The Differences between Ankle Taping and Ankle Bracing on Balance in NCAA Division I Football Student-Athletes

Submitted for partial requirements

MVSC 580

Justin Thomas Nadeau

University of Idaho College of Graduate Studies

College of Education—Department of Movement Sciences

Major Professor: Dr. Sharon K. Stoll, PhD

Contents

[Abstract iv](#_Toc419293541)

[Chapter One 6](#_Toc419293542)

[Introduction 6](#_Toc419293543)

[Problem Statement 7](#_Toc419293544)

[Subproblems 8](#_Toc419293545)

[Hypotheses 8](#_Toc419293546)

[Limitations 8](#_Toc419293547)

[Definitions 9](#_Toc419293548)

[Assumptions 9](#_Toc419293549)

[Significance of Study 9](#_Toc419293550)

[Chapter Two 12](#_Toc419293551)

[Literature Review 12](#_Toc419293552)

[Ankle Injuries 12](#_Toc419293553)

[Taping and stabilization 12](#_Toc419293554)

[Studies of taping and bracing 13](#_Toc419293555)

[Proprioception 17](#_Toc419293556)

[Chapter Three 19](#_Toc419293557)

[Methodology 19](#_Toc419293558)

[Subjects 19](#_Toc419293559)

[Protocol 19](#_Toc419293560)

[Data and Analysis 21](#_Toc419293561)

[Chapter 4 22](#_Toc419293562)

[Problem Statement 22](#_Toc419293563)

[Results 22](#_Toc419293564)

[Hypotheses 22](#_Toc419293565)

[Chapter 5 24](#_Toc419293566)

[Problem Statement 24](#_Toc419293567)

[Hypotheses 24](#_Toc419293568)

[Discussion 25](#_Toc419293569)

[Problem Statement 25](#_Toc419293570)

[Statistics 25](#_Toc419293571)

[Ankle Taping Comparisons 26](#_Toc419293572)

[Ankle Taping vs. Ankle Bracing 26](#_Toc419293573)

[Comparison of Ankle Taping in NCAA Division 1 Football Players 27](#_Toc419293574)

[Proprioception and the Effects of Ankle Stabilization on Proprioception 28](#_Toc419293575)

[Limitations 29](#_Toc419293576)

[Future Studies 30](#_Toc419293577)

[Conclusion 31](#_Toc419293578)

[References 34](#_Toc419293579)

[APPENDIX A 36](#_Toc419293580)

[Consent Form 36](#_Toc419293581)

[APPENDIX B 38](#_Toc419293582)

[IRB Approval Letter 38](#_Toc419293583)

[APPENDIX C 39](#_Toc419293584)

[RCR Certificate 39](#_Toc419293585)

# Abstract

Historically, much literature exists about the best method of ankle stabilization in competitive athletics. The debate centers on a comparison between the use of prophylactic ankle taping and the use of ankle braces as the most effective preventative measure, as well as the most cost-effective method of ankle stabilization over time. Ankle bracing has been a proper protocol in high-risk injuries in sports.  The debate always exists of what is better between ankle taping and ankle bracing.  Both ankle taping and ankle bracing appear to help reduce injuries.  Based on previous research from Lephart and Fu (1995) and experience, it has been shown that ankle injuries are potentially caused by poor proprioception and balance in athletes. Considering that there appears to be some debate in the literature, more research is needed to ferret out the proprioception and balance issues.  Therefore, this study is important to both athletes and Certified Athletic Trainers to examine if there is a better method of ankle stabilization between ankle taping and ankle bracing.  Athletes often have a preferred method of ankle taping.  This preference is not often indicated by the scientifically-best method. This present study will examine the effect of two different ankle stabilization methods on balance in selected NCAA Division I Football Student-Athletes. The current study examined eleven subjects who were all football players at the University of Idaho. Each subject was taped and braced while their balance was tested in between each trial. Data was collected using the Balance Error Scoring System (BESS). A paired samples t-test was administered for both groups as well to determine the differences between ankle taping and ankle bracing. For the paired samples test, the standard deviation score for both groups was 3.44 with a standard error mean of 1.04. The t score of both groups was -0.97 with a significance of 0.357 which determined that there was no statistically-significant difference between the use of ankle taping and ankle bracing on balance. Due to the significance value of .611 for the One-Way ANOVA for the ankle taping group, no difference existed between the effects of ankle taping on balance between the different groups. Due to the significance value of .670 for the One-Way ANOVA for the ankle bracing group, no difference existed between the effects of ankle bracing on balance between the different groups. Due to the significance value of .357 in the paired samples t-test, there was no statistically significant difference between ankle taping and ankle bracing on the groups. Therefore, it was determined that there was no difference between ankle taping and ankle bracing on balance and proprioception in football players. Therefore, there is not a more beneficial method of ankle stabilization between both ankle tape and ankle braces on balance or proprioception, so either method may be used by athletes in exercise and competition based on their preference.

# Chapter One

## Introduction

Historically, much literature exists about the best method of ankle stabilization in competitive athletics. The debate centers on a comparison between the use of prophylactic ankle taping and the use of ankle braces as the most effective preventative measure, as well as the most cost-effective method of ankle stabilization over time. Paris (1992) stated that during a basketball season, “when braces are substituted for tape, a net saving [can occur} of 63.2% [of taping funding] can be made during a basketball season” (p. 255). Rovere, Clarke, Yates, and Burley (1988) stated that taping is much more costly than ankle braces as well. However, from the cited research, it is not completely clear why ankle taping or ankle bracing are more effective than the other in preventing injuries. The reason why inversion ankle sprains occur may be due to poor proprioception.

Historically and scientifically, ankle bracing has been a proper protocol in high-risk injuries in sports.  The debate always exists of what is better between ankle taping and ankle bracing.  Both ankle taping and ankle bracing appear to help reduce injuries.  Based on previous research from Lephart and Fu (1995) and experience, it has been shown that ankle injuries are potentially caused by poor proprioception and balance in athletes. Considering that there appears to be some debate in the literature, more research is needed to ferret out the proprioception and balance issues.  Therefore, this study is important to both athletes and Certified Athletic Trainers to examine if there is a better method of ankle stabilization between ankle taping and ankle bracing.  Athletes often have a preferred method of ankle taping.  This preference is not often indicated by the scientifically-best method. This present study will examine the effect of two different ankle stabilization methods on balance in selected NCAA Division I Football Student-Athletes.

Taping is known to benefit the athlete by providing stability, according to Olmsted, Vela, Denegar, and Hertel (2004).  The subjects in this study will learn what the best method of ankle stabilization is over their preferential method.  Therefore, this will benefit the subjects to show what the best method of ankle stabilization is to help prevent ankle injuries and enhance performance.  This experiment is beneficial not only to the subjects, but also fellow colleagues in the Athletic Training Profession.  As a Certified Athletic Trainer, previous experience has shown that balance has implication on the prevention of injuries. Since one of the primary causes of ankle injuries is poor proprioception, this study will help provide knowledge to people in the profession about what method of ankle stabilization will be the best to preventing future injuries. Historically, Athletic Trainers have used ankle braces and ankle taping as a means for preventing ankle injuries. This study will help make Athletic Trainers more aware of what the best method is so that they may continue to provide the best healthcare possible to their patients.

## Problem Statement

The purpose of this quasi-experimental within-subjects design study was to examine the effect of two different ankle stabilization methods on balance in selected NCAA Division I Football Student-Athletes.

## Subproblems

1. What is the effect of ankle taping on ankle stabilization by position group?
2. What is the effect of ankle bracing on ankle stabilization by position group?
3. What is the difference of treatment in balance by position group?

## Hypotheses

1. No difference exists between the effects of ankle taping between the different groups in this study.
2. No difference exists between the effects of ankle bracing between the different groups.
3. No difference exists in balance between the different groups.

## Limitations

There are some limitations that exist of the present study. It is well established that the sample in this study was a convenience sample of NCAA Division 1 Football Players at the University of Idaho. The reason why it is so difficult with a convenience sample is because it is difficult to compare a convenience sample of football athletes to the general population. This study is only directed to benefit a certain population.

Another limitation is that this was a quasi-experimental study. This is a limitation because the sample to perform this study is chosen by the investigator, instead of being randomized. Therefore, this sample has a possibility of skewing the data because a randomized sample provides the best possibility of producing the best and most reliable results. However, a randomized sample was impractical for this study and was not possible for the recruitment of subjects, so choosing subjects was the best course of action for collecting data.

##  Definitions

It is important to state some definitions before beginning this study. The most important definition that one must know is the meaning of proprioception. Proprioception according to Lephart and Fu (1995), is “the conscious awareness of limb position” (p. 97). They also stated that proprioceptive sense is the “vestibular sensations and inputs from muscles and joints that are not necessarily perceived” (p. 97). Another definition of proprioception that Lephart et al (1995) found was that it is “a specialized variation of the sensory modality of touch that encompasses the sensations of joint movement and joint position” (p. 97).

## Assumptions

It is assumed that the current subjects are representatives of Division I College Athletics. They are all NCAA Division I Football Players at the University of Idaho who are qualified to be in the category of subjects. It is also assumed that the BESS is the most valid and reliable test to measure balance and proprioception.

## Significance of Study

The significance of this study is targeted towards the Athletic Training profession because people such as me and my colleagues will be able to see the results and be able to determine what the most effective method of preventing ankle injuries is. It will have practical importance no matter what the outcome will be and can be used in the future to help prevent injuries in athletics.

This is because of the fact that previous literature has concluded that ankle braces are more effective in providing prophylaxis compared to ankle taping. An example is from the literature by Rovere et al. (1988), where he stated that “taping is not only less effective than the stabilizer in preventing ankle injury, it is also much more costly” (p. 232). Other previous literature has also stated that both methods of ankle prophylaxis are effective in preventing ankle injuries, but ankle braces are a lot less expensive than ankle taping. Therefore, both methods have been shown to be effective, but ankle braces have been shown in previous studies that they can provide more stabilization and be longer-lasting than ankle taping.

Thacker, Stroup, Branche, Gilchrist, Goodman, and Weitman (1999) did a systematic review of the literature based on the prevention of ankle sprains in sports. They stated that “taping can prevent ankle sprains despite the fact that tape loosens in approximately 10 minutes and provides little to no measureable support to the inverting ankle within 30 minutes” (p. 757) and that to protection may be from “increased proprioception that allows the peroneal muscles to react more rapidly to inhibit extreme ankle inversion” (p. 757). Thacker et al (1999) also believes that the reason why a lot of ankle sprains occur are because of the fact that the reflex contraction of the peroneals are too slow. Thacker et al (1999) also believe that orthoses such as ankle braces may enhance proprioception and are less expensive than tape and can be easily adjusted. Thacker et al (1999) also concluded that more research must be done in this study for the prevention of ankle injuries in athletes in order to determine what the best method of ankle stabilization is.

The Balance Error Scoring System (BESS) Test, is the most valid and reliable test to measure balance compared to other tests including the Star Excursion Balance Test (SEBT). Onate, Beck, and Van Lunen (2007) stated that the BESS Test was developed as an objective assessment tool to test for balance and postural control in athletes on the sidelines. Finnoff, Peterson, Holloman, and Smith (2009) performed a study where they wanted to find the intra-rater and inter-rater reliability of the BESS Test and their results stated that certain subcategories of the BESS Test have sufficient intra-rater and inter-rater reliability to be used as a clinical assessment of balance. According to Olmstead, Carcia, Hertel, and Shultz (2002), the SEBT has been shown to be highly reliable. However, Kinzey and Armstrong (1998) did not find consistency in their tests and determined it is not an appropriate test for dynamic balance. Therefore, it is a good conclusion that the BESS Test is more reliable than the SEBT as a method of measuring balance.

# Chapter Two

## Literature Review

### Ankle Injuries

Ankle injuries occur very frequently in athletic participation. According to Shapiro, Kabo, Mitchell, Loren, and Tsenter (1994), “ankle sprains are one of the most common injuries treated by orthopaedic surgeons and athletic trainers” (pg. 78). The most common structure that is injured within the lateral ankle is the anterior talofibular ligament, with the calcaneo-fibular and posterior talofibular ligaments being affected as well. The most common injury for an ankle is an inversion sprain with a mechanism of the foot being inverted, along with the ankle being plantar flexed and internally rotated.

### Taping and stabilization

For years, medical professionals including athletic trainers and physical therapists, and also even coaches have promoted and applied the use of taping and bracing for stabilization in the attempt to prevent future injuries so that athletes are able to participate longer. Ankle taping and bracing has also been used as a method to support athletes who have previous ankle injuries. This then helps athletes to participate and contribute to their team’s success the best way possible. Research such as from Olmsted, Vela, Denegar, and Hertel (2004) has examined the effectiveness of ankle taping, the effectiveness of ankle bracing, and also have compared the difference in effectiveness between ankle taping and ankle bracing, as well as comparisons between the different types of ankle braces. The purpose of this literature review is to analyze the previous literature on the effectiveness of ankle taping, ankle bracing, and also on the comparisons between ankle taping and bracing.

### Studies of taping and bracing

Ricard, Sherwood, Schulthies, and Knight (2000) compared “the effects of tape with and without prewrap on dynamic ankle inversion before and after exercise” (pg. 572). Their independent variables were the tape application of no tape, tape with prewrap, and tape to the skin before and after exercise. Their dependent variables were their measurements of total inversion, time to maximum inversion, average inversion velocity, and maximum inversion velocity. They had thirty subjects and measured each of the variables on an inversion platform with the subject’s weight on the right foot. Randomly assigned subjects were pre-tested and post-tested with no tape, tape with pre-wrap, and tape without pre-wrap. Subjects were pre-tested for all of the independent variables first and then went through a 10-minute treadmill run, figure eight running, shuttle runs, and bilateral toe raises. Following exercise the subjects were post-tested performing the same test measuring for total inversion, time to maximum inversion, average inversion velocity, and maximum inversion velocity. Data collection was then analyzed by an Analysis of Variance (ANOVA) for the results. Ricard et al (2000) found no significant differences between taping to the skin and taping ankles with pre-wrap for any of the variables measured. However, not all variables of training and its effect of tape were evaluated.

In another earlier study done by Paris (1992), the purpose was to “determine if differences exist in selected tests of speed, balance, agility, and vertical jump when performed while using a variety of experimental conditions” (pg. 253). This included a trial in which the subjects would not be taped, a trial with non-elastic tape, and also a trial with ankle braces. The independent variables were the application of non-elastic tape, no tape, and the three different brands of ankle braces which included a McDavid ankle brace, a New Cross ankle brace, and a Swede-O ankle brace. The dependent variables were the measurements of speed, balance, agility, and vertical jump. Each subject was tested on speed, balance, agility, and vertical jump in random order but were tested under the five different ankle support conditions, which were also randomized. Paris (1992) found that there were no significant differences among the conditions in the results of speed, balance, and agility. However, he did find that there were differences in the change in vertical jump conditions, with the fact that New Cross ankle braces showed a less significant difference than ankles that were not taped. However, there was an insignificant difference in vertical jump measurements between untaped ankles compared to ankles that wore a McDavid brace. Overall, Paris found that ankle braces may be used as ankle support as an alternative to ankle taping during physical activity and competition. However, Paris (1992) also argued that ankle taping is more expensive overall during an athletic season compared to ankle braces and that ankle braces may be a lot more cost-effective for use. Paris (1992) found that “when braces are substituted for tape, a net saving of 63.2% can be made during a basketball season.” What he concluded was that ankle braces may be used as an alternative to ankle tape and that athletic trainers may want to consider investing in them for athletes to save money over a whole season. However, this 1992 study may be quite limited considering the technology of 2015 and ankle brace construction is different compared to the time of the study.

Shapiro et al, (1994), studied the passive mechanical effectiveness of braces or tape and footwear on resisting ankle inversion. They used five male cadavers from UCLA to determine the effects of prophylactic ankle bracing and ankle taping on ankle inversion. They performed their study using eight different strap-on ankle braces including the McDavid Ankle-Guard, McDavid A-101, Aircast Air-Stirrup Ankle Training Brace, Gelcast, Super-8, DonJoy Model, Eclipse Excel Ankle Support, Cramer Ankle Stabilizer, and High Top Ankle Support with the foot in high-top sneakers as well as low-top sneakers. The other independent variable that they used was ankle tape with high-top sneakers and low-top sneakers. The dependent variable that they used for this study was where they placed their cadavers in neutral flexion and 30 degrees of plantar flexion on a footplate mounted on a laterally directed roller bearing. They used an ANOVA and t-test, to determine the significant differences in the amount of inversion between the differences in tape and all of the different brands of ankle braces. Their results showed that all braces and tape significantly stiffened the unprotected ankle in low top shoes. They also found that high-top sneakers increased the passive resistance to inversion with braces and tape. Also, Shapiro et al (1994) found that braces functioned to resist inversion at a compared level to what ankle tape did. They also found that braces had advantages over tape based on the fact that braces were more cost-effective and were also easier to re-tighten than ankle tape. Tape easily loosens due to perspiration and other factors while ankle braces can be easily re-tightened by being laced back up. Shapiro et al (1994) concluded that braces represent a good alternative to ankle tape in the prevention of ankle injuries for those athletes who refuse to wear high-top sneakers. However, a question exists as to the validity of cadavers’ ankles compared to the ankles of real live athletes.

Rovere, Clarke, Yates, and Burley (1988), performed an experiment in which they wanted to measure the effectiveness of ankle taping and ankle bracing in preventing ankle injuries over the matter of six years in collegiate football players at Wake Forest University. They found that after 305 inversion cycles, taping was no more effective than ankle braces. They wanted to compare the rate of first-time ankle injuries associated with braces compared to tape, the relationship between the injury and what type of ankle support was used, and what type of shoe was worn, as well as the rate of re-injury to the type of ankle support that was used. They found that the best combination, which resulted in the fewest injuries, were low-top shoes and laced ankle braces. They concluded that ankle taping was less effective compared to the use of ankle braces in preventing ankle injuries during football practices and games. They also concluded that ankle braces would be the most cost-effective tool used to prevent ankle injuries because of the fact that taping supplies were more expensive overall during a football season. Both methods of ankle stabilization are effective but ankle braces are longer lasting solutions of ankle stability rather than ankle tape. Braces can easily be readjusted and retightened. Technology of taping design and ankle brace construction has changed since 1988 because football players have gotten bigger and stronger since then.

Olmsted, et al (2004), examined the differences between ankle taping and ankle bracing based on a cost-benefit analysis and a numbers-needed-to-treat analysis. According to Olmsted et. al. (2004), more than 25,000 ankle sprains occur in the United States per day. Olmsted et. al (2004) also stated that “in American football, ankle sprains comprise 10% to 15% of all injuries” (p. 95). In their numbers-needed-to-treat analysis, they found that to prevent one ankle sprain per game would require an athletic trainer or qualified professional to tape 26 ankles for those who have previous ankle sprains, while those who have not had a previous ankle sprain before would be required to tape 143 ankles to prevent one sprain. It is also determined that ankle braces are more cost-effective than ankle taping in this article. Because of this, ankle stabilization in football is important because a solid amount of ankle injuries occur in the sport of football. Therefore, it is apparently important to tape or brace in football in the prevention of ankle injuries.

### Proprioception

In order to measure proprioception, it is important to define proprioception in athletics. Lephart and Fu (1995), found the definition of proprioception to be “the conscious awareness of limb position” (p. 97) and that proprioceptive sense is the “vestibular sensations and inputs from muscles and joints that are not necessarily perceived” (p. 97). Another definition of proprioception that Lephart et al (1995) found was “a specialized variation of the sensory modality of touch that encompasses the sensations of joint movement and joint position” (p. 97). Proprioception is an important issue and is important for an athlete to have in order to prevent injuries. Lephart et al (1995) stated that “chronic ankle instability was due in part to partial differentiation of articular mechanoreceptors with joint injury” (p. 97). Lephart et al (1995) also believes that lack of proprioception can lead to a lack of functional stability in the ankle. Therefore, proprioception is important for the prevention of injuries, especially to the ankle. However, contradictory literature exists.

Raymond, Nicholson, Hiller, and Refshauge (2012), examined the effect of ankle taping and ankle bracing on proprioception in functional ankle instability. They examined the effect of taping and bracing on the different directions of movement and found that there was no significant effect of ankle taping or bracing on the movements of inversion, eversion, plantar flexion, or dorsiflexion. Raymond et al (2012) stated that “while ankle taping or [ankle] bracing has been shown to reduce the risk of re-spraining the ankle, this reduction in risk is not likely to be due to enhanced proprioception” (p. 390). They believe that ankle taping or bracing is more related to restricting joint range of motion and improving confidence for the athlete during activity. Therefore, even though Raymond et al (2012), states that therefore, there is not enhanced proprioception for athletes who wear ankle tape or braces, it is still important to determine which method is better on balance since it is unknown if either method has been determined to be more effective. Raymond et al (2012) also stated that there are few studies that examine the effect of ankle taping or bracing on proprioceptive acuity of people who suffer ankle sprains. Since the literature appears to contradict the relation between taping and proprioception, further studies are needed to understand this phenomenon.

Therefore, it is important to determine if any method is better than the other on proprioception in order to prevent future injuries.

# Chapter Three

## Methodology

The purpose of this quasi-experimental within-subjects design study is to examine the effect of two different ankle stabilization methods on balance in selected NCAA Division I Football Student-Athletes.

## Subjects

The Difference between Ankle Taping and Ankle Bracing on Proprioception on NCAA Division I Football Student Athletes was approved by the Institutional Review Board (IRB) at the University of Idaho. The project number from the IRB is 14-550. (Appendix B)

 Eleven NCAA Division I Football Student-Athletes from the University of Idaho were recruited for the study. All eleven subjects were football student-athletes at the University of Idaho between the ages of 18-23 years of age. Each subject was required to sign a consent form before participating in this study and they were divided into three groups based on what positions they play out on the field. The Linebackers, Tight Ends, Running Backs and Fullbacks part of one group, while the Offensive Linemen and Defensive Linemen were part of another group, with the third and final group being Quarterbacks, Wide Receivers, and Defensive Backs.

## Protocol

Three groups were needed because these three groups of positions all have similar body types with regards to height and weight, and center of gravity. Subjects were asked to report to the Athletic Training Room. They were asked to have their ankles taped and have their balance tested. After that, they were asked to wear an ankle brace during the same session and have their balance tested again. This study took a total of about 20 minutes during a one-day session.

This was quasi-experimental within-subjects study design along with a post-test only design for the group. Each subject belonged to one group and was treated to three different interventions during the test. Each subject’s balance was be tested after each of the three interventions to determine what the best method of ankle stabilization was. Each subject’s balance was tested using the Balance Error Scoring System (BESS) Test (Onate et al, 2007). They were asked what their non-dominant foot was, as well as if they have had any serious previous ankle injuries or surgeries. They then had their non-dominant ankle taped and measured on the BESS. The second trial included the subject having an ankle brace applied on their non-dominant ankle and their balance was measured again with the BESS.

The object of the BESS is for the subject to place their hands on their hips and keep their head up, facing forward, and their eyes closed. Errors are counted if the patient opens their eyes, steps, stumbles, or falls, removes their hands from their hips, moves the hip into more than 30 degrees of hip flexion or hip abduction, lifts their toes or heels away from the test surface, or remains out of their test position for longer than five seconds.

The order of this test consists of a double-legged stance on a flat surface, a single-legged stance on a flat surface on their non-dominant foot, a tandem stance on a flat surface, the double-legged stance on the foam surface, the single-legged stance on the foam surface with their non-dominant foot, and the tandem stance on the foam surface. Each component of the test lasts 20 seconds.

Each subject was well aware of the conditions of the BESS and were well notified before the administration of the test. The foam surface that the subjects used was a blue AIREX Balance Pad and was administered through the Concussion Assessment & Response Android App using a Verizon Wireless Ellipsis 7 Tablet.

## Data and Analysis

Data was collected using ANOVA techniques. Tukey’s post hoc procedures were be used to examine significant findings where appropriate with the alpha level set at p<.05. The independent variables were the different methods of ankle stabilization: ankle taping and ankle bracing. The other independent variable was the type of position group each subject was classified. The dependent variable was ankle stability based on the number of errors encountered on the BESS. Descriptive statistics were also run for each intervention and each position group. Also, a paired samples t-test was administered for the number of errors encountered in each ankle stabilization method.

The BESS was used for both ankle taping and ankle bracing methods and were used to count the number of errors each subject made during the testing. The number of errors was classified based on what method of ankle stabilization was used.

# Chapter 4

## Problem Statement

The purpose of this quasi-experimental within-subjects design study was to examine the effect of two different ankle stabilization methods on balance in selected NCAA Division I Football Student-Athletes.

## Results

## Hypotheses

1. No difference exists between the effects of ankle taping between the different groups in this study.

2. No difference exists between the effects of ankle bracing between the different groups.

3. No difference exists in balance between the different groups.

Descriptive statistics were analyzed for each ankle stabilization intervention. For the ankle taping intervention, the mean number of errors for the ankle taping group was 17.09 with a standard deviation of 4.805. For the ankle bracing group, the mean number of errors for the ankle bracing group was 18.09 with a standard deviation of 4.847.

A paired samples t-test was administered for both groups as well to determine the differences between ankle taping and ankle bracing. For the paired samples test, the standard deviation score for both groups was 3.44 with a standard error mean of 1.04. The t score of both groups was -0.97 with a significance of 0.357 which determined that there was no statistically-significant difference between the use of ankle taping and ankle bracing on balance.

A One-Way ANOVA was administered to compare the difference between the position groups during the test. Descriptive statistics were administered for each group as well. The mean score for ankle taping for Group 1, which was the group which included Quarterbacks, Wide Receivers, and Defensive Backs was 18.80 with a standard deviation of 6.65. The mean score for ankle taping for Group 2, which was the group that consisted of Linebackers, Tight Ends, Running Backs, and Fullbacks was 15.67 with a standard deviation of 2.89. The mean score for ankle taping for Group 3, which was the group that consisted of Offensive Linemen and Defensive Linemen was 15.67 with a standard deviation of 2.31. The mean score for ankle bracing for Group 1 was 19.60 with a standard deviation of 5.98. The mean score for ankle bracing for Group 2 was 16.33 with a standard deviation of 3.21. The mean score for ankle bracing for Group 3 was 17.33 with a standard deviation of 4.93.

For the One Way ANOVA for the ankle taping group, the sum of squares between groups was 26.78 on 2 degrees of freedom with a mean square of 13.39. The sum of squares within groups was 204.13 on 8 degrees of freedom with a mean square of 25.52. The F score was 0.52 for the ankle taping group with a significance of .611. For the One Way ANOVA for the ankle bracing groups, the sum of squares between groups was 22.38 on 2 degrees of freedom with a mean square of 11.19. The within groups sum of squares was 212.53 on 8 degrees of freedom with a mean square of 26.57. The F score was for the ankle bracing group was .42 with a significance of .670.

# Chapter 5

## Problem Statement

The purpose of this quasi-experimental within-subjects design study was to examine the effect of two different ankle stabilization methods on balance in selected NCAA Division I Football Student-Athletes.

## Hypotheses

No difference exists between the effects of ankle taping between the different groups in this study. Due to the significance value of .611 for the One-Way ANOVA for the ankle taping group, the first hypothesis stated above was supported.

No difference exists between the effects of ankle bracing between the different groups. Due to the significance value of .670 for the One-Way ANOVA for the ankle bracing group, the second hypothesis stated above was supported. No difference exists in balance between the different groups.

Due to the significance value of .357 in the paired samples t-test, there was no statistically significant difference between ankle taping and ankle bracing on the groups. Therefore, the third hypothesis stated above was also supported.

## Discussion

### Problem Statement

The purpose of this study was to examine the effect of two different ankle stabilization methods on balanced in selected NCAA Division I Football Student-Athletes.

### Statistics

Interpretation of the statistical results showed that there was no statistically-significant difference between the use of ankle taping and ankle bracing on balance and proprioception. Due to the mean scores of 17.09 in the ankle taping group compared to the ankle bracing group which was 18.09, there was a slight difference in the number of errors each subject had when they were taped compared to when they were braced. Due to the mean scores difference, it could be suggested that ankle taping was more effective for the subjects on their balance compared to ankle bracing. However, due to the significance of 0.357 value of the significance in the paired samples t-test, there was no statistically-significant difference between ankle taping and ankle bracing on balance and proprioception due to the alpha level at a p < .05. Also, due to the significance of .611 for the ankle taping group and the significance of .670 for the ankle bracing group on the One-Way ANOVA, it was also determined that there was no statistically-significant difference between the different position groups on ankle taping, ankle bracing, and balance.

### Ankle Taping Comparisons

Ricard et al (2000), who examined the difference between taping with pre-wrap and taping without pre-wrap after a 10-minute treadmill run, figure eight run, shuttle runs, and bilateral toe raises using each intervention, found no significant differences between taping to the skin and taping ankles with pre-wrap for any of the variables measured. In the current study, subjects were not required to exercise due to time as stated in the limitations. Also, subjects were all given pre-wrap during testing for their balance. Therefore, even though these studies are not similar, it was still important to have quality background information regarding ankle taping before conducting the experiment.

### Ankle Taping vs. Ankle Bracing

Paris (1992) wanted to “determine if differences existed in selected tests of speed, balance, agility, and vertical jump when performed while using a variety of experimental conditions” (p. 253). They performed three trials where the subjects would not be taped, a trial with non-elastic tape, and a trial with ankle braces. Paris (1992) found no significant differences among the conditions in the results of speed, balance, and agility. In the current study, the only variable that was measured was balance, to determine if either ankle taping or ankle bracing had a more positive effect on balance. The current study appears to agree with Paris (1992).

Shapiro (1994) found that ankle braces functioned to resist inversion at a compared level to ankle taping. Shapiro (1994) concluded that braces represent a good alternative to ankle tape in the prevention of ankle injuries. However, there was a question about the validity of the test since Shapiro (1994) used the ankles of cadavers compared to the ankles of living athletes. The current study argues with Shapiro (1994) since no significance is found between taping and bracing.

Olmsted et al (2004) examined the differences between ankle taping and ankle bracing on a cost-benefit analysis and a numbers-needed-to treat-analysis. They determined that ankle braces were more cost-effective than ankle taping overall. Ankle stabilization in football is important because ankle injuries occur in the sport, so it is important to tape or brace to prevent injuries from occurring. The current study attempted to determine if ankle taping or ankle bracing would be more effective on proprioception to help prevent ankle injuries from occurring. However, two of the hypotheses included: (1) what was the effect of ankle taping on ankle stabilization by position group? (2) What was the effect of ankle bracing on ankle stabilization by position group? Even though ankle braces were shown to be more cost-effective, one of the questions to examine was if ankle tape was more effective and worth the cost of paying for ankle tape and all of the supplies for it including pre-wrap, heel and lace pads, and tape adherent spray. However, since the study showed no significant difference for either intervention, it is assumed that either method can be effective for prophylaxis in exercise and competition.

###  Comparison of Ankle Taping in NCAA Division 1 Football Players

Rovere et al (1988), measured the effectiveness of ankle taping and ankle bracing in the prevention of ankle injuries in NCAA Division 1 collegiate football players. They found that taping was no more effective than ankle braces. However, they concluded that ankle taping was less effective compared to the use of ankle braces in the prevention of ankle injuries during football practices and games. However, because of the higher cost for ankle tape and the other supplies that are included in ankle taping, ankle braces are preferred between some professionals. The current study was conducted because ankle taping design and the construction of ankle bracing have changed since the late 1980s. Football players are bigger and stronger today compared to the late 1980s. However, there were very similar results found in the current study comparing the effectiveness of ankle taping and ankle bracing on balance and proprioception which leads to the conclusion that no new changes have occurred in the research since 1988.

### Proprioception and the Effects of Ankle Stabilization on Proprioception

Lephart et al (1995) stated that “chronic ankle instability was due to in part to partial differentiation of articular mechanoreceptors with joint injury” (p. 97). They also stated that a lack of proprioception can affect the stability in the ankle. Thus, for the current study, proprioception measured because without it, functional stability in the ankle is affected, which can lead to injury.

Raymond et al (2012) indicated that “while ankle taping or bracing [were] shown to reduce the risk of re-spraining the ankle, [the] reduction risk [was] not likely due to enhanced proprioception” (p. 390). They believed that ankle taping or ankle bracing were more related to the restriction of range of motion in the ankle joint. Also, Raymond et al (2012) indicated that ankle stabilization methods were also played a role in confidence for the athlete during physical activity. The athlete may feel more confident with ankle tape than ankle braces or vice versa. Ankle taping or ankle bracing can provide a sense of perceived comfort, which can help provide confidence for the athlete. This is why athletes decide which method of ankle stabilization that they prefer during exercise and competition.

## Limitations

The current study was chosen because of the theory of ankle taping having a significant difference compared to ankle bracing on proprioception. However, there was no significance because of the limitations of this study, including the lack of subjects a lack of time, and a few other limitations.

It is well established that the sample in this study was a convenience sample of NCAA Division 1 Football Players at the University of Idaho. The reason why it is so difficult with a convenience sample is because it is difficult to compare a convenience sample of football athletes to the general population. Therefore, this study is only directed to benefit a certain population.

Another limitation is that this is a quasi-experimental study. This is a limitation because the sample to perform this study is chosen by the investigator, instead of being randomized. Therefore, this sample has a possibility of skewing the data because a randomized sample provides the best possibility of producing the best and most reliable results. However, a randomized sample was impractical for this study and was not possible for the recruitment of subjects, so choosing subjects was the best course of action for collecting data.

Another limitation in this study was the lack of time. This was a limitation because of the fact that due to job restrictions and lack of time to do the original idea of having athletes exercise after taping and bracing them, some modifications needed to be made before the data was collected in order to ensure that this study met the expected deadlines. Having the athletes exercise after they were taped and then have them exercise right after they were braced would have been a better research study to answer the questions of if one or the other is more effective on balance and proprioception. Future studies can help answer this research question further.

Another limitation was due to the lack of subjects involved. There were only eleven subjects selected in the current study. A larger pool of subjects could have been more helpful to determine a possible significance in the study. Also, the variety of subjects was also a limitation. There were an unequal amount of subjects in each group to answer the hypotheses which skewed the ANOVA in favor of Group 1 more than Group 2 or Group 3. Rovere et al (1988) found a significant difference in their study because their sample had 297 Division 1 Collegiate Football players to participate. The current study only was able to have eleven. More subjects could have made a possibility for a significant difference.

## Future Studies

For future studies, researchers could follow through on the original study by having athletes go exercise after taping them and bracing them and then testing their balance and proprioception. Also, a random sample in the study would be more effective to help produce the most reliable results if it is practical. Also, more subjects will be needed for future research to help produce more reliable results. More subjects will also be better because of the fact that the larger the sample, the more likely of a chance that the researcher can find a significance in the study. Regardless of the fact that the results were insignificant, it was important to conduct this study because of the idea that there could have been a difference between ankle taping and ankle bracing. However, because of the limitations, including the lack of subjects, the results did not show any significant difference.

## Conclusion

The purpose of this study was to examine the effect of two different ankle stabilization methods on balanced in selected NCAA Division I Football Student-Athletes. During the study, a group of eleven NCAA Division 1 Football Student-Athletes between the ages of 18-23 were asked to be ankle taped before testing their balance using the BESS, followed by being ankle braced and testing their balance using the BESS. Although the mean scores in the number of errors on the BESS were lower in the group that was ankle taped compared to the group that was ankle braced, the significance scores in the t-test and One-Way ANOVA showed to be insignificant. Therefore, there was no support to determine that either method of ankle taping compared to ankle bracing was more effective on balance.

Due to the significance value of .611 for the One-Way ANOVA for the ankle taping group, the first hypothesis stated above was supported: No difference existed between the effects of ankle taping on balance between the different groups. Due to the significance value of .670 for the One-Way ANOVA for the ankle bracing group, the second hypothesis stated above was supported: No difference existed between the effects of ankle bracing on balance between the different groups. Due to the significance value of .357 in the paired samples t-test, there was no statistically significant difference between ankle taping and ankle bracing on the groups. Therefore, the third hypothesis stated above was also supported: No difference existed of either treatment of ankle taping or ankle bracing between the different groups. This shows that neither ankle taping nor ankle bracing are more effective on balance or proprioception in NCAA Division 1 football players.

Even though there was no significance in the study, future studies could help determine this topic of the effectiveness of ankle tape compared to ankle braces. Future studies can focus on whether ankle tape or ankle braces are more effective in the prevention of ankle injuries based on factors such as confidence and perception, joint range of motion, or proprioception using different methods. Currently, there is no evidence to determine whether ankle tape or ankle braces are more effective on proprioception in NCAA Division 1 football players. However, other modifications can be made for future studies to determine which method is more effective. Some examples include that there could be a different group of subjects other than football players due to the wide variety in sizes between them. Another example could be that researcher could have them exercise after taping and bracing them and then testing their balance and proprioception.

Therefore, there is not a more beneficial method of ankle stabilization between both ankle tape and ankle braces on balance or proprioception, so either method may be used by athletes in exercise and competition based on their preference. It also was not determined whether ankle taping or ankle bracing are even more effective on proprioception and balance because it was not tested, but it is assumed based on previous literature that they are. It is still important to tape or brace ankles to prevent injuries in the sport of football because of this, but the method of which to stabilize the ankles is up to the decision of the athlete.

Overall, this was an important study to determine whether ankle tape or ankle braces were more effective on balance and proprioception because it is still important to have up to date research for the topic. Future research can determine if there is anything new to learn about the effectiveness of ankle tape and ankle braces.

# References

Finnoff, J. T., Peterson, V., Hollman, J., & Smith, J. (2009). Intrarater and interrater reliability of the balance error scoring system (BESS). *PubMed*.

Kinzey, S. J. (1998). The reliability of the star-excursion test in assessing dynamic balance. *Journal of Orthopaedic and Sports Physical Therapy*, 356-360.

Lephart, S., & Fu, F. (1995). The role of proprioception in the treatment of sports injuries. *Sports and Exercise Injury*, 96-102.

Olmsted, L. C., Carcia, C. R., Hertel, J., & Shultz, S. J. (2002). Efficacy of the star excursion balance tests in detecting reach deficits in subjects with chronic ankle instability. *Journal of Athletic Training*, 501-506.

Olmsted, L. C., Vela, L. I., Denegar, C. R., & Hertel, J. (2004). Prophylactic ankle taping and bracing: A numbers-needed-to-treat and cost-benefit analysis. *Journal of Athletic Training*, 95-100.

Onate, J. A., Beck, B. C., & Lunen, B. L. (2007). On-field testing environment and balance error scoring system performance during preseason screening of healthy collegiate baseball players. *Journal of Athletic Training*, 446-451.

Paris, D. L. (1992). The effects of swede-o, new cross, and mcdavid ankle braces and adhesive ankle taping on speed, balance, agility, and vertical jump. *Journal of Athletic Training*, 253-256.

Raymond, J., Nicholson, L. L., Hiller, C. E., & Refshauge, K. M. (2012). The effect of ankle taping or bracing on proprioception in functional ankle instability: A systematic review and meta-analysis. *Journal of Science and Medicine in Sport*, 386-392.

Ricard, M. D., Sherwood, S. M., Schulthies, S. S., & Knight, K. L. (2000). Effects of tape and exercise on dynamic ankle inversion. *Journal of Athletic Training*, 31-37.

Rovere, G. D., Clarke, T. J., Yates, C. S., & Burley, K. (1988). Retrospective comparison of taping and ankle stabilizers in preventing ankle injuries. *The American Journal of Sports Medicine*, 228-233.

Shapiro, M. S., Kabo, J. M., Mitchell, P. W., Loren, G., & Tsenter, M. (1994). Ankle sprain prophylaxis: An analysis of the stabilizing effects of braces and tape. *The American Journal of Sports Medicine*, 78-82.

Thacker, S. B., Stroup, D. F., Branche, C. M., Gilchrist, J., Goodman, R. A., & Weitman, E. A. (1999). The prevention of ankle sprains in sports: A systematic review of the literature. *The American Journal of Sports Medicine*, 753-758.

Wilkins, J. C., McLeod, T. C., Perrin, D. H., & Gansneder, B. M. (2004). Performance on the balance error scoring system decreases after fatigue. *Journal of Athletic Training*, 156-161.

# APPENDIX A

##  Consent Form

1. The University of Idaho Institutional Review Board has approved this project.
2. The purpose of this study is to examine the effect of two different ankle stabilization methods on balance in selected NCAA Division I Football Student-Athletes.
3. You will be asked to report to the Athletic Training Room. You will asked to have your ankles taped and have your balance tested. After that, you will be asked to wear an ankle brace during the same session and have your balance tested again. This study should take a total of 20 minutes during one day.
4. A time commitment of at 20 minutes for one session. Also, this experimental procedure is a common evaluation technique of balance - and one often done in the athletic training facility.  There is a slight possibility of falling over during the BESS test.  Commonly no injuries occur, because athletes are "athletic" and recapture balance quickly and efficiently.  However, if any injury occurs, certified athletic trainers will be on site to prevent and care for injuries. The Student investigator, Justin Nadeau, on this project is a Certified Athletic Trainer and Licensed in the State of Idaho to provide medical care to these student-athletes.
5. Historically and scientifically, ankle bracing has been a proper protocol in high-risk injury in sports.  The debate always exists of what is better between ankle taping and ankle bracing.  Ankle taping and ankle bracing help reduce injuries.  Based on previous experience, it has shown that ankle injuries are caused by poor proprioception and balance in athletes.  Therefore, this study is important to both athletes and Certified Athletic Trainers to examine if there is a better method of ankle stabilization between ankle taping and ankle bracing.  Athletes often have a preferred method of ankle taping.  This preference is not often indicated by the scientifically-best method.  Taping is known to benefit the athlete by providing stability.  The subjects in this study will learn what the best method of ankle stabilization is over their preferential method.  Therefore, this will benefit the subjects to show what the best method of ankle stabilization is to help prevent ankle injuries and enhance performance.  This experiment is beneficial not only to the subjects, but also fellow colleagues in the Athletic Training Profession.  As a Certified Athletic Trainer, previous experience has shown that balance has implication on the prevention of injuries.
6. Please note that you are able to withdraw your consent to participate in this study at any time without prejudice. Refusal to participate will involve no penalty. You will be given the opportunity to ask questions about the research and about concerning areas that you do not understand.
7. Any information about you obtained as a result of your participation in this research will be kept confidential. In any publications that result from this research, neither your name nor any information from which you will be identified will be published without consent. Your data will be given a code number for research identification and your name will be kept anonymous. Data, along with consent forms, will be kept in the possession of the Investigator at all times. Only the Investigator and Faculty Sponsor will have access to the identification data.
8. If you have any further questions concerning the study, you may contact the Investigator and/or Faculty Sponsor during the study, or at any time when you is appropriate.
9. **Investigator:** Justin Nadeau, University of Idaho Department of Movement Sciences, 875 Perimeter Drive, Moscow, ID 83844, (210) 835-8245

**Faculty Sponsor:** Dr. Sharon Stoll, University of Idaho Department of Movement Sciences, 875 Perimeter Drive, Moscow, ID 83844, (208) 885-2103

I, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ am giving my consent to participate in this study. I am aware of the risks and that I have the option to withdraw my consent and my data from this study at any time without prejudice.

Signature Date

# APPENDIX B

## IRB Approval Letter



# APPENDIX C

## RCR Certificate

