According to Norkin and White,[4] the standard range of motion for plantar flexion and dorsiflexion are 55° and 11° respectively. Myburgh, Vaughan, and Isaacs[5] compared the restricting effects of non-elastic tape and elastic tape for ankle inversion, eversion, plantar flexion, and dorsiflexion. They stated that non-elastic tape provided greater restriction to ankle range of motion immediately after the tape application.

It is unsure how this decrease in range of motion in the sagittal plane of the ankle may influence running speed immediately following application of a standard closed basket weave ankle taping. It was reported that tape has significantly limited performance in the vertical jump as well as in agility tests.[3] Other studies have concluded that a taping application significantly reduced performance when plantar flexion of the ankle was

required.[3] In softball, the time it takes to run from home to first base is anywhere from 2.3 to 3.0 seconds.[6] In many other sports such as baseball, volleyball, and basketball, where running and vertical jump are essential parts of the game, it is important that those athletes are not limited in any aspect of their performance. McKenna and Riches[6] stated that while running the amount of ankle motion ranges from 30° of plantar flexion at heel strike to 56° of plantar flexion at toe-off.

The data shows a significant decrease in ankle plantar flexion immediately after the application of a closed basket weave taping. Since a full range of plantar flexion is needed for running, the limitations of an ankle taping should decrease running speed in a 20 yard dash. It is questionable if the use of stretch tape for heel locks and figure 8's will allow for the necessary range of motion to maintain full running speed while providing the necessary support.

Purpose of Study

The purpose of this study was to determine if a closed basket weave ankle taping decreases running speed in college athletes. It also identified if there is a difference in running speed when using stretch tape for the heel locks and figure eights in lieu of 1.5 inch white tape. Finally, this study identified the differences in range of motion between the two types of tape.

Research Question

Does a closed basket weave ankle taping with white athletic tape and stretch tape decrease running speed in a 20 yard dash for collegiate athletes?

Is there a difference in running speed between using stretch tape and 1.5 inch white tape for the heel locks and figure eights?

Is there a difference in ankle range of motion when using stretch tape for the heel locks and figure eight?

Is there a decrease in ankle range of motion with 1.5 inch white tape for the entire tape application in plantar flexion and dorsiflexion?

Variables

Independent – type of tape used

Dependent – time from in a twenty yard dash; sagittal plane range of motion plantar flexion and dorsiflexion

Research Hypotheses

1. White tape will decrease running speed in a twenty yard dash
2. There will be no change in running speed and time when using stretch tape
3. White tape will decrease plantar flexion and dorsiflexion
4. Stretch tape will have no affect on ankle plantar flexion and dorsiflexion

Null Hypotheses

1. No difference in running speed between baseline and taped measurements
2. No difference in range of motion between no tape, white tape and stretch tape.

Statistical significance will be determined with an alpha set at 0.05.

Definition of Terms

Active Range of Motion – the arc of motion attained by a subject during unassisted voluntary joint motion.[4]

Sprinting – running at a mean constant velocity equal to or over 7.0 m/s.[6]

Plantar flexion – movement in the sagintal plane bringing the foot down and slightly medially.[4]

Dorsiflexion – movement in the sagital plane brining the foot up and slightly laterally.[4]

Goniometer – a large protractor with measurements in degrees most commonly used to measure joint position and motion in the clinical setting.[4]

Sagittal Plane – proceeds from the anterior to the posterior aspect of the body dividing the body into left and right sides.[4]

Basket Weave – offers strong support and is primarily used in athletic training for newly sprained or chronically weak ankles[7]

Heel Lock – strips of tape that lock the calcaneus in an everted position to stabilize the subtalar joint[7]

Figure-8 – tape around the foot and lower leg in a figure-8 pattern that pulls the talocrural join into dorsiflexion[7]

Stretch Tape – adhesive tape containing elastic allowing for the tape to stretch with the movement of the taped joint[7]

Assumptions

1. It was assumed that the goniometer is a valid and reliable technique for assessing ankle plantar flexion and dorsiflexion.

2. It was assumed that all athletes will give a full effort in every sprinting trial.
3. It was assumed that tape applications, range of motion measurements, and stretching will be consistent for all participants.

Significance of the Study

This study can prove to be important in the realm of athletics due to the fact that an increase in time from home plate to first base of a half second can be the difference in being safe and being out. As the nature of softball and baseball is to get on base and score, if a supportive ankle taping is the reason for being slower, then there is a need for this to be examined. This study will determine a proper course of action to allow for the athletes to maintain their full running speed while still having the necessary reinforcement of the supportive ankle tape. Athletic trainers and coaches may use the results of this study to determine the proper course of action when deciding if the application of ankle tape is needed and possible what type of tape should be used based on the sport specific activities of the athlete. Myburgh, Vaughan, and Isaacs[5] compared the restricting effects of non-elastic tape and elastic tape for ankle inversion, eversion, plantar flexion, and dorsiflexion. They stated that non-elastic tape provided greater restriction to ankle range of motion immediately after the tape application.

Many studies[8,13,15] conducted to investigate the restrictive effects of ankle prophylactics on range of motion on done in a controlled environment. This indicates that many of the studies can not be applied to real-life situations in athletics. This being said, it is difficult to conclude that a superior mechanical restriction of ankle range of motion

does not always imply a greater preventive effect.[8] This study will be a more realistic setting allowing for the results to be applied to a wider range of athletes and sports.

CHAPTER TWO

LITERATURE REVIEW

The purpose of this study was to investigate if an ankle tape application decreased running speed in a twenty yard dash in collegiate athletes. It compared standard 1 ½ inch white athletic tape and 2 inch stretch tape for two of the main components to determine if there are any differences in running speed. Many studies conclude that a decrease in range of motion assists in decreasing ankle injuries, though there is still much controversy if this is the sole reason.[9,10] Other researchers[11] state that tape increases proprioception allowing the ankle to better protect itself. Ankle taping has been shown to decrease performance for agility and vertical jump[3,12] but little research has been done to determine if the tape application decreases straight ahead running speed.

Many studies that have been conducted on the effects of ankle tape on performance have been performed in clinical settings. This indicates that many of the studies can not be applied to real life situations and makes it difficult to draw any conclusions as to the protective and performance restrictive effects it may have in real life situations.[8] This study will try and bridge that gap by performing the sprinting protocol on a field with collegiate athletes.

Rationale for Ankle Taping

Ankle injuries are the most common injury seen in sports. The inversion ankle sprain is by far the most numerous.[1,2,8,13] Ankle injuries and fractures were the most common injuries resulting from sliding in softball. It is uncertain if this is caused by

improper sliding technique or if the actual base itself is the cause of high number of ankle injures. Ankle sprains make up 85% of all ankle injuries and are the result of forced plantar flexion and inversion of the foot beyond normal limits.[8] Roughly 83% of players were injured sliding foot first and during base running.[1] Most bases used in collegiate softball are set into the ground by a post in the middle of the base. The use of a breakaway base has been known to alleviate the high incidence of ankle injuries during sliding.[1] Adhesive tape is a popular treatment method for athletic injuries because of its many uses. It can be used for stabilizing recent injuries, preventing additional injury that might result from further athletic activity, and the protection of acute injuries and support of recent injuries.[7,14]

Taping has been an important part of athletic training; the widespread belief in the effectiveness of ankle taping and the extremely high number of lateral ankle sprains among athletes resulted in the great use of the procedure within secondary schools, collegiate, and professional athletics.[15] Studies[7,14] have documented the effectiveness of ankle taping in reducing the number of lateral ankle sprains, and many other researchers have evaluated the amount to which tape provides mechanical resistance to excessive ankle motion.[9,10] The protection of the ankle when taped is not solely related to decreased inversion range of motion; the speed to which the ankle is passively inverted decreases. This decrease enables the functional reflexes of the peroneal muscles and other extrinsic muscles to react and protect the joint.[15] The slow reaction of the peroneal muscle group is one of the deficiencies of the human body that causes an injury that can lead to an athlete missing a couple days to a number weeks of athletic participation.

For many years, athletic trainers have made many attempts to provide external support to stabilize the ankle to allow for a return to play.[2,3,8,14] Various external supports have been designed to restrict the abnormal range of motion that causes ankle sprains.[8] Athletic trainers have utilized different ankle braces, such as semi-rigid, rigid, lace-up, and air-casts, as well as different types of tape, standard 1 ½ inch white athletic tape, 2 inch stretch tape, Elastikon, and moleskin, to provide support to the joints of the ankle. Ankle tape is widely used to provide the necessary support and range of motion restrictions for athletes by athletic trainers. The ankle is protected when the range of motion is restricted. It is believed by some researchers that the greater the restriction the greater the protection.[3,8,16] One clinical study[11] stated that there was no distinctive differences between tape, braces, and high top shoes in preventing ankle sprains. These finding may suggest prophylactic measures improve the proprioception of the ankle joint more so than preventing ankle motion.

The primary supportive components of a closed basket weave are the stirrup-strips, heel locks, and figure 8's. The stirrup strips are placed perpendicular to the anteroposterior axis through the talocrural joint. This positioning provides the maximum resistance to inward rotation, supination, of the hind foot and decreases the displacement of the calcaneus and lateral tilting of the talus in the talocrural joint. The heel locks and figure 8's provide additional support to prevent lateral distraction of the talocrural and subtalar joints.[15] When combined, these components work together to keep the ankle in a neutral, or slightly everted and pronated position allowing the peroneal muscles to be activated and work more efficiently in the event of sudden inversion.

Effects of Ankle Tape on Range of motion

The primary function of prophylactic ankle tape is to reduce ankle range of motion, especially for inversion, and plantar flexion. According to Paris, Vardaxis, and Kokkaliaris[2] significant reductions in ankle inversion range of motion were found between unsupported ankles and pre-activity tape. Gehlsen, Pearson, and Bahamonde stated that stirrup-type braces are superior to tape and lace-up braces because of the less adverse effects on sagittal plane isokinetic strength and range of motion.[16] This implies that tape decreases the force generated by the extrinsic musculature that would be needed for running at full speed. Paris et al, also stated that post-activity inversion range of motion increased significantly with tape between 0 and 15 minutes. Tape significantly restricted pre-activity eversion range of motion but there was a significant increase after 15 minutes of activity.[2]

The results of the study conducted by Paris et al indicated a significant restriction of plantar flexion range of motion by 56.9% pre-activity with tape. Taped ankles significantly increased in plantar flexion range of motion by 9.3% after 15 minutes of activity. There were further significant increases up to 26.9% in plantar flexion range of motion at 30, 45, and 60 minutes of activity.[2] There were significant restrictions in dorsiflexion range of motion before activity with the tape application. There was a significant increase in dorsiflexion range of motion after 45 minutes of activity.[2] After 60 minutes of activity tape offered no significant support to the ankle in any direction of motion.[2]

Lohrer, Alt, and Gollhofer[9] found that plantar flexion was reduced from 53° to 33°, which was 63% of the baseline, immediately following the tape application.

Following 20 minutes of exercise, plantar flexion mobility increased to 46°, which is 87% of the baseline. After 24 hours of having the ankle tape application plantar flexion increased to 49°, 92% of the baseline measures. Ankle inversion had significant decreases in range of motion as well. Baseline range of motion measurements were 23° of inversion and decreased to 11°, 48%, immediately following the tape application. After 20 minutes of activity, inversion increased to 15°, 65% of baseline and after 24 hours it was 18°, putting it up to 78% of the baseline measurement.[9]

According to Metcalfe, Schlabach, Looney, and Renehan[3] all ankle prophylactics would lose their restrictive properties after 20 minutes of exercise. There were significant increases in all ranges of motion when the mean values after 10 minutes were compared with the initial values and when the mean values at 20 minutes were compared with initial values. Other studies found that a post-application restriction for plantar flexion and plantar flexed-inversion, varying range of motion from 22 to 36%.[8,17] One study[18] found that tape reduced range of motion 10-14° at application. Greatest mechanical resistance was seen in plantar flexion, inversion, and plantar flexion with inversion. Resistance decreased 50% following exercise and post-exercise residual restriction provided by tape was still greater than untapped state, which may indicate a possible benefit of tape even during extended periods of activity.

Athletes have stated they do not like having their ankles taped because it feels stiff and restricting causing them to decide against having the tape applied daily. One explanation for the increased feeling of restriction is that the injury response following an acute injury causes physiological changes that cause a loss of range of motion. These changes include swelling and edema that make the athletes' ankles feel restricted during

performance with or without tape application. A possible explanation for why athletes who were recently injured felt restricted at first, then became used to the ankle tape over time, could be related to the healing process of the injury and decrease in swelling and edema.[14] This may take up to three days for the athlete to feel comfortable in the ankle tape because at that point acute inflammation has decreased allowing for the swelling and edema to be reabsorbed through the lymphatic and venous systems.

Sprinting Kinematics

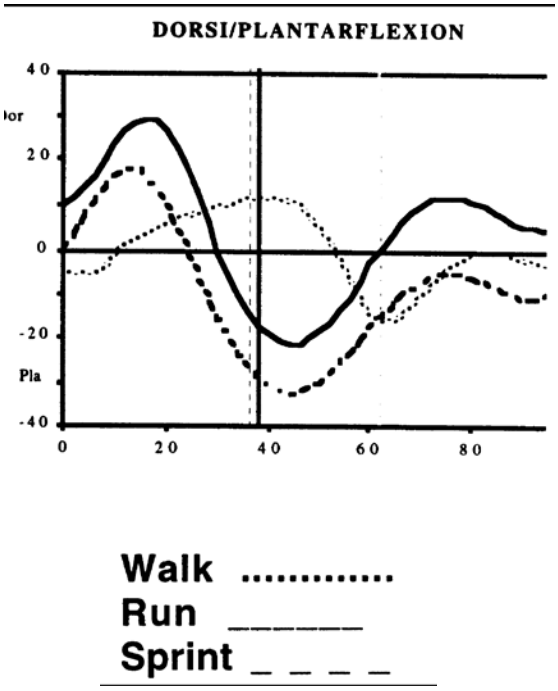
In many sports, running speed is necessary to be successful. In a study conducted by Norkin and White[4] the mean maximum over-ground velocities were 7.77m/s. In sports such as soccer or basketball this speed is what allows the athlete to sprint down the court or field and beat the defender to score. There are many times in a soccer game where a player has to sprint to the sideline or end line in order to save the ball and keep in play, or to make a cross towards the goal. If the athlete is not able to run at full speed, then the ball may go out or be intercepted by the opposing team. According to another study by Nummela, Deranen, and Mikkelsson[19] maximal 30-meter running speed ranged from 7.7 to 9.4 m/s. For sports such as softball and baseball where it is a game of inches, a decrease in running speed can be the difference in being safe or out, winning or losing, first place or first runner-up.

Novacheck[20] stated that during sprinting there is no initial dorsiflexor moment because initial contact is on the forefoot followed by immediate dorsiflexion. The total energy absorbed at the ankle is greater in sprinting than in running. The period of absorption is followed by a period of power generation. The power generated provides

energy for forward propulsion. The magnitude of the ankle power generation is directly related to the athlete's speed.[20]

Both Norkin and White[4] and Novacheck[20] found that there is a need for full plantar flexion motion while sprinting in order to achieve maximal running speed. Norkin and White[4] state that the average range of motion needed during sprinting is 30° of plantar flexion at heel strike and 56° of plantar flexion at toe off. In baseball and softball where there is primarily sprinting and less jogging involved. Therefore, it is very necessary to have full motion to have the essential power force generation to sprint at full speed. Novacheck concluded that during the generation phase of stance, maximum ankle plantar flexion is greater in sprinting than in running.[20] The figure below illustrates the important need for plantar flexion and dorsiflexion during walking, running, and sprinting. The figure shows that for sprinting there needs to be 30° of plantar flexion available to sprint efficiently and effectively.[20]

Figure 1: Amount of ankle motion needed for walking, running and sprinting[20]



Effects of Ankle Tape on Performance

Athletics is all about mental and physical performance. If an athlete is unable to perform then they will be unsuccessful in their chosen sport. The application of tape on the ankle has been shown to have adverse effects on athletic performance. Two studies found that the vertical jump heights were significantly shorter when tape was applied. There were also a slower Southeast Missouri agility test (SEMO agility test) times, in seconds, with tape.[3,12] The SEMO agility test requires the participant to sidestep, back pedal and sprint forward through a series of cones. Metcalfe et al[3] stated that the reduction in performance may be attributed to the fact that each performance test was administered within 5 minutes of the tape application. This short time period did not allow for the tape to lose its supportive properties and allow for greater ranges of motion. Even though most athletes are taped prior to participation, giving the tape at least an hour of warm-ups to loosen up and allow for greater motion, there are times when athletic trainers have to apply tape in the middle of a game after an athlete "tweaks" their ankle. If this is the case, there is not time for the athlete to move around and have the tape stretch. If that athlete is put back in the game right away, the tape application may be the cause of a slower running speeds and agility, aspects of sports that are necessary in just about all sports. Athletes have said that they will avoid wearing adhesive ankle tape if they perceive that their performance will be diminished.[14,21] Hunt and Short[14] stated that the responses from athletes ranged from the tape restricting performance to having no effect on performance. Many athletes have the misconception that by taping their ankles they will be quicker and able to run faster because the tape will assist them in pushing off harder.

This can be important especially for basketball and soccer where agility and vertical jump are essential components of those sports. If the center on the basketball team is unable to jump to their fullest ability, they may not get as many rebounds or blocks, decreasing the effectiveness of their strengths. In soccer, it is necessary to be able to cut hard, change directions quickly, as well as have an acceptable vertical jump. If they can not make the necessary move to fake a defender they may not get in the position they need to take a shot or make a pass. Likewise, if the forward is unable to fully jump they may come up short on a game winning header.

Other studies have found that tape application significantly reduced athletic performance when plantar flexion of the ankle was required.[3] This restriction of range of motion can adversely affect performance in running and jumping activities.[22] In sports such as softball and baseball where little lateral movement is required and more forward running and jumping is required, it is essential for these athletes to have the necessary motion in the sagittal plane while still providing the necessary support in the coronal plane. Volleyball is another sport where plantar flexion is important to maintain. There is still a great amount of lateral movement, especially on defense, but when a hitter is jumping to hit the ball, they need to know that they will have all the force they need to jump as high as possible. If they can not jump to their fullest extent it may disrupt the timing to strike the ball causing it to go out or a miss-hit that makes it easier for the opposition to make a defensive play and possibly score.

Summary

Ankle injuries are the most common injury in athletics. The most common form of treatment used by athletic trainers is taping and bracing ankles to allow the athletes to return to activity as quickly as possible. It is proposed that by limiting the range of motion of the ankle it decreases the probability of having an ankle injury. Other studies reported that the tape provides greater amounts of proprioception, which in turn allows the extrinsic muscles to perform more efficiently in stabilizing the subtalar and talocrural joints. The increased proprioception allows the peroneal muscles to activate in the event of sudden inversion. The tape has been shown to decrease the velocity of inversion which also gives the peroneals time to fire and stabilize the joint.

Ankle taping has many different components that have specific functions. The different components of the ankle tape application serve many purposes to limit the motion of the subtalar and talocrural joints, which is perceived to decrease the incidence of ankle injuries. The stirrups apply a lateral force to the subtalar joint to prevent supination of the calcaneus. The heel locks and horse shoes pull the ankle into dorsiflexion as well as stabilize the subtalar joint into a neutral or slightly pronated position.

One area that has failed to be studied thoroughly is the effects of ankle taping on performance, including straight ahead running. Some studies have found a decrease in agility and vertical jump while the ankle is supported by tape or a brace. There are still inconsistencies within the research regarding the effects on performance. Straight ahead running is a primary component of sports such as baseball and softball, where being one step, or even half a step, can determine the outcome of a game. Some research found that

up to 56° of plantar flexion is needed for running efficiently and that full plantar flexion is needed to achieve maximal running speed.

CHAPTER THREE

METHODS

Participants

Twenty-eight individuals were recruited on a volunteer basis for participation in the study. The participants included current collegiate athletes from Barry University. For recruitment purposes, flyers were be placed around the athletic department of Barry University containing general information on the study as well as contact information of the researcher. The researcher then met with each participant to pass out information on the research study being conducted as well as verbally explained the process. The information included contact information for the researcher to allow the participants to set up an appointment for a pre-participation screening. All participants must be free of lower extremity injury to participate in the study. Additionally, each participant should be physically and medically able to run six, twenty yard sprints on two separate days. All participants read and signed an informed consent form before participation the study.

Pre-participation Screening

All participants filled out a demographic form including, age, height, weight, and previous medical history as well as sign the informed consent form. Each participant accepted to the study chose two days to perform the testing sessions.

Procedures

This study used a measurement of time in seconds as an indicator of running speed. Range of motion (ROM) measurements were taken to determine amount of plantar flexion and dorsiflexion of the ankle joint. Participants were instructed to wear gym shorts and running shoes to allow for comfort and ease while running. Once the demographic information was collected and examined, those participants meeting criteria set-up dates to perform the testing sessions. If the participant did not meet the inclusion criteria, they were excluded from participation due to delimitations of the research study. Participants were instructed to warm-up prior to the study examination. The warm-up included jogging two laps around the soccer practice field, having the researcher stretch their hamstrings, quadriceps, and gastro-soleus complex. The participants were read the instructions for the study. Ankle dorsiflexion and plantar flexion were measured prior to running. The lateral malleolus, fibula, and fifth metatarsal were identified as the major landmarks for goniometric measurements. The goniometer was properly positioned using the identified markings. The participant was then placed in a neutral position by the examiner. Next, they actively dorsiflexed the ankle joint to the fullest extent. The researcher stabilized the goniometer while measured the participant's degree of active ankle dorsiflexion. The participant was returned to neutral by the researcher. They were then told to fully plantar flex the ankle while the examiner stabilized the goniometer and measured the degree of active plantar flexion. The range of motion measurements were repeated bilaterally.

Following baseline range of motion measurements the participants were instructed on the sprinting protocol. They began from a standing start at a predetermined point on the field.

They were instructed to run through the line twenty yards away. This was repeated two more times to have a baseline running time. One day the participant was taped with one and a half inch Johnson-Johnson white athletic tape and on the second day they were partially taped with one and a half inch Johnson-Johnson white athletic tape then had two inch The Kendal Company Sher-Light stretch tape applied for the heel locks and figure eight portions of the taping procedure. The tape application was applied bilaterally.

The participants then performed the same sprinting routine as they did prior to being taped. They began from a standing start at a predetermined point on the field. They were instructed to run through the line twenty yards away. This was repeated two more times to have the running times while taped. The same procedures listed above were used on the second day with the second type of tape.

All data was recorded both on paper and electronically and kept in a secure location for the remainder of the study. After a three year period, all confidential documents will be properly destroyed and discarded.

Taping Protocols

White Tape Application

The application of tape followed the standard ankle tape protocol as defined by William Prentice in Arnheim's Principles of Athletic Training.[7] To begin the tape application procedure, the ankle was thoroughly cleaned and shaved of all hair on the foot and ankle. A thin layer of Tuf-skin liquid adherent made by Cramer Products was sprayed on smoothly over the area to be taped. Heel and lace pads with skin-lube, both by Cramer Producs, were applied to the anterior portion of the ankle over the distal talofibular joint

and the distal third of the Achilles tendon. The heel lace pads are used to decrease friction from the tape and limit the number of blisters and cuts from the tape. A layer of pre-wrap was applied starting from the mid-foot and ending half way to the distal end of the gastronemeus muscle bellies. Two anchors were placed over the lower leg approximately 5 or 6 inches above the malleolus and one over around the instep directly over the styloid process of the fifth metatarsal. Apply the first stirrup strip posteriorly to the malleolus and attach it to the ankle anchor. The strips were placed on the medial side and pulled laterally. The horseshoe was applied by placing it directly under the malleolus and attach it to the foot anchor. In an alternating series, two more stirrup strips and horseshoes on the ankle with each piece of tape overlapping at least half of the preceding strip. Two heel locks were applied by starting high on the instep, bringing the tape along the ankle at a slight angle, hooking the heel, leading under the arch, then coming up on the opposite side, and finishing at the starting point. Tear the tape to complete half of the heel lock. Repeat this on the opposite side of the ankle. This was repeated once more to have two heel locks on either side of the ankle. One figure eight was applied starting on the sinus tarsi angled toward the medial aspect of the foot, wrapping around the mid-foot, over the anterior side of the ankle around the medial side of the lower leg then around the posterior aspect and lateral aspect of the lower leg then ended at the anterior ankle joint. Then closing strips were applied distal to proximal overlapping by one half the width of the tape and one closing strip was placed over the mid-foot. One final closing anchor was place around the instep of the foot and covered the styloid process of the fifth metatarsal. This procedure was repeated identically on the opposite ankle.

Stretch Tape Application

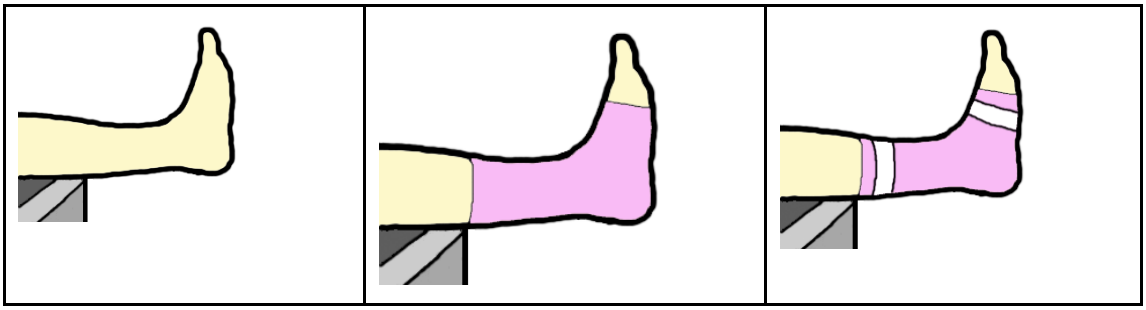
The application of tape followed the standard ankle tape protocol as defined by William Prentice in Arnheim's Principles of Athletic Training.[7] To begin the tape application procedure, the ankle was thoroughly cleaned and shaved of all hair on the foot and ankle. A thin layer of Tuf-skin liquid adherent made by Cramer Products was sprayed on smoothly over the area to be taped. Heel and lace pads with skin-lube, both by Cramer Producs, were applied to the anterior portion of the ankle over the distal talofibular joint and the distal third of the Achilles tendon. The heel lace pads are used to decrease friction from the tape and limit the number of blisters and cuts from the tape. A layer of pre-wrap was applied starting from the mid-foot and ending half way to the distal end of the gastronemeus muscle bellies. Two anchors were placed over the lower leg approximately 5 or 6 inches above the malleolus and one over around the instep directly over the styloid process of the fifth metatarsal. Apply the first stirrup strip posteriorly to the malleolus and attach it to the ankle anchor. The strips were placed on the medial side and pulled laterally. The horseshoe was applied by placing it directly under the malleolus and attached it to the foot anchor. In an alternating series, two more stirrup strips and horseshoes were applied on the ankle with each piece of tape overlapping at least half of the preceding strip. At this point, two inch stretch tape was used for the heel locks and figure eights. Start the stretch tape in a medial-to-lateral direction around the midfoot and continue it in a figure-eight patter to above the lateral malleolus. Continue to stretch tape across the midfood, then across the heel. The heel lock began on the anterior portion of the ankle joint wraps toward the medial side of the leg then over the distal aspect of the posterior surface of the lower leg and around the lateral surface of the heel then up to the medial side of the mid-foot, back over the anterior portion of the ankle joint, down the

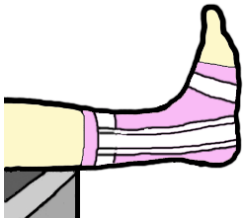
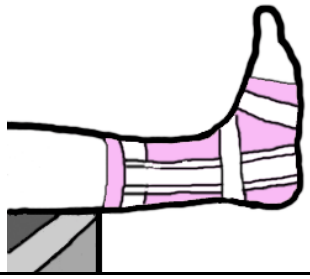
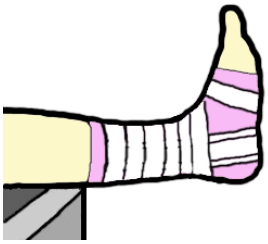
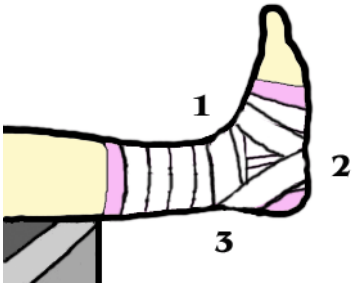
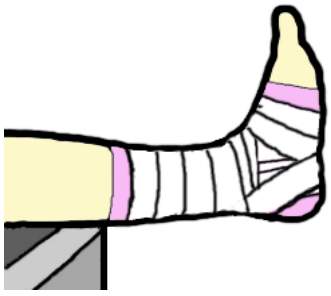
lateral side the lower leg wrapping around the medial surface of the heel, up around the lateral mid-foot and back to end at the anterior surface of the ankle joint. These two portions were repeated once more with stretch tape. Continue with a spiral pattern toward the proximal anchor filling the space up to the anchor. Closing strips were applied with one and a half inch athletic tape over the lower leg at the site of the original anchors as well as over the instep of the foot over the styloid process of the fifth metatarsal.

Materials and Instruments

All measures of ankle motion were performed with a clear plastic universal goniometer with 1° increments. To ensure accuracy, only Johnson-Johnson one and a half inch athletic tape, Cramer tuf-skin, heel and lace pads, skin lub and pre-wrap, and Kendall sher-light stretch tape were used for all tape applications. The same Timex stop watch was used to record time for the running protocols.

Figure 2: Step by Step illustration of ankle taping[23]



Step 1 Place athlete on table. Spray ankle area with adhesive spray. Have athlete pull toe back so foot is at a 90 degree angle and point toes slightly outward.	**Step 2** Pre-wrap ankle from mid-calf to just past the mid-foot.	**Step 3** Using 1.5" athletic tape, place anchor strip at the base of the gastrocnemius (calf). Be sure to angle slightly upward. Place another anchor strip around medial arch on foot – loosely.
		
Step 4 Place 3 stirrups longitudinally around ankle joint. Start on inside of foot, pull snug on outside as you fasten at the top.	**Step 5** Place 3 horseshoe strips at base of lower leg around ankle joint – just above the heel.	**Step 6** Cover stirrups with more strips around lower leg. Be sure to maintain upward angle. Be sure to tear tape after each rotation to avoid circulation problems.
		
Step 7 Apply heel locks. Start tape at 1 (top of ankle), around to 2 (base of heel bone) and around to 3 (back of heel/Achilles' tendon). Then continue to 1– 2– 3 again. Do this 1 more time, tearing tape each time. Be careful not to go too low on the foot or too high on the ankle.	**Step 8** Place more strips around to secure heel locks. Check for gaps and cover them with strips. Be sure there are no significant folds in tape to avoid blistering or cuts.	

Study Design Analysis

The participants received both types of tape on two separate days. The order of the type of tape was randomly assigned to each participant. One day they were taped with one and a half inch white athletic tape and on the other day the heel locks and figure-8's were applied with two inch stretch tape. A pre-test and post-test measurement was also performed on each participant, and the results were analyzed and compared once the study is completed.

A multivariate analysis of variance (MANOVA) was used to determine statistical significance ($p<0.05$). It compared the pre-test and post-test measurements for ankle range of motion, plantar flexion and dorsiflexion, and running time for the two types of tape. If a significant MANOVA is found, a univariate analysis will be performed.

CHAPTER FOUR

RESULTS

Twenty-eight athletes participated in this study. The participants consisted of ten males and eighteen females. The average age of the participants was 20.96 years. All participants were athletes during the 2007-2008 academic year and varied from freshman to senior athletes. The participants consisted of seven softball players, two men's basketball players, six women's basketball players, four baseball players, three women's soccer players, four men's soccer players, and two rowers. All participants took part in the study on a volunteer basis and could elect to cease all activities at any time.

A repeated measures multiple analysis of variance (MANOVA) was performed with three conditions: baseline application (BL), white tape application (WT), and stretch tape application (ST). Each analysis evaluated the effects of each application on each of the dependent variable: bilateral ankle range of motion (ROM), plantar flexion and dorsiflexion, as well as running time. Table 1 illustrates the mean values for each dependent variable for the baseline on day one and white tape.

The repeated measures MANOVA found a significant multivariate difference between the baseline and white tape application $F(5,23)=922.08$, $p<0.001$. Therefore univariate tests were completed. There were significant differences between baseline and white tape for all dependent variables (left plantar flexion: $F(1,27)=54.825$, $p<0.001$, right plantar flexion: $F(1,27)=46.623$, $p<0.001$, left dorsiflexion: $F(1,27)=60.854$, $p<0.001$, right dorsiflexion: $F(1,27)=68.437$, $p<0.001$, sprint time: $F(1,27)=9.936$, $p=0.004$).

Table 1: Mean ROM and sprit time for BL and WT

Variable	Mean	Standard Deviation
BL left plantar flexion	60.6°	9.1
WT left plantar flexion	46.1°	8.2
BL right planter flexion	60.2°	9.3
WT right plantar flexion	49.8°	6.2
BL left dorsiflexion	10.7°	5.2
WT left dorsiflexion	3.6°	4.8
BL right dorsiflexion	11.1°	5.2
WT right dorsiflexion	4.8°	5.9
BL time (sec)	3.35	0.31
WT time (sec)	3.39	0.34

Note: BL = Baseline, WT = White Tape

Table 2 illustrates the mean values for each dependent variable for the baseline on day two and the stretch tape. The repeated measures MANOVA found a significant multivariate difference between the baseline and the stretch tape application ($F(5,23)=718.35$, $p<0.001$). Therefore univariate tests were completed to determine significance for each dependent variable. There were significant differences between the baseline and stretch tape application for left and right plantar flexion and dorsiflexion but

not for the sprint time (left planter flexion: $F(1,27)=14.118$, $p=0.001$, right plantar flexion: $F(1,27)=36.566$, $p<0.001$, left dorsiflexion: $F(1,27)=25.135$, $p<0.001$, right dorsiflexion: $F(1,27)=23.622$, $p<0.001$, sprint time: $F(1,27)=1.760$, $p>0.05$).

Table 2: Mean ROM and sprint time for BL and ST

Variable	Mean	Standard Deviation
BL left plantar flexion	59.6°	8.8
ST left plantar flexion	54.5°	9.2
BL right planter flexion	60.4°	8.3
ST right plantar flexion	53.4°	7.8
BL left dorsiflexion	10.6°	6.0
ST left dorsiflexion	7.1°	5.5
BL right dorsiflexion	11.9°	4.9
ST right dorsiflexion	7.9°	5.6
BL time (sec)	3.35	0.31
ST time (sec)	3.38	0.35

Note: BL = Baseline, ST = Stretch Tape

Table 3 illustrates the mean values for each dependent variable for the white tape and the stretch tape. The repeated measures MANOVA found a significant multivariate difference between the white tape application and the stretch tape application ($F(5,23)=796.05$, $p<0.001$). Therefore univariate tests were completed to determine significance for each dependent variable. There were significant differences between the

white tape application and stretch tape application for left and right plantar flexion and dorsiflexion but not for the sprint time (left planter flexion: $F(1,27)=31.272$, $p=0.001$, right plantar flexion: $F(1,27)=13.192$, $p<0.001$, left dorsiflexion: $F(1,27)=17.246$, $p<0.001$, right dorsiflexion: $F(1,27)=15.648$, $p<0.001$, sprint time: $F(1,27)=.995$, $p>0.05$).

Table 3: Mean ROM and sprint times for WT and ST

Variable	Mean	Standard Deviation
WT left plantar flexion	46.1°	8.2
ST left plantar flexion	54.5°	9.2
WT right planter flexion	48.8°	6.2
ST right plantar flexion	53.4°	7.8
WT left dorsiflexion	3.6°	4.8
ST left dorsiflexion	7.1°	5.5
WT right dorsiflexion	4.8°	5.9
ST right dorsiflexion	7.9°	5.6
WT time (sec)	3.39	0.34
ST time (sec)	3.38	0.35

Note: WT = White Tape, ST = Stretch Tape

In summary, the results show that white tape significantly decreases running speed compared to the baseline. Stretch tape appeared to decrease running speed when compared to the baseline but it was not significant ($p>0.05$). Both the white tape and

stretch tape applications significantly decreased bilateral ankle plantar flexion and dorsiflexion with compared to the baseline. However, the range of motion was significantly decreased when the range of motion for white tape and stretch tape was compared. The second null hypothesis stated that there would be no change in ankle range of motion between no tape, white tape, and stretch tape. This was rejected because both applications of white tape and stretch tape significantly decreased bilateral ankle plantar flexion and dorsiflexion. Therefore the fourth research hypothesis, stating that stretch tape would have no affect on ankle plantar flexion and dorsiflexion, is rejected because stretch tape did significantly decrease ankle range of motion. The first three research hypotheses were that white tape would significantly decrease running speed, and increase sprint time, there would not be a significant change in sprint time when stretch tape was applied, and that white tape would significantly decrease ankle planter flexion and dorsiflexion. Each of these hypotheses are accepted because the results indicate a significant change in each corresponding analysis.

CHAPTER FIVE

DISCUSSION

Purpose of Study

The purpose of this study was to determine if a closed basket weave ankle taping decreases running speed in college athletes using different types of taping applications. It also identified if there was a difference in running speed when using stretch tape for the heel locks and figure eights in lieu of 1.5 inch white tape. Finally, this study identified the differences in ankle range of motion between the two types of tape. The dependent variables were bilateral ankle plantar flexion and dorsiflexion range of motion and twenty yard sprint time.

Results Related to the Hypotheses

The results of the study indicate that both stretch tape and white tape significantly decrease bilateral ankle plantar flexion and dorsiflexion range of motion compared to baseline range of motion. There was also a significant decrease in sprinting time for the white tape when compared with the baseline measures, however, stretch tape did not significantly increase sprint time from the baseline measures. When stretch tape and white tape are compared to each other, the restriction of the range of motion for white tape was significantly greater for bilateral ankle planter flexion and dorsiflexion than that of stretch tape, even though there was not a significant difference in sprint times between the white tape and stretch tape measures.

There were a number of research questions that these results must answer. The basic questions are whether there is a difference in ankle range of motion when using

stretch tape for the heel locks and figure eight and whether there is a decrease in ankle range of motion with 1.5 inch white tape for the entire tape application in plantar flexion and dorsiflexion. Both of these questions can be answered with one statement, yes. The application of both stretch tape and white tape significantly decreases ankle range of motion in plantar flexion and dorsiflexion. Although, further analysis reveals that white tape provides a significantly greater decrease in motion than stretch tape. This indicates to athletic trainers that if the purpose of the ankle tape application is to limit ankle range of motion and provide the most support possible, then white tape is the better option.

Does a closed basket weave ankle taping with white athletic tape and stretch tape decrease running speed (increase sprint time) in a 20 yard dash for collegiate athletes? White tape was shown to significantly increase sprint time in a twenty yard sprint whereas stretch tape did not have a significant increase in sprint time. When the two types of tape were compared it was revealed that there was not a significant difference in sprint times between white tape and stretch tape. One explanation for the significant difference in sprint times with the application of white tape could be that the trials were performed within three minutes of being taped. This short time period did not allow for the tape to lose its initial restrictive properties and provided the greatest amount of resistance.

In the sport of softball the difference in the sprint times may be significant by causing a base runner to be safe or out. Softball is, as well as many other sports, a game of inches. If the average time from when the ball is hit to when the fielder throws it to the first baseman is roughly three seconds. If an athlete can run from home to first in 2.8 seconds then they would be safe. If the athletic trainer decided that this individual needs

to be taped, then it will increase their sprint time to 3.2 seconds. In the sport of softball that means the athlete will be called out and ineffective as a baserunner.

Application and Past Research

These results are very important to athletic trainers when deciding what type of tape to use for any particular athlete or injury. If there is a need for greater support of the ankle joint then white tape should be used because of the significantly less range of motion allowed by this application. This will inhibit the athlete's sprinting abilities, but not significantly more than stretch tape. Even though stretch tape sprint time was not significantly slower than no tape application sprint times, these sprint times were not significantly faster than white tape sprint times. Therefore, if support for the ankle is needed white tape is suggested for the extra support. The use of stretch tape would be acceptable if the athlete prefers the feeling of having their ankles taped but do not need the full support of white tape and they also want to maintain a faster running speed.

In a previous study conducted by Paris et al, the application of white tape decreased ankle plantar flexion by 56% that was found to be a statistically significant decrease in ankle plantar flexion.[2] The current study had a 25% decrease in ankle range of motion. There are many reasons why there is such a difference between Paris et al and this study. The first being the type of athletic tape used. This study used Johnson & Johnson 1½" athletic tape, which may not be as strong as the type of tape Paris et al used. Another explanation may be the amount of forced used during the application of tape and tightness applied by the researcher. This study has similar findings to that of Lohrer et al,[9] who stated that the application of ankle prophylactics significantly decreased ankle

plantar flexion and dorsiflexion. One study found that ankle plantar flexion decreased by 10-14° immediately following the application of ankle taping.[18] The results of this study had equivalent findings with the average decrease in ankle planter flexion with the white tape application being 13°. This decrease in range of motion could be the reason that white tape significantly increased sprint time. With stretch tape, the average decrease in ankle plantar flexion was 6°. The decrease in ankle range of motion with the use of the stretch tape application was only half that of white tape may be the reason that there was not a significant decrease in sprint times with this tape application.

In a study conducted on the psychological effects of ankle taping participants stated that they do not like having their ankles taped because it felt too restricting, stiff, and uncomfortable.[14] Many of the participants in this present study stated that they did not like the feeling of white tape for those same reasons. They stated that it was tight and uncomfortable but that the stretch tape felt better because they believed it to be less restrictive and did not dig into their ankles as much. One participant did state that during the third sprint with the white tape on it felt a little better as if it was loosening up but it was still not as comfortable as the stretch tape.

Metcalfe et al[3] concluded that one possible explanation for the decrease in performance was because each performance test were administered within five minutes of the tape application. This study was conducted in a similar manner by having the participants perform the sprinting protocol within five minutes of having the tape applied to their ankles. Hume and Gerrard[22] stated that the restriction of range of motion can adversely affect performance in running activities. This study found the statement made

by Hume and Gerrard to be true. The significant decrease in ankle range of motion with white tape may have played a large role in the increased sprint times.

Even though stretch tape significantly decreased ankle range of motion following the application, there was still enough motion to allow for the participants to maintain efficient sprinting kinematics. Norkin and White[4] found that it is necessary to have 30° of plantar flexion at heel strike and as much as 56° of plantar flexion during toe off while sprinting. The average amount of planter flexion with stretch tape for this study was 53.93°, which is only a 3° difference for Norkin and White's conclusion. Given that there was no significant decrease in running speed with stretch tape, it can be inferred that the amount of ankle restriction with stretch tape, although statistically significant, may not be as significant when applied in the athletic and clinical setting.

Study Limitations

There are limitations that affected this study that can be considered for further research.

1. Short time period between tape application and sprinting trials did not allow for adjustment for the athlete.
2. The tape application was performed outdoors, often in windy conditions, not allowing for the amount of Tuff-Skin to be consistent between each participant. The tape should be applied indoors under a more controlled setting.

Recommendations for Future Research

This study introduced a number of other possible research opportunities that can be examined in the future. These are:

1. Replicate this study with longer distances for running to determine if the tape application decreased sprint time (eg. A 40 yard dash, which is a standard in many field sports). This information would be valuable because softball is one of the few sports where the athletes only sprint twenty yards. Other sports sprint anywhere from thirty to over a hundred yards.
2. Replicate this study with other types of tape such as moleskin and Elastikon. These two types of tape are commonly used in acute ankle injuries for their superior strength and restrictive abilities.
3. Perform a similar study observing gender differences. The mechanics between males and females may be different during a sprint as well as any adjustments made with the application of ankle tape.
4. Design a similar study to investigate the effects of tape over long distance running. Distance running has different aspects of biomechanics and the tape application has different restrictive properties after fifteen minutes.
5. Design a similar study to examine the biomechanical effects of tape application with both white tape and stretch tape. This would allow for researchers to determine if the tape application changes the biomechanics of sprinting.
6. Design a similar study to examine the differences between using a lace up brace comparing it to the application of tape. This would allow clinicians to be better educated about what support to use for their athletes.

Conclusion

This study suggested that a closed basket weave ankle tape application significantly decreases ankle range of motion in the sagittal plane, plantar flexion and dorsiflexion, when both white tape and stretch tape are used. The results of this study illustrate that the application of white tape significantly increased sprint times whereas the application of stretch tape did not increase sprint times significantly. It can be concluded that if support is needed for the ankle joint then white tape should be used over stretch tape. White tape provides significantly greater support than stretch tape but does not inhibit sprinting performance significantly more than stretch tape. Which ever taping application is used, the athlete will be slower than without tape. Even though stretch tape was not significantly slower than no tape, it is not significantly faster than white tape. Therefore if ankle support is required, white tape is suggested to provide the greatest support and protection for the ankle joint. The study was conducted following a certain protocol that did not take into consideration the pathology to dealing with an injury. The physiologic effects of an ankle injury need to be taken into consideration by athletic trainers when deciding what type of tape would be most beneficial to allow the athlete to participate.

APPENDICES

APPENDIX A

IRB Letter of Approval

BARRY
UNIVERSITY
OFFICE OF THE PROVOST
INSTITUTIONAL REVIEW BOARD

11300 NE Second Avenue
Miami Shores, FL 33161-6695
phone 305-899-3020
toll free 800-756-6000, ext. 3020
fax 305-899-3026
www.barry.edu

Research with Human Subjects
Protocol Review

Date: May 29, 2008

Protocol Number: 080414
Title: The Effects of Two Types of Ankle Tape on Ankle Range of Motion and Running Speed

Meeting Date: May 20, 2008

Researcher Name: Samuel J. Eisen
Address: 2775 NE 187`h St. #202 W
Aventura, FL33180

Faculty Sponsor: Dr. Sue Shapiro
School: Human Performance and Leisure Science

Dear Mr. Eisen:

On behalf of the Barry University Institutional Review Board (IRB), I have verified that the specific changes requested by the convened IRB on May 20, 2008 have been made. It is the IRB's judgment that the rights and welfare of the individuals who may be asked to participate in this study will be respected; that the proposed research, including the process of obtaining informed consent, will be conducted in a manner consistent with requirements and that the potential benefits to participants and to others warrant the risks participants may choose to incur. You may therefore proceed with data collection.

As principal investigator of this protocol, it is your responsibility to make sure that this study is conducted as approved by the IRB. Any modifications to the protocol or consent form, initiated by you or by the sponsor, will require prior approval, which you may request by completing a protocol modification form.

It is a condition of this approval that you report promptly to the IRB any serious, unanticipated adverse events experienced by participants in the course of this research, whether or not they are directly related to the study protocol. These adverse events include, but may not be limited to, any experience that is fatal or immediately life-threatening, is permanently disabling, requires (or prolongs) inpatient hospitalization, or is a congenital anomaly cancer or overdose.
The approval granted expires on May 1, 2009. Should you wish to maintain this protocol in an active status beyond that date, you will need to provide the IRB, with and IRB Application for Continuing Review (Progress Report) summarizing study results to date. The IRB will request a progress' report from you approximately three months before the anniversary date of your current approval.

If you have questions about these procedures, or need any additional assistance from the IRB, please call the IRB point of contact, Mrs. Barbara Cook at (305)899-3020 or send an e-mail to dparkhurst(&mail.barry.edu . Finally, please review your professional liability insurance to make sure your coverage includes the activities in this study.

Sincerely,

Doreen C. Parkhurst, M.D., FACEP
Chair Institutional Review Board
Assistant Dean, SGMS & Program Director, PA Program Barry University
Box SGMS
11300 NE 2nd Avenue Miami Shores, FL 33161

cc: «Sponsor»
****

Note: The investigator will be solely responsible and strictly accountable for any deviation from or failure to follow the research protocol as approved and will hold Barry University harmless from all claims against it arising from said deviation or failure.

APPENDIX B

Flyer

NOW SEEKING 30
BARRY UNIVERSITY ATHLETES
TO PARTICIPATE
IN A RESEARCH STUDY

This study will investigate the effects of two types of ankle tape on running speed and ankle range of motion.

Interested athletes should be injury free to their lower body, willing to run 6, 20 yard sprints on two separate days. The testing session will take approximately 45 minutes each day.

If interested, please contact:

Sam Eisen ATC, LAT
Graduate Assistant Athletic Trainer
336-213-0831
or in the
Barry University
Athletic Training Room

APPENDIX C

Consent Form

Barry University

Informed Consent Form

Your participation in a research project is requested. The title of the study is "The effects of two types of ankle tapings on ankle range of motion and running speed". The research is being conducted by Samuel Eisen ATC, LAT, a graduate student in the Human Performance and Leisure Science department at Barry University, and is seeking information that will be useful in the field of athletic training. The aims of the research are is to determine if a closed basket weave ankle taping decreases running speed in college athletes. It will also identify if there is a difference in running speed when using stretch tape for the heel locks and figure eights in lieu of 1.5 inch white tape. Finally, this study will identify the differences in range of motion resulting from the two types of tape. We anticipate the number of participants to be 30. In accordance with these aims, the following procedures will be used: you must be free of any injury to your legs, knees, ankles, or feet. Those participants with an injury will be disqualified from the study. Participants will warm-up by jogging around the soccer field two times. They will then have their hamstrings, quadriceps, hip flexors, and calves stretched by the investigator to insure proper stretching technique. Ankle range of motion will then be measured using a standard goniometer placed on the outside of the ankle. There will be no pain during the measurement process. You will then be asked to perform three, twenty yard sprints at full speed on the field. You will have both ankles taped with either all standard athletic tape or with two inch stretch tape depending on what the researcher chooses for that day. Your range of motion will measured once again and then you will perform three more twenty yard sprints. This will conclude the study for that day. The participant will return on another day to be tested with the other form of tape. The same procedures will be followed on this day.

If you decide to participate in this research, you will be asked to do the following: on one day, you will have either stretch tape or white, athletic tape applied for the second sprinting session. On the second day you will have the other type of tape applied to both of your ankles before running the second set of sprints. You will be instructed to warm-up and stretched by the investigator 15 minutes prior to participation to prevent injury. The range of motion measurements will take 2 minutes for both ankles. An additional 3 minutes will be given to allow the participant to regain energy prior to sprinting. Only plantar flexion and dorsiflexion measurements will be taken. The sprinting protocol will take approximately 5 minutes to allow for a one minute rest period between each sprint to reduce the effect of fatigue. It will take another 5 minutes to tape both ankles. Range of motion measurements will be taken again that will last 3 minutes. The final sprinting protocol will take 5 minutes as well. The entire procedure will last no more than 45 minutes each day.

Your consent to be a research participant is strictly voluntary and should you decline to participate or should you choose to drop out at any time during the study, there will be no adverse effects on your current status on your sports team or level of care given in the athletic training room.

The risks of involvement in this study are minimal and include muscle strains and

ankle sprains. The following procedures will be used to minimize these risks: proper warm-up and stretching by the investigator to minimize the risk of muscle strains and the running area will be inspected and free of any objects that may cause injury. If injured, participants will receive treatment in the athletic training room. Although there are no direct benefits to you, your participation in this study may help our understanding of whether or not different types of tape allow athletes to maintain their full running speed.

As a research participant, information you provide will be held in confidence to the extent permitted by law. Any published results of the research will refer to group averages only and no names will be used in the study. An identification number will be given to every participant prior to beginning the test session. Data will be kept in a locked file in the researcher's office. Your signed consent form will be kept separate from the data to ensure confidentiality. All data will be destroyed after 3 years.

If you have any questions or concerns regarding the study or your participation in the study, you may contact me, Sam Eisen, at (336) 213-0831, my supervisor, Dr. Shapiro, at (305) 899-3574, or the Institutional Review Board point of contact, Mrs. Barbara Cook, at (305)899-3020. If you are satisfied with the information provided and are willing to participate in this research, please signify your consent by signing this consent form.

Sincerely,

Samuel Eisen	Dr. Sue Shapiro
Researcher	*Supervisor*

Voluntary Consent

I acknowledge that I have been informed of the nature and purposes of this experiment by Samuel Eisen ATC, LAT and that I have read and understand the information presented above, and that I have received a copy of this form for my records. I give my voluntary consent to participate in this experiment.

_____

Signature of Participant

_____

Researcher

APPENDIX D

Pre-Participation Questionnaire

Pre-participation Questionnaire

Identification Number: _____ Age: _____

Sex: _____

1. **What sport do you play?**

2. **Do you run on a regular basis?**

   No _____ Yes _____

3. **Have you ever had your ankle taped?**

   No _____ Yes _____

4. **Do you tape your ankles before any athletic activity?**

   No _____ Yes _____

5. **If so, do you prefer white tape or stretch tape? Why?**

6. **Have you had an injury to either of your legs, knees, or ankles?**

   No _____ Yes _____

7. **Are you currently recovering from an injury to your lower extremities?**

   No _____ Yes _____

8. **Do you feel comfortable running with and without both of your ankles taped?**

No _____ Yes _____

APPENDIX E

Data Collection Sheet

Data Collection Sheet

Identification Number: _____ Age: _____

Sex: _____

Baseline Measurements

Range of Motion **Running Time**

Goniometer **Trial 1: _____ seconds**

Dorsiflexion: Left _____ Right _____ **Trial 2: _____ seconds**

Plantar flexion: Left _____ Right _____ **Trial 3: _____ seconds**

Range of Motion **Running Time**

Goniometer **Trial 1: _____ seconds**

Dorsiflexion: Left _____ Right _____ **Trial 2: _____ seconds**

Plantar flexion: Left _____ Right _____ **Trial 3: _____ seconds**

Taped Measurements

White Tape

Range of Motion **Running Time**

Goniometer **Trial 1: _____ seconds**

Dorsiflexion: Left _____ Right _____ **Trial 2: _____ seconds**

Plantar flexion: Left _____ Right _____ **Trial 3: _____ seconds**

Stretch Tape

Range of Motion

Goniometer

Dorsiflexion: Left _____ Right _____

Plantar flexion: Left _____ Right _____

Running Time

Trial 1: _____ seconds

Trial 2: _____ seconds

Trial 3: _____ seconds

APPENDIX F

Contact Information Sheet

Contact Information Sheet (for scheduling purposes only)

ID No.	Name	Email	Phone
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