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**ANKLE PROPHYLACTIC INTERVENTIONS IN DIVISION III MALE AND  
FEMALE BASKETBALL ATHLETES**

by  
David C. Seeberger, ATC

A Thesis

Submitted to the  
Department of Educational Services, Administration, & Higher Education  
College of Education  
In partial fulfillment of the requirement  
For the degree of  
Master of Arts in Higher Education Administration  
at  
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Thesis Chair: Burton R. Sisco, Ed.D.

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## **ABSTRACT**

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ANKLE PROPHYLACTIC INTERVENTIONS IN DIVISION III MALE AND  
FEMALE BASKETBALL ATHLETES

2011/12

Burton R. Sisco, Ed.D.  
Master of Arts in Higher Education Administration

Prophylactic ankle taping has been considered the basis of lateral ankle injury prevention and has been used at all levels of sport competition. An alternative to ankle taping is a semirigid reusable ankle brace. This study compared the incidence of ankle sprains in Division III collegiate basketball players during a 4 week period. Each subject was randomly selected to one of four groups which include a taping group, bracing group, PowerTape® group, and rehabilitation group. The purpose of this study was to prospectively compare ankle taping, bracing, PowerTaping, and rehabilitation for the prevention of ankle sprains. A total of 25 men and women basketball players were followed up for a 4 week period, 5 ankle sprains occurred with no lateral ankle injuries occurring in either of the PowerTape® groups. There were no statistically significant differences in the incidence of ankle sprains between the 4 groups. Findings of the survey data revealed that subjects reported having no performance deficits in basketball drills, athletic performance, and muscle performance.

## **ACKNOWLEDGEMENTS**

I would like to thank my colleagues and the student-athletes of the basketball teams of Rowan University for their contributions to a study that may help in the prevention of lateral ankle sprains in the future. I would also like to thank my girlfriend, family, and friends for supporting me through this process.

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## **Chapter I**

### **Introduction**

Ankle sprains are one of the most common injuries among athletes who participate in sports that have a high demand of sudden changes in body direction, and strenuous acceleration and deceleration of the body. When ankle sprains occur, the anterior talofibular ligament is the most commonly injured followed by the calcaneofibular ligament. The majority of inversion ankle sprains occur with the foot in plantarflexion, thereby placing greatest strain upon the anterior talofibular ligament (Kadikia & Haddad, 2003). Two of the most frequently encountered residual symptoms of ankle sprains include feelings of ankle joint instability, and reported episodes of giving way (O'Driscoll, Kerin, & Delahunt, 2011). Since these injuries have such a high occurrence rate, institutions across the nation have implemented prophylactic actions to decrease the occurrence and severity of ankle inversion injuries. One such action is prophylactic ankle taping. Prophylactic ankle taping has been considered the core of ankle injury prevention and has been used at all levels of collegiate sports. An alternative to ankle taping is a semirigid ankle support brace that can be worn again and again.

Another preventative ankle sprain intervention is a stronger type of tape, Andover PowerTape™. Andover PowerTape™ is a cohesive athletic tape that sticks only to itself or to PowerFlex® creating the strongest combination taping system. An additional intervention is preventative ankle strengthening and balance training

exercises. Balance and coordination training are common components of intervention programs for the prevention and treatment of acute lateral ankle sprains and chronic ankle instability (McKeon & Hertel, 2008). Traditionally, balance training has been used as part of the rehabilitation program for ankle inversion sprain injuries, but more recently, balance training has been conducted to try and prevent injuries to the ankle and knee during sport (Hrysomallis, 2007).

### **Statement of the Problem**

It has been estimated that over 25,000 ankle sprains occur per day in the United States, and ankle sprains have been shown to account for 10% to 15% of all injuries sustained in American football (Mickel et al., 2006). For that reason, researchers are attempting to better understand what methods best prevent lateral ankle injuries. These methods include prophylactic ankle taping, power taping, bracing, and balance training.

### **Purpose of the Study**

The purpose of this study was to prospectively compare Swede-O Easy Lok® Ankle Brace, traditional Johnson and Johnson® ankle taping, Andover PowerTape™, and balance training for the prevention of ankle sprains in Division III college basketball players over the course of a 4 week period. A secondary purpose was to assess which preventative ankle protocol technique was preferred by student athletes participating in the study.

### **Significance of the Study**

The review of the literature indicated that there has never been a comparison of traditional ankle taping, power taping, semirigid ankle bracing, and balance training in

Division III collegiate basketball and lacrosse players. In addition, there is a paucity of studies on the comparison of ankle taping to bracing as well as the use of Andover PowerTape™ and balance training. Controversy still exists in regards to the best method of lateral ankle injury prevention. Athletic trainers argue that prophylactic ankle taping or bracing is the best and most effective method to the prevention of such injuries. Conversely, others believe that proprioceptive and balance exercises are by far the best treatment option in the prevention of lateral ankle sprains.

### **Assumptions and Limitations**

This study assumes that subjects who wore semirigid ankle braces did so during all practices and games. It is also assumed that the ankle braced subjects did not remove their ankle braces during physical activity. The study assumes that subjects who wore ankle taping or power taping did not remove the ankle tapings during practices or games as well. This study also assumes that the instruments used measured the intended construct, and the sample size participating was representative of the entire population.

Small sample size of the representative population, short time period for the study's completion, and Rowan University ankle brace supply are limitations of the study. Rowan University has a strict budget for supplies, thus each subject would only receive one ankle brace. Consequently, this meant that each subject in the ankle taping group would only receive one ankle taping for each exposure. There may also be researcher bias due to athletic trainer to student-athlete relationship.

### **Operational Definitions**

1. Dorsiflexion: Flexion or bending toward the extensor aspect of the foot.

2. Eversion: A turning outward or inside out, such as a turning of the foot outward at the ankle.
3. Inversion: A turning inward, such as a turning of the foot inward at the ankle.
4. Kinesthesia: The sensation of position, movement, tension, and so on of parts of the body as perceived through nerve end organs in the muscles, tendons, and joints.
5. Lateral Ankle Sprain: A common musculoskeletal injury in which the ligaments on the outside of the ankle partially or completely tear due to sudden stretching.
6. Plantar Flexion: Extension or bending toward the flexor aspect of the foot.
7. Prophylaxis: A measure taken for the prevention of a disease or condition, such as ankle sprains.
8. Proprioception: The unconscious perception of movement and spatial orientation arising from stimuli within the body itself.
9. Pes Cavus: A human foot type in which the sole of the foot is distinctly hollow when weight bearing also known as high arch.
10. Pes Planus: A human foot type in which the arch of the foot collapses with the entire sole of the foot coming into complete contact with the ground also known as flat feet.

## **Research Questions**

This study investigated the following two questions:

1. What is the most effective method in preventing lateral ankle sprains for basketball and lacrosse players, ankle taping, bracing, power taping, or rehab balance training?
2. Does either ankle taping, bracing, power taping, or balance training have an effect on athletic performance?

To investigate the quantitative purpose of this study, the following hypotheses were observed:

Hypothesis 1: Balance and ankle proprioceptive training will be the most effective method in the prevention of lateral ankle sprains.

Hypothesis 2: Neither traditional ankle taping, semirigid ankle bracing, power taping, nor rehab balance training will have an effect on the subject's athletic performance.

## **Overview of the Study**

Chapter II offers a substantive review of relevant and current literature considered important to the study. It provides an explanation on the biomechanics of the ankle joint, effects of prophylactic ankle taping and bracing, the effects of prophylactic balance and strength rehabilitation, the effects of ankle stabilizers on proprioception and balance, taping and bracing effects on athletic performance, and cost efficacy of ankle taping and bracing.

Chapter III demonstrates the procedures and methodologies utilized in the study. Included in this chapter are the context of the study, population, sample size,

data collection instruments, the process of data collection, and a collected data analysis.

Chapter IV presents the findings or results of this study based upon the research questions. This section summarizes results, using tables, graphs, and/or charts and it provides an explanation and discussion of the contents of all tables, graphs, and/or charts that may have been used.

Chapter V discusses the major findings in the study and how they relate to the literature review. This final section concludes the report with recommendations for practice and further research.

## **Chapter II**

### **Review of the Literature**

#### **Biomechanics of the Ankle Joint**

The anterior talofibular ligament which blends with the anterior capsule of the ankle, spans the anterior later ankle joint (Hintermann, 1999). The posterior talofibular ligament takes origin from the medial surface of the lateral malleolus and courses medially in a horizontal fashion to the posterior aspect of the talus (Hintermann, 1999). The calcaneofibular ligament's attachment on the anterior edge of the distal fibula is centered from the distal tip just below the origin of the anterior talofibular ligament (Hintermann, 1999).

The ankle joint receives its primary support from an array of ligaments that lie medially, laterally, posteriorly, and superiorly to the joint (Russell et al., 2008). Hintermann (1999) states that each of the lateral ligaments has a role in stabilizing the ankle and/or subtalar joint, depending on the position of the foot. In dorsiflexion, the posterior talofibular ligament is maximally stressed and the calcaneofibular ligament is taut, whereas the anterior talofibular ligament is loose (Hintermann, 1999). This movement places the ankle into its most stable position, when the trochlea of the talus and the articular surfaces of the tibia and fibula are close-packed (Russell et al., 2008). Conversely, in plantarflexion the anterior talofibular ligament is taut, and the calcaneofibular and posterior talofibular ligaments become loose (Hintermann, 1999). Hintermann (1999) found that motion between the tibia and the foot is a complex

combination of ankle and subtalar motion limited by osseous shape and soft tissue interaction. It has been recognized that ankle motion does not occur about one axis alone; rather, ankle motion combines dorsiflexion and plantarflexion with slight internal and external rotation and some anterior/posterior translation of the talus on the tibia (Hintermann, 1999).

It has been shown that loss of the anterior talofibular and/or calcaneofibular ligaments leads to a measurable increase in inversion without any tilting of the talus or subtalar gapping (Hintermann, 1999). It has also been shown that loss of anterior talofibular ligament function does allow for an increase in external rotation of the leg. Hintermann (1999) states that the loss of anterior talofibular restraint unlocks the subtalar joint, allowing further inversion. It is this increase in inversion that may lead to symptomatic instability (Hintermann, 1999).

According to Russell, McEwan, Koutedakis, and Wyon (2008) the ankle, or talocrural joint, is a trochoid synovial joint. Though it is often considered a hinge, or ginglymus joint, several authors indicate that its axis is more complicated than a simple uniaxial hinge (Russell et al., 2008). The distal tibia and fibula form the joint's box-like mortise; this is an area rather than a specific anatomical structure (Russell et al., 2008). The three articular surfaces of the ankle mortise are medial, the lateral portion of the medial malleolus, superior, the tibial plafond, and lateral, the medial surface of the lateral malleolus (Russell et al., 2008).

In a recent study (Russell et al., 2008) found that motion at the ankle depends on how forces are applied to the levers of the skeleton. Dorsiflexion while weight bearing creates a fulcrum where the heel rests on the floor (Russell et al., 2008). This



is a second class lever system because the force of the dorsiflexors is exerted forward of the resistance (Russell et al., 2008). Consider the situation of using an elastic resistance band to develop plantar flexion strength. The fulcrum is the talocrural joint, the resistance is applied on the plantar forefoot, and the force of the triceps surae acts on the calcaneus (Russell et al., 2008).

Stoffel, Nicholls, Winata, Dempsey, Boyle, and Lloyd (2010) found that by limiting motion at the ankle, taping increased mechanical stability at the joint. Use of taping reduced ankle adduction or abduction range of motion for running and sidestepping tasks (Stoffel et al., 2010). Similarly, inversion or eversion range of motion and peak inversion angle were reduced for the run trials but yielded no significant change for sidestepping (Stoffel et al., 2010). Stoffel et al (2010) found that use of taping also resulted in significant reductions in knee and ankle joint loads during planned tasks. The nature of this effect may be in part mechanical because the results indicate a reduction in ankle dorsiflexion/plantarflexion range of motion during both planned and unplanned taped trials (Stoffel et al., 2010). Ankle taping reduced the peak ankle inversion angle by 16%, thereby decreasing the potential for inversion trauma, which accounts for 75% of ligament strain injuries (Stoffel et al., 2010).

There is a risk of injury to the ankle during landings, and the kinematics and forces involved in different landing strategies may be related to the occurrence of trauma. The stiff-knee plantar flexors had slightly lower vertical forces than the bent-knee natural plantar flexor drops (Self & Paine, 2001). This indicates that during normal landings, the body does not maximize the energy-absorbing characteristics of the ankle plantar flexors (Self & Paine, 2001). Since the knees may be prepared to

bend more during the bent-knee natural drops, the gastrocnemius may not be firing fully because it will not be in an optimum position once the knees bend (Self & Paine, 2001). Because the gastrocnemius is a two joint muscle, it becomes more slack when the knee is bent (Self & Paine, 2001). During the stiff-knee drops, the subjects plantar flexed more when instructed to absorb the impact energy through their toes (Self & Paine, 2001). Self and Paine (2001) found that the data showed that this results in a softer landing, both in maximum acceleration and in peak force, than the other drop strategies.

### **Effects of Prophylactic Ankle Taping and Bracing**

Prophylactic ankle taping and bracing has been considered the foundation of lateral ankle injury prevention and is used at all levels of competitive sports. Because of the high occurrence of these injuries, many sports organizations have applied preventative measures in an attempt to lower the occurrence and severity of inversion ankle injuries. Ankle inversion sprains are the most common injuries in sports and occur during plantar flexion and inversion of the foot (Mohammadi, 2007). However, controversy continues to exist with regards to the best method of treatment and prevention of these injuries whether it would be taping or bracing. Mickel et al. (2006) found that a semirigid ankle stabilizer used for prevention of ankle sprains in high school football athletes was equivalent to prophylactic taping. There is sufficient evidence supporting the argument that the currently used methods of ankle sprain prophylaxis, namely taping or bracing, provide a significantly better measure of lateral ankle sprain prevention in comparison with no preventive measures (Mickel et al., 2006).

Kadokia and Haddad (2003) found that the data support the use of a semirigid orthosis over a cloth brace, neoprene brace, or taping for long term control of inversion and eversion motion during athletic activity. Although limited by a small number of injured players, inability to control variations in strength training, and proprioceptive training, the study demonstrates a statistically significant decrease in the incidence of recurrent ankle sprains with the use of prophylactic taping (Kadokia & Haddad, 2003). Semirigid orthotic support has been examined and found a statistically significant reduction in the incidence of recurrent ankle sprains (Kadokia & Haddad, 2003). The data strongly suggest that bracing is effective in the prevention of recurrent sprains and may provide superior performance in comparison to taping (Kadokia & Haddad, 2003).

### **Effects of Prophylactic Balance and Strength Rehabilitation**

Proprioception, a sensory modality of joint movement and position, is important in postural control. Based on the links between stabilometric performance and decrease ankle sprain through improved neuromuscular control and mechanical support (Dai, Sorensen, & Gillette, 2010). Dai et al (2010) found that balance training could improve stabilometric performance as well as reducing incidence rate of ankle sprains. One potential cause for high injury rates in preseason could be the detraining effects of a postseason break which decreased athletes' balance control (Dai et al., 2010). The results indicated that after one month postseason break, although standing times, center of pressure areas, medial/lateral center of pressure standard deviation, and overall center of pressure standard deviation parameters remained similar, subjects demonstrated relatively larger anterior/posterior postural sway magnitude and faster postural sway velocities and to maintain balance (Dai et al., 2010). After one month

postseason break, decreases in training resulted in decreased posture controlling ability and the decreases in balance control were detected by the more sensitive center of pressure velocity and some center of pressure displacement parameters (Dai et al., 2010). Dai et al (2010) discovered that the decrease in stabilometric performance suggests possible increased risk factors of ankle sprain after postseason break.

McHugh, Tyler, Mirabella, Mullaney, and Nicholas (2007) found that the stability pad was successful in reducing injury incidence by 77%, thereby eliminating the risk associated with a previous ankle sprain and/or a high body mass index (BMI). The results of this study are in agreement with previous studies showing reductions in ankle sprains after a balance training intervention (McHugh et al., 2007). McHugh's et al (2007) rationale was that stability pad training would improve proprioception and/or improve proximal control of body mass, thereby avoiding an inversion ankle injury. The stability pad training was an easily implemented intervention that proved very effective in reducing the incidence of noncontact inversion ankle sprains in high school football players (McHugh et al., 2007).

O'Driscoll, Kerin, and Delahunt (2011) found that a dynamic 6 week neuromuscular training program resulted in improvements in a number of sensorimotor insufficiencies that have been associated with chronic ankle instability. Following completion of the 6 week training program, the athlete improved on all three Star Excursion Balance Test reach directions (O'Driscoll et al., 2011). The results indicate that the 6 week dynamic neuromuscular training program reduced the angle of ankle joint plantar flexion upon initial contact during jump landing, and the second initial ground contact during the drop vertical jump task (O'Driscoll et al., 2011). The 6

week dynamic neuromuscular training program improved parameters of ankle joint sensorimotor control and subjective function in an athlete with chronic ankle instability (O'Driscoll et al., 2011).

McKeon and Hertel (2008) found that the preventative effects were most apparent in those with a history of ankle sprains and in those with 2 consecutive years of balance training. In those with a history of ankle sprains, balance training was associated with relative risk reductions for recurrent ankle sprains of up to 60% (McKeon & Hertel, 2008). The study demonstrated a 54% to 76% reduction in the risk of recurrent ankle sprains after balance and coordination training for the treatment of an acute ankle sprain (McKeon & Hertel, 2008). Completing as least 6 weeks of balance and coordination training during recovery from an acute ankle sprain substantially reduce the risk of recurrent ankle sprain for up to 1 year (McKeon & Hertel, 2008).

Hrysomallis (2007) found that low balance ability was significantly associated with an increased risk of ankle injury. Balance training, as a part of a multifaceted intervention, has been shown to significantly reduce the number of ankle or knee injuries in team handball, volleyball, and recreational athletes (Hrysomallis, 2007). It also appears that balance training, as a single intervention, is probably not as effective for injury prevention as when it is part of a multifaceted intervention (Hrysomallis, 2007).

Proprioceptive training is important in ankle rehabilitation, noting that ankles which are not proprioceptively trained prior to activity resumption could have an increased risk of reinjury (McKnight & Armstrong, 1997). Proprioceptive

rehabilitation does need to be emphasized; however, a requisite amount of strength must also be maintained (McKnight & Armstrong, 1997). McKnight and Armstrong (1997) found no significant differences in ankle active range of motion, strength, or work measurements in subjects with normal ankles, those with functional ankle instability, and those with histories of functional ankle instability who had been through formal proprioceptive rehabilitation.

### **Ankle Taping and Bracing Effects on Proprioception and Balance**

Ankle proprioception is widely considered as an important factor that can help in the prevention of ankle injuries. Proprioceptive and balance training is a crucial part of preventing lateral ankle injury. It usually includes exercises on equipment such as balance boards, ankle disks, and tilt boards. Proprioceptive training was an effective strategy in reducing the rate of ankle sprains among male soccer players who suffered ankle sprain compared with no intervention (Mohammadi, 2007).

Ankle taping and bracing can also have an effect on proprioceptive and balance training. The procedure of ankle taping includes having the patient in dorsiflexion and eversion of the ankle which is thought to facilitate more proprioception in the ankle. Ankle bracing keeps the athlete's foot in a neutral position and has straps to pull the foot into eversion which has proprioceptive advantages as well as taping. In a more recent study (Barkoukis, Sykaras, Costa, & Tsorbatzoudis, 2002) found that the perceived effectiveness of the stabilizer (taping or bracing) did not significantly predict balance or left deviation. Ankle brace use has been reported to increase proprioception or to have no effect on ankle kinaesthesia or balance (Hume & Gerrard, 1998). Even though there was no statistically significant difference between the control and tape

conditions in the current study, tape seemed to have a positive effect during the beginning of soccer specific treadmill protocol and balance exercises (Lohkamp, Craven, Walker-Johnson, & Greig, 2009).

### **Effects of Ankle Stabilizers on Athletic Performance**

Many researchers believe that prophylactic ankle taping and bracing does not hinder athletic performance. If preventative taping or bracing did affect athletic performance negatively, athletes would be noncompliant with wearing tape or a brace. Therefore, athletic trainers would see a significant increase in the number of lateral ankle sprains during the course of the year. The impact on athletic performance is a critical consideration when choosing ankle support devices for competitive athletes. External support has been reported to have no effect on performance in jumping, sprint, or shuttle activities or to have an adverse effect on performance in running and jumping activities dependent upon the brace or tape tested (Hume & Gerrard, 1998). On the contrary, Bot, Verhagen, and van Mechelen (2003) found that ankle bracing or taping in healthy subjects had no or only a minor effect on athletic performance including vertical jump height, running speed, broad jump, and agility. However, in subjects with previously unstable ankles an ankle support may improve agility (Bot et al., 2003).

External ankle support may affect ankle muscular strength either positively or negatively. During the process of ankle taping and bracing, there is some loss of range of motion in the ankle which may affect the muscles of the ankle to contract to their maximum potential. However, the effects on ankle muscular strength during taping are insignificant to the prevention of lateral ankle sprains. Ankle braces have been

variously reported to have no effect on peak torque strength (strength in producing a rotation about the ankle joint) at the ankle joint complex and to limit peak torque strength (Hume & Gerrard, 1998). Hopper, McNair, and Elliot (1999) found that the use of an ankle brace can lead to specific changes in gastrocnemius, peroneal, and tibialis anterior muscle activity. Conversely, these changes were not of a magnitude to influence the position of the foot at landing (Hopper et al., 1999).

Hunt and Short (2006) found that athletes who had not sustained an ankle injury were the only athletes to comment on the psychological effects of adhesive ankle tape, comments that included the tape making them feel more confident. The other athletes who had sustained an ankle injury during their collegiate athletic careers focused on the injured area and how the tape specifically made their ankle feel (Hunt & Short, 2006). In a recent study (Hunt & Short, 2006) showed a progression in psychological responses from a negative view to a positive view (i.e., tape restricts performance for those recently injured to helps performance for those with a past injury) (Hunt & Short, 2006). It is also interesting to note that athletes who had not sustained an ankle injury during their participation as a college athlete responded that the tape had no effect on their performance, yet they still continue to tape (Hunt & Short, 2006).

Sanioglu, Ergun, Erkmén, Taskin, Goktepe, and Kaplan (2009) found that taekwondo athletes' performances in plantar flexion and dorsiflexion isokinetic strength at 60 and 180°/s were not significantly affected by ankle taping despite a decrease in performance. The study also revealed a significant decrease in vertical jump performance between the un-taped and taped ankles (Sanioglu et al., 2009).



There were no significant differences in ankle plantarflexion and dorsiflexion torque production when ankles were taped (Sanioglu et al., 2009). In contrast with these findings, no significant differences were found in the performance of vertical or long jump among any of the experimental treatments (Sanioglu et al., 2009).

### **Ankle Injuries Between Dominant and Nondominant Legs**

It has been shown that athletes place different demands on the left and right limbs and most athletes place a greater demand on the dominant limb (Knight & Weimer, 2011). Research has demonstrated that among elite soccer players, the knee flexors of the dominant leg were significantly weaker than those of the nondominant leg and that the quadriceps of the dominant leg is injured more frequently than the quadriceps of the nondominant leg (Knight & Weimer, 2011). These differences between the dominant and nondominant limb suggest that athletes place different demands on and even rely on one limb more than the other, which may lead to injury (Knight & Weimer, 2011).

Since prior research has demonstrated that the ankle of the dominant limb may be sprained more frequently than the ankle of the nondominant limb, and the peroneus longus is a key component in the prevention of lateral ankle sprains (Knight & Weimer, 2011). A potential explanation for why some researchers found that the dominant ankle is sprained more frequently may lie in the behavior of the peroneus longus (Knight & Weimer, 2011). Specifically, the different demands placed on the dominant and nondominant limbs could cause a difference in the latency of the peroneus longus between the 2 limbs (Knight & Weimer, 2011).

Knight and Weimer (2011) found that the peroneus longus of the nondominant limb had a significantly shorter latency than that of the dominant limb. This increase in latency of the peroneus longus of the dominant limb may help explain why some researchers have found that the dominant ankle is injured at a significantly higher rate than the nondominant ankle (Knight & Weimer, 2011). It has been established that different demands are placed on the dominant and nondominant legs and that the dominant leg may be placed in positions that would lead to a lateral ankle sprain more frequently than the nondominant leg (Knight & Weimer, 2011).

Knight and Weimer (2011) discovered that because the peroneus longus provides the primary active defense against a lateral ankle sprain, the quicker this muscle is activated after the ankle is forced into inversion, the greater the chance it has at preventing or attenuating the rate at which a lateral ankle sprain occurs. In a current study, Knight and Weimer (2011) found that the latency of the peroneus longus of the dominant limb was more than 10 milliseconds greater than the latency of the peroneus longus of the nondominant limb. This finding aids in the investigation of why the ankle of the dominant limb may be sprained more frequently than the ankle of the nondominant limb (Knight & Weimer, 2011).

### **Ankle Taping Versus Bracing Cost**

Taping has been criticized for loosening with prolonged physical activity, and it has been shown that it loses its support after sweating. Mickel et al. (2006) found that there is an obvious loosening of the tape within 10 minutes of application. Another issue with regards to taping is the routine of using tape to help stabilize the ankle is expensive related to the materials used such as the tape, pre-wrap, adhesive spray, and

heel and lace pads. Ankle taping is also somewhat time consuming to the athletic trainer with each ankle taping averaging about 2 minutes in duration. Taping both ankles for the duration of the season required an average of 3 hours and 14 minutes, while applying the orthosis took minimal time. Furthermore, the cost of taping each ankle during the course of the season was \$40.01, while the cost of the orthosis was \$28.00 (Mickel et al., 2006).

While prophylactic bracing and taping for the prevention of ankle sprains seem similar in their efficacy, bracing can save time and money for a high school football team over the course of a season (Levitan, 2005). For these reasons, a number of ankle braces have been developed. These braces can be applied by the athlete, retightened during activity, and present a onetime cost to the athlete or athletic department.

### **Summary of the Literature Review**

This literature review provides a significant foundation for arguments pertaining to the use of ankle taping, ankle bracing, ankle power taping, and ankle balance training and its effects on athletic performance and proprioception. The expense of ankle taping compared to bracing is also a chief concern amongst athletic training professionals.

Many different perceptions exist on the correct treatment or prevention protocol for lateral ankle sprains. Researchers still have not found the best method of treatment and prevention of lateral ankle sprains. Therefore, more research is needed on the effectiveness of ankle taping, ankle power taping, ankle bracing, and ankle balance training in prevention of lateral ankle sprains.

## **Chapter III**

### **Methodology**

#### **Context of the Study**

This study was conducted at Rowan University located in Glassboro, New Jersey. Rowan University consists of more than 11,000 undergraduate and graduate students who can select a major from 80 undergraduate majors, 55 master's degree programs and a doctoral program in educational leadership. The university is divided into six academic colleges including business, communication, education, engineering, fine & performing arts and liberal arts & sciences (Rowan University: From Normal to Extraordinary, ¶ 19).

Rowan University consists of approximately 500 student athletes who participate in 1 of 16 Division III collegiate sports. Of those 500 student athletes, there are about 25 men and women basketball players. One athletic director, five assistant athletic directors, two athletic secretaries, one equipment manager, two sports information directors, two certified athletic trainers, and approximately 50 coaches make up Rowan University Athletic Department (Rowan University: Rowan Athletics).

#### **Population and Sampling**

The target population for this study was all Rowan University student athletes between the ages of 18-22. The available population was 14 male basketball athletes and 11 female basketball athletes between the ages of 18-22. A combination of

purposive and simple random sampling was used to select Rowan University basketball athletes. Each subject has had no prior history of ankle injuries within 2 years. Moreover, none of the subjects had a history of foot surgery and foot fractures. Each subject was clinically examined by a certified athletic trainer to determine the stability and any complaints of the subject's ankle.

Each athlete was randomly assigned to 1 of 4 different study groups. These groups include a taping group, bracing group, power taping group, and rehabilitation group. After being fitted for the ankle brace and receiving verbal instructions on its application and use, all of the participants in the brace group had to demonstrate proper application of their ankle brace to me or another certified athletic trainer. Subjects in the rehabilitation group were shown Thera-Band® ankle strength exercises, and balance exercises using a foam pad or DynaDisc®. These subjects performed these balance and strength exercises before each practice and game.

## **Materials**

For the taping group, a modified closed basket weave technique of taping, with two heel locks and one figure-eight was applied before each practice and game. The subjects were sitting with foot in dorsiflexion and eversion. The foot and the ankle were wrapped with foam pre-wrap, then the anchors, the support, and the lock strips were applied with white Johnson & Johnson athletic tape. The same taping techniques and patient positioning was used for the Andover PowerTape™ group. The Swede-O Easy Lok® Ankle Brace was a lace-up, boot style stabilizer which consisted of two figure-eight straps, a full elastic back, and a heavy duty top strap that locks the figure-eight straps in position for a secure fit. Thera-Band® exercise bands, DynaDisc®, and

foam pads were used for the rehabilitation group. The ankle taping, bracing, and balance and strength training were performed on the subject's dominant ankle.

### **Data Collection Instruments**

The number of ankle sprains and exposures (practices and games) were recorded in a Microsoft Excel (Appendix D) worksheet and the incidence of the outcome was calculated. If the subjects participated for the day, a check was written under that specific date next to his or her appropriate player number. If the subjects sustained a lateral ankle injury, a triangle was placed accordingly. Lastly, subjects who did not participate due to an ankle injury, an X was written accordingly.

The instrument used to assess the effects of ankle taping, bracing, or power taping on athletic performance was short, close ended questionnaire created from the discussions and findings of the literature review. The items on the questionnaire were gathered from Barkoukis et al. (2002) who studied the effectiveness of ankle stabilizers on balance as well as Hume and Gerrard (1998) who examined ankle brace effects on proprioception and balance. Hume and Gerrard (1998) also evaluated ankle stabilizers in jumping, sprint, and shuttle activities. Bot et al. (2003) studied effects on vertical jump height, running speed, broad jump, and agility.

The 30-item questionnaire (Appendix C) presented questions to determine the basketball athletes' feelings on the effects of ankle taping, bracing, or power taping on basketball drills, athletic performance, and muscle performance. No errors or problems of understanding of the questions were reported and the allotted time of 10 minutes was not exceeded. Member checking was utilized to ensure that the given responses were the intended responses. In order to determine the validity and

reliability of the survey, field test surveys were distributed to athletes, who were trustworthy in returning the survey within a couple of days, one week into the data collection period.

### **Data Gathering Procedures**

Prior to the collection of any data, an Institutional Research Board application was completed and approved (Appendix A). All subjects completed and returned informed consent forms (Appendix B). No personally identifiable information on specific subjects was used in the study with the exception of a spreadsheet that was used to select the simple random sample. Selected subjects were assigned to one of four groups including the taping, bracing, power taping, and rehabilitation groups, and the subjects were identified in these groups as Player 1, Player 2, Player 3, and so on.

Permission was obtained from each subject to collect data using the taping, bracing, power taping, and balance training effects on athletic performance survey. The surveys were distributed to the subjects and returned back to the researcher at the end of practice on a date later assigned.

### **Data Analysis**

The data were collected to identify which prophylactic method, ankle taping, ankle bracing, ankle power taping, or ankle rehabilitation was most effective in preventing lateral ankle sprains. The data were also collected in a manner that allowed for the determination of injury exposure, and for the purpose of calculating incidence, the total number of exposures for each group served as the denominator and the number sprains in those groups served as the numerator. These percentages were utilized to determine the number of ankle sprains per ten exposures to injury. Survey

data were analyzed using the PASW computer program. Data were entered into the program to discover the mean score for each survey question and percentage to each response for the questions in the survey.



## Chapter IV

### Findings

#### Profile of the Sample

Twenty-five subjects were enrolled in the study. During the preparticipation screening, the population of 25 individuals had 3 male subjects with previous ankle injuries, and 2 female subjects with a prior history of ankle injuries. All subjects had normal clinical examinations as determined by me, and therefore, none of these subjects were excluded from participation in the study. All subjects participated in the study to its completion with no subjects dropping out during the study. Table 4.1 references the sample demographics of the subjects in the study.

Table 4.1

#### *Sample Demographics*

Value	(N=25) <i>f</i>	%
Sex		
Male	14	56%
Female	11	44%
Grade Level		
Freshman	5	20%
Sophomore	8	32%
Junior	5	20%
Senior	7	28%
Enrollment Status		
Full Time	25	100%
Part Time	0	0%
Racial/Ethnic Group		
White	18	72%
Black/African American	6	24%

Asian/Pacific Islander	1	4%
Native American Indian/Native Alaskan	0	0%
Other	0	0%
Multiple Responses	0	0%
Age		
18 or under	2	8%
19	5	20%
20	3	12%
21	9	36%
22/over	6	24%
College of Major		
Education	11	44%
Business	5	20%
Communication	2	8%
Engineering	0	0%
Liberal Arts & Sciences	4	16%
Fine & Performing Arts	3	12%
Multiple Responses	0	0%

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### **Analysis of the Data**

Research Question 1: What is the most effective method in preventing lateral ankle sprains for basketball players; ankle taping, bracing, power taping, or rehab balance training?

Table 4.2 contains results of the male subjects by intervention group. Table 4.3 contains results of the female subjects by intervention group. Looking at Table 4.2 and 4.3, it appears that ankle PowerTape® is the most effective way to prevent lateral ankle injuries compared to ankle taping, bracing, and rehab balance training.

Table 4.2

*Male Intervention Group*

Variable	Intervention groups			
	Tape	PowerTape®	Brace	Rehab
n	3	4	3	4
Ankle sprains	1	0	0	0
Exposures*/group	81	108	83	102
Sprains/10 exposures	.12	0.0	0.0	0.0

\*Exposure = each practice or game in which the subject participated.

Table 4.3

*Female Intervention Group Results (n=11)*

Variable	Intervention groups			
	Tape	PowerTape®	Brace	Rehab
n	3	2	3	3
Ankle sprains	1	0	1	2
Exposures*/group	67	54	78	75
Sprains/ 10 exposures	.15	0.0	.13	.27

\*Exposure = each practice or game in which the subject participated.

Further analysis of the data determined that there were a total of 374 exposures in the male subject's group, and a total of 274 exposures in the female subject's group. There were 5 documented ankle injuries throughout the 4 weeks in the overall study population, 1 in the male tape group, 1 in the female tape group, 1 in the female brace group, and 2 in the rehab balance training group. All 5 injuries were determined to be Grade I lateral ligamentous sprains.

There were no clinically evident fractures or high ankle sprains (disruption of the inferior tibiofibular syndesmosis) in either group. The overall rate of ankle sprains

for men, regardless of the method of prophylaxis, was .03 per 10 exposures. The overall rate of ankle sprains for women was .15 per 10 exposures.

The male tape group displayed a mean average of .12 ankle sprains per 10 exposures compared with 0.0 sprains in the other intervention groups. The female tape group displayed a mean average of .15 ankle sprains per 10 exposures compared with .13 sprains in the brace group and .27 sprains in the rehab group.

My previous study data displayed the quantity of lateral ankle sprains and how effectively the ankle interventions prevented lateral ankle injuries. That data revealed that over a 4 week period, PowerTape® ankle taping was more effective at preventing lateral ankle sprains than Johnson & Johnson® ankle taping, ankle bracing, and balance rehabilitation training. The following survey data demonstrates the subjects' perceptions of ankle interventions on their performance including basketball drills, athletic performance, and muscle performance.

Research Question 2: Does either ankle taping, bracing, power taping, or balance training have an effect on athletic performance?

Table 4.4 contains results of perceived positive or negative effects on basketball drill performance. Table 4.5 contains perceived results of ankle intervention effects on athletic performance. Table 4.6 includes results of subjects' perceived effects on muscle performance while wearing the ankle interventions. Looking at Tables 4.4, 4.5, and 4.6 it appears that neither ankle taping, PowerTaping, bracing, nor rehab balance training had a negative impact on any form of athletic performance.

Table 4.4

*Ranking of Basketball Drill Performance*

	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Planting with intervention foot <i>N</i> =25, <i>M</i> =4.24, <i>SD</i> =.597	0	0%	0	0%	2	8%	15	60%	8	32%
Performing jump stops <i>N</i> =25, <i>M</i> =4.04, <i>SD</i> =.676	0	0%	0	0%	5	20%	14	56%	6	24%
Sprinting the length of the court <i>N</i> =25, <i>M</i> =4.04, <i>SD</i> =.735	0	0%	0	0%	6	24%	12	48%	7	28%
Performing a vertical jump <i>N</i> =25, <i>M</i> =4.04, <i>SD</i> =.735	0	0%	0	0%	6	24%	12	48%	7	28%
Curling around a pick <i>N</i> =25, <i>M</i> =3.72, <i>SD</i> =.792	0	0%	2	8%	6	24%	14	56%	3	12%
Rebounding <i>N</i> =25, <i>M</i> =3.96, <i>SD</i> =.790	0	0%	1	4%	5	20%	13	52%	6	24%
Pivoting with intervention foot <i>N</i> =25, <i>M</i> =3.96, <i>SD</i> =.841	0	0%	1	4%	6	24%	11	44%	7	28%
Landing after jumping <i>N</i> =25, <i>M</i> =3.96, <i>SD</i> =.790	0	0%	0	0%	8	32%	10	40%	7	28%
Performing layups <i>N</i> =25, <i>M</i> =3.96, <i>SD</i> =.841	0	0%	0	0%	9	36%	8	32%	8	32%
Performing defensive slide <i>N</i> =25, <i>M</i> =3.92, <i>SD</i> =.862	0	0%	1	4%	7	28%	10	40%	7	28%
Ball handling <i>N</i> =25, <i>M</i> =3.92, <i>SD</i> =.862	0	0%	1	4%	7	28%	10	40%	7	28%
Decelerating after sprinting <i>N</i> =25, <i>M</i> =3.92, <i>SD</i> =.909	0	0%	1	4%	8	32%	8	32%	8	32%
Cutting to change direction <i>N</i> =25, <i>M</i> =3.88, <i>SD</i> =1.013	0	0%	3	12%	5	20%	9	36%	8	32%
Performing jab step with intervention ankle <i>N</i> =25, <i>M</i> =3.84, <i>SD</i> =.850	0	0%	1	4%	8	32%	10	40%	6	24%

Boxing out opposing player <i>N=25, M=3.80, SD=.816</i>	0	0%	1	4%	8	32%	11	44%	5	20%
Performing v-cut <i>N=25, M=3.76, SD=.879</i>	0	0%	2	8%	7	28%	11	44%	5	20%
Accelerating from stationary position <i>N=25, M=3.76, SD=.831</i>	0	0%	1	4%	9	36%	10	40%	5	20%

Table 4.5

*Ranking of Athletic Performance*

	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Agility <i>N=25, M=4.24, SD=.723</i>	0	0%	0	0%	4	16%	11	44%	10	40%
Quickness <i>N=25, M=4.12, SD=.927</i>	0	0%	1	4%	6	24%	7	28%	11	44%
Stops <i>N=25, M=4.00, SD=.866</i>	0	0%	1	4%	6	24%	10	40%	8	32%
Jumps <i>N=25, M=3.92, SD=.909</i>	0	0%	2	8%	5	20%	11	44%	7	28%
Speed <i>N=25, M=3.88, SD=.927</i>	0	0%	2	8%	6	24%	10	40%	7	28%
Balance <i>N=25, M=3.80, SD=.645</i>	0	0%	0	0%	8	32%	14	56%	3	12%
Turns <i>N=25, M=3.72, SD=.843</i>	0	0%	2	8%	7	28%	12	48%	4	16%

Table 4.6

*Ranking of Muscle Performance*

	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Muscle strength <i>N=25, M=4.04, SD=.790</i>	0	0%	0	0%	7	28%	10	40%	8	32%

Muscle endurance <i>N</i> =25, <i>M</i> =4.00, <i>SD</i> =.816	0	0%	1	4%	5	20%	12	48%	7	28%
Muscle power <i>N</i> =25, <i>M</i> =3.64, <i>SD</i> =.810	0	0%	2	8%	8	32%	12	48%	3	12%

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### **Basketball Drills**

Analysis of the survey data revealed that the majority of the subjects reported that none of the interventions had any effect on performing basketball drills. Fifteen subjects disagreed that their ankle intervention negatively affected their performance of planting with their intervention foot. Thirteen subjects described having absolutely no problems with rebounding with their ankle taping, PowerTaping, bracing, or balance rehab. The majority of subjects also reported disagreeing that performing jump stops had any effects on performing the task. In addition, the majority of subjects reported that their ankle intervention did not have any adverse effects on curling around a pick. None of the ankle interventions had perceived negative effects on basketball drills.

### **Athletic Performance**

Additional analysis of the survey data determined that the preponderance of the subjects either disagreed or strongly disagreed with having any negative effects on balance, quickness, agility, speed, turns, stops, and jumps. Twelve subjects reported disagreeing that their ankle intervention had negatively affected their performance of turns. The vast majority of subjects described having no problems with the performance of balancing. The majority also described having absolutely no problems with quickness or agility. Ankle interventions did not have perceived negative effects on athletic performance; therefore, athletes will not be apprehensive about using any of the interventions.

## **Muscle Performance**

Further analysis of the survey data revealed that ankle muscle performance was not affected by any of the ankle interventions. Seventy-two percent of the subjects disagreed with their ankle interventions having negative effects on ankle muscle strength. Approximately the same percent of subjects strongly disagreed or disagreed that ankle muscle endurance was affected by the ankle interventions. The majority of subjects believed that neither types of ankle intervention had any effect on ankle muscle power. There were no perceived negative effects on muscle performance in any of the intervention groups.



## **Chapter V**

### **Summary, Discussion, Conclusions, and Recommendations**

#### **Summary of the Study**

Ankle sprains are one of the most common injuries among athletes who participate in sports that have a high demand of sudden changes in body direction, and strenuous acceleration and deceleration of the body. Since these injuries have such a high occurrence rate, institutions across the nation have implemented prophylactic actions to decrease the occurrence and severity of ankle inversion injuries. One such action is prophylactic ankle taping. An alternative to ankle taping is a semirigid ankle support brace that can be worn again and again.

The purpose of this study was to prospectively compare ankle taping, PowerTaping, bracing, and rehab balance training for the prevention of ankle sprains in Division III college male and female basketball players over the course of a 4 week period.

A total of 25 men and women basketball players were followed up for 4 weeks, 5 ankle sprains occurred with no lateral ankle injuries occurring in either of the PowerTaping groups. Findings of the survey data revealed that the subjects reported having no performance deficit in basketball drills, athletic performance, and muscle performance.

## **Discussion of the Findings**

The results of my study demonstrate that PowerTape® used for the prevention of ankle sprains in Division III collegiate basketball players was superior to the other preventative ankle interventions. Furthermore, the overall rate of ankle sprains in college basketball players at Rowan University using either of the 4 preventative ankle interventions was 0.8 per 100 exposures.

Conversely, Mickel et al. (2006) discovered that a semirigid ankle stabilizer used for prevention of ankle sprains in high school football athletes was equivalent to prophylactic taping. Most studies have shown that braces prevent lateral ankle sprains more effectively than tape, but braces can also loosen and not provide the same support as when it is dry and first applied. This may be due to both tape and braces losing their integrity or structure when exposed to sweat. Subjects were not instructed to retighten the brace if it loosened during a practice or game. If this was done, there may have been no lateral ankle sprains in the bracing group.

Also, Dai et al. (2010) found that balance training could improve stabilometric performance as well as reducing incidence rate of ankle sprains. Proprioception balance training is the single most important factor for preventing lateral ankle sprains. Several studies show that it reduces the occurrence of ankle sprains. This is due to the firing of different ankle muscles to facilitate one's balance. Therefore, in theory, if a subject is about to "roll" their ankle, the muscles that evert the ankle will fire to help prevent the subject from suffering a lateral ankle sprain.

Contrary to the study's results, the balance group had the most sprains as compared to any other intervention groups. Those subjects who sprained their ankles

may have worn tape or braces previous to the study making them comfortable to the sensation of tape or brace on their ankle. Taping and bracing also gives the subject added proprioception since they become more aware of their ankle related to their body position when tape or braces are worn.

In opposition to my study where the balance training group had the highest occurrence of ankle sprains, most research indicates that a balance training regimen reduces the incidence of lateral ankle injuries. McHugh et al. (2007) found that the stability pad was successful in reducing injury incidence by 77%, thereby eliminating the risk associated with a previous ankle sprain. O'Driscoll et al. (2011) demonstrated that their results indicate that the 6 week dynamic neuromuscular training program reduced the angle of ankle joint plantar flexion upon initial contact during jump landing, and the second initial ground contact during the drop vertical jump task. The reduction of the angle of ankle joint plantar flexion is essential in preventing the occurrence of lateral ankle sprains. When the ankle joint is plantar flexed, the anterior talofibular ligament is most taut, and the ankle joint is no longer in its most compact form. This exposes the ankle joint to more easily invert, predisposing the anterior talofibular ligament to sprain.

Not performing data collection for longer period of time as suggested by O'Driscoll et al. (2011) could have contributed to a higher occurrence of ankle sprains in the balance rehab group. Hrysomallis (2007) found that low balance ability was significantly associated with an increased risk of ankle injury. It is possible that subjects in the balance rehab group had low balance ability since the 2 lateral ankle sprains that occurred, happened within the first week of the study. Performing a

balance training regimen for at least 6 weeks improves proprioception of the ankle, thereby reducing the occurrence of lateral ankle sprains.

If I had each one of the subjects in the balance rehab group perform a balance training program 6 weeks prior to starting the data collection and did not allow them to participate in practices or games, it is possible that when data collection started there may have not been any lateral ankle injuries in the balance rehab group. Ideally, the 6 week balance training regimen should be implemented before the beginning of the season to prevent subjects from missing practices or games unnecessarily.

The biomechanics of the ankle joint may have also contributed to the occurrence of lateral ankle sprains. Hintermann (1999) found that motion between the tibia and the foot is a complex combination of ankle and subtalar motion limited by osseous shape and soft tissue interaction. The limitation of motion in the ankle joint may be caused by two structural deformities of the ankle: pes cavus and pes planus. Pes cavus predisposes subjects to lateral ankle sprains since their foot and ankle are already in the position of inversion.

Both pes cavus and pes planus may predispose a subject to a wide variety of foot and ankle injuries including lateral ankle injuries. Subjects of the study were not screened for pes cavus or pes planus deformity before data collection began. Therefore, subjects who suffered lateral ankle sprains may have had pes cavus or pes planus and were more predisposed to lateral ankle injuries compared to the other subjects.

In addition, results of the study determined that there was no correlation between ankle intervention and its effect on the subjects. I found that subjects had no

performance deficit in balancing during practices or games. Barkoukis et al. (2002) found that the perceived effectiveness of the stabilizer did not significantly predict balance. This is in contradiction of other research that is in agreement of ankle interventions increasing proprioception in the ankle joint. Hume and Gerrard (1998) reported that ankle bracing use increased an athlete's ankle proprioception.

My study found that the vast majority of the subjects disagreed that any of the ankle interventions had a negative effect on basketball drill, athletic, or muscle performance. My study however, did not indicate for having positive effects on basketball drill, athletic, or muscle performance. In contrary, Lohkamp et al. (2009) discovered ankle taping had a positive effect during the beginning of soccer specific treadmill protocol and balance exercises.

Results of the study revealed that the subjects had no effects on athletic performance while wearing ankle tape, PowerTape®, or braces or performing balance training. Hume and Gerrard (1998) agreed that external support has been reported to have no effect on performance in jumping, sprint, or shuttle activities or to have an adverse effect on performance in running and jumping activities between ankle interventions.

The goal of athletic trainers is to do no further harm to the patient. Thus, if these types of ankle interventions did have negative effects on athletic performance, the athletic training profession would therefore, not use them during their practices or games. Any athlete who may perceive that taping or bracing had adverse effects on performance may remove these interventions, and not acquire the adequate support or

prophylactic measures for an injury they may have suffered, thus predisposing them to further injury.

Bot et al. (2003) refute that ankle bracing or taping had only minor effects on athletic performance including vertical jump height, running speed, broad jumps, and agility. This is due to the fact that taping and bracing does reduce and limit ankle range of motion also predisposing a subject to a lateral ankle injury. Taping and bracing do not allow the ankle full range of motion to get the most effective muscle performance for vertical jump height, running speed, broad jumps, and agility.

My study had a high rate of athletes reporting that the prophylactic ankle interventions had no effect on muscle performance in strength, endurance, or power. This collaborates with real world observations that any type of hindrance on athletic potential, the athlete is going to feel like he or she cannot perform to the best of their abilities, and therefore, will not wear tape or braces or perform balance training to prevent ankle injuries. Hume and Gerrard (1998) concur that ankle braces have no effect on peak torque strength at the ankle joint complex. On the contrary, Hopper et al. (1999) believe that the use of an ankle brace can lead to specific negative changes in gastrocnemius, peroneal, and tibialis anterior muscle activity.

## **Conclusions**

This is the first prospective, randomized comparison of taping, PowerTaping, bracing, and rehab balance training for the prevention of ankle sprains in Division III college basketball players to my knowledge. Each of the preventative interventions were well endured by the subjects. The incidence of ankle injuries was highest in the female rehab group with no ankle injuries occurring in either of the PowerTape®

groups. Based on the results of this study, college basketball programs may validate the use of semirigid ankle braces to decrease the occurrence of lateral ankle injuries.

PowerTape® may lower the percent of lateral ankle sprains not only in basketball players, but every other intercollegiate sport as well. Due to the stronger consistency and water repellent of PowerTape®, it can hold its integrity better, and aid in the prevention of lateral ankle sprains more effectively compared to traditional taping, bracing, and balance rehabilitation.

Traditional white athletic trainers tape is not water proof; therefore, it loses its integrity and does not provide ample support when it becomes saturated with sweat. Most ankle braces are made out of the same materials as clothing that expand when wet, and this does not provide ample ankle support when saturated with sweat as well. Balance rehabilitation training is theorized to aid in better proprioception of the ankle joint. However, it may be perceived that when wearing tape or a brace, it allows the subject to be aware of where their ankle is related to their body than compared to just balance training alone.

### **Recommendations for Practice**

Based upon my findings and conclusions, I recommend the following:

1. Athletic trainers use a combination of ankle interventions such as taping and bracing to help better prevent lateral ankle sprains than using just one intervention alone.
2. Athletic trainers should implement a “balance rehabilitation training before taping” policy after a lateral ankle injury to facilitate the prevention of lateral ankle sprains.

3. Athletic trainers should only purchase PowerTape® and not purchase ankle braces in order to save money.

### **Recommendations for Further Research**

Based upon my findings and conclusions, I recommend the following:

1. The study should be done over a longer period of time than compared to 4 weeks.
2. The study should allow for more subject participation.
3. The subjects should use the ankle interventions on both ankles.
4. The subject population should have no prior history of lateral ankle sprains.
5. The athletic trainer or other medical personnel should apply the brace on the ankle to ensure that is being put on correctly.



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**APPENDIX A**

Institutional Review Board Approval Letter



December 14, 2011

David Seeberger  
62 Tilford Road  
Somerdale, NJ 08083

Dear David Seeberger:

In accordance with the University's IRB policies and 45 CFR 46, the Federal Policy for the Protection of Human Subjects, I am pleased to inform you that the Rowan University Institutional Review Board (IRB) has approved your project:

IRB application number: 2012-127

Project Title: Ankle prophylactic Interventions in Division III Male and Female Basketball Athletes

In accordance with federal law, this approval is effective for one calendar year from the date of this letter. If your research project extends beyond that date or if you need to make significant modifications to your study, you must notify the IRB immediately. Please reference the above-cited IRB application number in any future communications with our office regarding this research.

Please retain copies of consent forms for this research for three years after completion of the research.

If, during your research, you encounter any unanticipated problems involving risks to subjects, you must report this immediately to Dr. Harriet Hartman ([hartman@rowan.edu](mailto:hartman@rowan.edu) or call 856-256-4500, ext. 3787) or contact Dr. Shreekanth Mandayam, Associate Provost for Research ([shreek@rowan.edu](mailto:shreek@rowan.edu) or call 856-256-5150).

If you have any administrative questions, please contact Karen Heiser ([heiser@rowan.edu](mailto:heiser@rowan.edu) or 856-256-5150).

Sincerely,

A handwritten signature in cursive script that reads "Harriet Hartman".

Harriet Hartman, Ph.D.  
Chair, Rowan University IRB

c: Burton Sisco, Educational Services, Administration and Higher Education, Education Hall

Office of Research  
Bole Hall  
201 Mullica Hill Road  
Glassboro, NJ 08028-1701

856-256-5150  
856-256-4425 fax

**APPENDIX B**

Subject Consent Form

January 13, 2012

Dear Student-Athlete,

I am currently enrolled in a class at Rowan University which requires a research study to be conducted. My study aims to explore the effects of ankle stabilizers for the prevention of ankle sprains.

You have been selected from a list of all varsity basketball players at Rowan University

You should know that:

- Your participation is completely voluntary.
- The survey should take approximately 5-10 minutes to complete.
- No personally identifiable information will be presented in the paper.
- It is your opportunity to tell how you feel about ankle taping or bracing effects on the prevention of ankle injuries and effects on athletic performance.

If you would like to participate in this brief survey, please complete the consent form below.

If you have any questions you can contact me at (P) 856-298-6005 and email at seeber87@students.rowan.edu or you can contact Dr. Sisco at (P) 856-256-4500 ext 4717 or email at sisco@rowan.edu.

Thank you for your time,

David Seeberger, ATC

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I give my consent to participate in this survey to the above referenced research.

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Signature

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Printed Name

---

Date

## **APPENDIX C**

Instrument: Ankle Taping, PowerTaping, Bracing, and Balance Training Effects on  
Athletic Performance Survey



**Taping, PowerTaping, Bracing, and Balance Training Effects on Athletic Performance Survey**

I have developed the following survey to measure if your athletic performance was affected by ankle taping, bracing, power taping, and balance training. It will take approximately 5-10 minutes for you to complete. Your answers will be kept completely confidential and will be used anonymously for data collection. It is not necessary for you to include your name on the survey. I appreciate your participation in this survey. If you have any questions you can contact me or Dr. Sisco by phone or email. David Seeberger - (P) 856-298-6005 or seeber87@students.rowan.edu. Dr. Sisco - (P)856-256-4500 ext 3717 or sisco@rowan.edu. Thank you.

1. What is your gender?  
 M  F
2. What is your age?
3. What is your current year at Rowan University?  
 Freshman  
 Sophomore  
 Junior  
 Senior

Please rate the extent to which you agree or disagree if your athletic performance was negatively affected by taping, bracing, power taping, or balance training. For each statement please circle your level of agreement using the scale: SA- Strongly Agree; A- Agree; N-Neutral; D- Disagree; SD- Strongly Disagree

**Basketball Drills**

4. Performing layups	SA	A	N	D	SD
5. Sprinting the length of the court	SA	A	N	D	SD
6. Cutting to change direction	SA	A	N	D	SD
7. Performing a vertical jump	SA	A	N	D	SD
8. Landing after jumping	SA	A	N	D	SD
9. Planting with taped or braced foot	SA	A	N	D	SD
10. Pivoting with taped or braced foot	SA	A	N	D	SD
11. Rebounding	SA	A	N	D	SD
12. Boxing out opposing player	SA	A	N	D	SD
13. Performing jump stops	SA	A	N	D	SD
14. Decelerating after sprinting	SA	A	N	D	SD

15. Accelerating from stationary position	SA	A	N	D	SD
16. Performing jab step with taped or braced foot	SA	A	N	D	SD
17. Performing defensive slides	SA	A	N	D	SD
18. Ball handling	SA	A	N	D	SD
19. Performing a V-cut to get open	SA	A	N	D	SD
20. Curling around a pick	SA	A	N	D	SD
<b>Athletic Performance</b>					
21. Balance	SA	A	N	D	SD
22. Quickness	SA	A	N	D	SD
23. Agility	SA	A	N	D	SD
24. Speed	SA	A	N	D	SD
25. Turns	SA	A	N	D	SD
26. Stops	SA	A	N	D	SD
27. Jumps	SA	A	N	D	SD
<b>Muscle Performance</b>					
28. Muscle strength	SA	A	N	D	SD
29. Muscle endurance	SA	A	N	D	SD
30. Muscle power	SA	A	N	D	SD

Thank you for taking part in this project. I appreciate the time you have taken to complete this survey. If you have any questions pertaining to this survey, please contact me via phone or e-mail and I will make arrangements for a mutually agreeable time. Thanks again.

David Seeberger  
 Phone: 856-298-6005  
 E-mail: seeber87@students.rowan.edu

## **APPENDIX D**

Instrument: Data Collection of Lateral Ankle Sprains



**Key**

v	Athlete Participated
Δ	Lateral Ankle Injury
X	Athlete Didn't Participate