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The effect of tape and neoprene ankle supports on balance in athletes with injured ankles

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The Effect of Tape and Neoprene Ankle Supports on Balance in Athletes with Injured Ankles

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CHAPTER ONE

Introduction

Injuries to the ankle joint are among the most common in athletics (Feuerbach et al., 1994; Gross, 1987). As clinicians, it is important to investigate various factors which could potentially reduce the occurrence of ankle injuries. One such factor is an improvement in proprioception (Cox et al., 1993; Glencross & Thornton, 1981; Wilkerson & Nitz, 1994). A suggested method for improving proprioception in the ankle is application of an external support, such as tape or a brace (Feuerbach et al., 1994; Karlsson & Andreasson, 1992). This study compared the proprioceptive abilities of the ankle under three conditions: unsupported, taped, and using a neoprene ankle support.

The most common injury to the ankle joint is an inversion sprain (Gross, 1987). With this mechanism, the most commonly injured structures are the lateral ligaments (Gross, 1987) and lateral muscles (Karlsson & Andreasson, 1992). The reaction time of the peroneus brevis and longus muscles play an important role in ankle proprioception by returning the joint to a functional position from inversion. If impairment occurs during injury, a loss in proprioceptive function is likely to occur (Karlsson & Andreasson, 1992).

When this inversion mechanism occurs, sensory receptors also are likely to be among the affected structures (Glencross & Thornton, 1981). Decreased sensation from these receptors could lead to a lack in joint position sense, increasing the

possibility of re-injury (Feuerbach et al., 1994). One possible method of improving the sensory response of the receptors is the application of an external ankle support. Some of these receptors are located in the skin, and the external ankle support may increase their response, improving joint position sense (Feuerbach et al., 1994). These external supports may also stimulate the peroneus brevis muscle (Karlsson & Andreasson, 1992). It is not well understood, however, the extent to which external supports can improve an injured athlete's ability to maintain balance or prevent further injury.

Statement of the Problem

The purpose of this study was to compare the effects of ankle taping and neoprene ankle supports on proprioceptive responses in the ankle joint as measured by balance.

Operational Definitions

Proprioception- The body's ability to know its location in space.

External Ankle Supports- Tape or neoprene ankle supports applied to the ankle.

Ankle Taping- Support applied by a non-elastic tape. It is applied with adherent spray, heel and lace pads, and underwrap. The tape is applied using standard taping techniques with stirrups, basket weave, heel locks, and figure eights.

Unsupported Ankle- Any ankle without any of the above mentioned means of external support.

Injured Ankle- Any ankle injured from August, 1997 to two weeks prior to testing. The injury must have been severe enough to

require at least one of the following: holding the subject from athletic participation for at least two days or using crutches for at least two days.

Basic Assumptions

1. All subjects had the same desire to participate in the study.
2. The 16020 Stabilometer (Lafayette Instrument Co., Lafayette, Indiana) was properly calibrated and displayed accurate results.
3. The tester used the 16020 Stabilometer correctly.
4. The tester recorded the correct data.

Limitations

1. Only fifteen subjects were available for testing.
2. The subjects may not have had the same level of motivation for participation.
3. The subjects may have been inaccurate in reporting ankle injuries.
4. This study only tested the effects of tape and neoprene ankle supports, and not other types of external ankle supports.
5. This study did not test responses in non-athletes or other age groups.

Delimitations

1. Subjects were athletes aged 16-23 years from Marshall University, Huntington High School, and Cabell Midland High School.
2. Subjects had an injury in one ankle.

Null Hypotheses

1. There will be no difference in balance between wearing a neoprene ankle support and unsupported ankle in the subjects' injured ankles.
2. There will be no difference in balance between taped ankle and unsupported ankle in the subjects' injured ankles.
3. There will be no difference in balance between wearing a neoprene ankle support and taped ankle in the subjects' injured ankles.
4. There will be no difference in balance between injured and uninjured ankles with both ankles unsupported.
5. There will be no difference in balance between injured and uninjured ankles with both ankles taped.
6. There will be no difference in balance between injured and uninjured ankles with both ankles wearing a neoprene ankle support.

CHAPTER TWO

Review of Literature

Injuries to the ankle joint are among the most common in athletics (Feuerbach et al., 1994; Gross, 1987). With this fact in mind, it is important to investigate all factors which could lead to a reduction in the occurrence of these injuries. One such factor is an improvement in proprioception (Cox et al., 1993; Glencross & Thornton, 1981; Wilkerson & Nitz, 1994). A suggested method for improving proprioception in the ankle is application of an external ankle support, such as tape or a brace (Feuerbach et al., 1994; Karlsson & Andreasson, 1992).

Ankle Injury

The most common injury to the ankle joint is an inversion, or lateral sprain (Gross, 1987). With this mechanism, the most commonly injured structures are the lateral ligaments, peroneus muscles, and the sensory receptors in and around the joint (Feuerbach et al., 1994; Glencross & Thornton, 1981; Gross, 1987; Karlsson & Andreasson, 1992).

The lateral muscles, the peroneus brevis and longus, play an important role in ankle proprioception. As ankle everters, the contraction of these muscles returns the joint to a functional position from inversion (Karlsson & Andreasson, 1992). If impairment occurs during injury, a loss in proprioceptive function is likely to occur due to the slowing of the peroneus muscles' reaction time (Karlsson & Andreasson, 1992).

When this inversion mechanism occurs, sensory receptors also are likely to be among the affected structures (Feuerbach et al., 1994; Glencross & Thornton, 1981; Gross, 1987). The strength of these receptors is less than that of their surrounding tissues; therefore, an injury to these surrounding tissues will result in damage to the sensory receptors (Gross, 1987).

Proprioception

Proprioception is the body's inherent ability to perceive where it is in space. This is carried out by sensory receptors in the skin, muscles, tendons, ligaments, and joint capsules, as well as by visual and vestibular cues (Cox et al., 1993; Feuerbach et al., 1994; LaRiviere & Osternig, 1994; Perlau et al., 1995; Wilkerson & Nitz, 1994). Decreased sensation from these sensory receptors could lead to a lack in joint position sense and postural sway, increasing the possibility of re-injury (Cox et al., 1993; Feuerbach et al., 1994; LaRiviere & Osternig, 1994).

Studies Examining Proprioception

In previous studies, a connection has been established between external ankle supports and improved proprioception at the ankle joint. Feuerbach and colleagues (1994) tested 12 subjects, ten men and two women. None of the subjects had a recent ankle injury. They found that uninjured subjects wearing an Aircast Air-Stirrup were better able to reproduce specific ankle joint positions when compared to subjects without an ankle support (Feuerbach et al., 1994). Ankle joint position sense was

measured using nine reference joint angles in plantar-dorsiflexion, inversion-eversion, and forefoot abduction-adduction (Feuerbach et al., 1994). This external ankle support is believed to increase the response of the sensory receptors by increasing afferent feedback, thus improving joint position sense (Feuerbach et al., 1994).

Karlsson and Andreasson (1992) found in a study of ten men and ten women that a taped, injured ankle had a decreased time span between the onset of a sudden inversion and the reaction of the peroneus muscles when compared to an untaped, injured ankle. The inversion was caused by a tilting platform and the time was measured from the time of the tilt to the onset of EMG activity by the peroneus muscles (Karlsson & Andreasson, 1992). However, the peroneus muscles' reaction time was not decreased in the uninjured ankle (Karlsson & Andreasson, 1992).

Perlau and colleagues (1995) demonstrated that application of an elastic bandage significantly improved knee joint proprioception in an uninjured knee. Thirty nine women and fifteen men aged 22 to 40 years were tested (Perlau et al., 1995). Subjects had increased joint position sense while wearing the elastic bandage in comparison to without it (Perlau et al., 1995). Joint position sense was tested by matching a specific knee flexion-extension angle (Perlau et al., 1995). In order to determine the subjects' inherent propriception ability, their initial test results without an elastic bandage served as their baseline (Perlau et al., 1995). The subjects with inherently better joint position sense according to this method did not show

as much improvement as those with poorer inherent joint position sense (Perlau et al., 1995). Because the bandage stimulates the skin and the underlying musculature and joint capsule, it is theorized that it increases sensory receptor response, leading to an increase in proprioception ability (Perlau et al., 1995).

Heit and assosciates (1996) conducted a study in which subjects performed active ankle joint repositioning of positions of 30 degrees plantar flexion and 15 degrees inversion. The subjects performed the repositioning while braced, taped, and with no support (Heit et al., 1996). For plantar flexion, both the brace and tape improved joint position sense. In the eversion tests, only tape significantly improved joint position sense (Heit et al., 1996). This study showed that both a brace and tape can increase joint position sense, leading to an improvement in proprioception (Heit et al., 1996).

Twenty-four uninjured male subjects were tested in the braced and unsupported conditions by using the change in center of pressure as a measurement of proprioception (Kinzey et al., 1997). These measurements were taken while the subject attempted to balance in a modified Romberg position and a force plate measured the center of balance. The subjects were tested with altered visual input, vestibular input, or proprioceptive input and with no changes in sensory input (Kinzey et al., 1997). This study did not conclusively show that ankle braces improve proprioception. The subjects changed their center of pressure while braced and with normal sensory input. It was expected that the braced condition would decrease changes in center of

pressure. However, the change in center of pressure could be to a more stable position, thus showing an improvement in proprioception (Kinzey et al., 1997).

Simoneau and colleagues (1997) tested the effect strips of athletic tape had on ankle joint movement sense and ankle joint position sense in uninjured male subjects. Each subject was tested with and without two strips of tape on the skin in front of and behind the talocrural joint. The subjects were tested for sensation of joint movement and joint position an plantar flexion and dorsiflexion (Simoneau et al., 1997). It was shown that the tape strips significantly improved ankle joint position sense in the non weight bearing condition. However, the strips showed no improvement in joint position sense while weight bearing. The strips also showed no improvement in perception of movement for weight bearing or non weight bearing (Simoneau et al., 1997).

Because of the frequency of ankle injuries, it is necessary to study methods of reducing the number of these injuries. One such method is improvement of proprioception. Earlier studies have shown a correlation between external supports and improved proprioception.

CHAPTER THREE

Methodology

Ankle joint injuries have been shown to be among the most common injuries in athletics (Feuerbach et al., 1994; Gross, 1987). Because of the frequency of these injuries, it is important to investigate any factors which could potentially reduce these injuries. One factor which has been suggested to reduce the occurrence of these injuries is an improvement in proprioception (Cox et al., 1993; Glencross & Thornton, 1981; Wilkerson & Nitz, 1994). A suggested method for improving proprioception in the ankle is application of an external support, such as tape or a brace (Feuerbach et al., 1994; Karlsson & Andreasson, 1992).

Subjects

Subjects were athletes aged 16-23 from Marshall University, Huntington High School, and Cabell Midland High School. The subjects all had one injured ankle. The injury must have occurred between August 1, 1997, and two weeks prior to testing. The injury must have been severe enough to require the athlete to avoid athletic participation for at least two days or to utilize crutches for at least two days.

All subjects' rights were observed. The subjects have the right to privacy or non-participation, the right to remain anonymous, the right to confidentiality, and the right to expect experimenter responsibility. These rights were explained to the

subjects through the informed consent agreement. For the subjects under 18 years of age, their parents also signed the informed consent agreement.

Instrumentation

For the balance tests, the 16020 Stabilometer (Lafayette Instrument Co., Lafayette, Indiana) was used. This instrument measured the time the subject was out-of-balance. Time was measured to one tenth of a second. The neoprene ankle support used was the Ace Neoprene Ankle Brace (Becton Dickinson and Company, Franklin Lakes, New Jersey).

Johnson and Johnson Coach 1½ inch athletic tape (Johnson and Johnson Consumer Products, Inc., Skillman, New Jersey) was used for the ankle tape. The taping was performed by the same Certified Athletic Trainer for every subject. Adherent spray, heel and lace pads, and underwrap were first applied; then the tape was applied using standard taping techniques including basketweave, stirrups, figure eights, and heel locks.

Procedures

Before testing, all subjects filled out a questionnaire. The questionnaire included the sport in which the subject participates, the subject's dominant foot, and the subject's injured ankle. It also contained questions regarding the date of injury, time missed from athletic participation, and if the subject was required to use crutches. The questionnaire also inquired about any rehabilitation activities, the amount of time rehabilitation activities were conducted, and who conducted the

rehabilitation activities.

For all balance tests each subject wore socks and low cut athletic shoes on both feet. The subject stood with one foot in the center of the platform. The subject balanced on this foot. The non weight bearing limb was slightly flexed at the knee. The subject attempted to hold this position while keeping the platform in a balanced position for 30 seconds. The subject initially performed a practice trial. For the practice trial, the subject attempted to balance on the foot to be used for the first test. The subject performed the practice trial under the condition to be used for the first test.

The Stabilometer timed to one tenth of a second the amount of time during the 30 second test that the subject was not balanced. Any time the platform tilted five degrees in either direction, a sensor turned on the Stabilometer's timer. When the platform was tilted less than five degrees in either direction, the timer did not run. In this way, the Stabilometer measured the time the subject was not balanced.

Both the injured and non injured ankles were tested as the weight bearing limb. Both ankles were tested under the unsupported, taped, and neoprene sleeve conditions. Both the order of the ankle to be tested and the order of the conditions were counterbalanced. Each ankle was tested under each condition twice.

The testing required one session per subject which lasted approximately 30 minutes. Subjects rested 15 seconds between trial one and trial two for each condition. Three minutes were

taken between conditions and between ankles to allow time to change conditions.

CHAPTER FOUR

Results

The primary purpose of this study was to compare the effects of ankle taping and neoprene ankle supports on proprioceptive responses as measured by balance. A 2x3 repeated measures ANOVA was used to analyze the data from the balance tests.

Subjects

Fifteen subjects (8 male, 7 female) ranging in age from 16 years to 23 years participated in this study. The subjects were athletes (Table 1) at either the high school or college level (7 high school, 8 college). All subjects had injured one ankle. Descriptive data can be found in Table 2.

Balance Test Data

A repeated measures ANOVA with two within subject factors (condition [tape, neoprene, unsupported] and status [injured, uninjured]) was conducted on the balance test scores for the fifteen subjects (Table 3).

Null hypothesis 1 stated that there would be no differnce in balance between the conditions of neoprene ankle support and unsupported. This study failed to reject null hypothesis 1 because no significance was shown for condition [$F(2)=1.97$, $p=0.1470$] (Figure 1).

Null hypothesis 2 stated that there would be no difference in balance between the conditions of taped ankle and unsupported ankle. Null hypothesis 2 failed to be rejected because no

significance was found for condition [$F(2)=1.97$, $p=0.1470$] (Figure 1).

Null hypothesis 3 stated that there would be no difference in balance between the conditions of neoprene ankle support and taped ankle. This study failed to reject hypothesis 3 because no significance was revealed for condition [$F(2)=1.97$, $p=0.1470$] (Figure 1).

Null hypothesis 4 stated that there would be no difference in balance between the status of injured and uninjured ankles with both ankles unsupported. Null hypothesis 4 failed to be rejected because there was no significance shown for status [$F(1)=1.09$, $p=0.3003$] (Figure 2).

Null hypothesis 5 stated that there would be no differences in balance between the status of injured and uninjured ankles. This study revealed no significance for status [$F(1)=1.09$, $p=0.3003$]; therefore, null hypothesis 5 failed to be rejected (Figure 2).

Null hypothesis 6 stated that there would be no difference in balance between the status of injured and uninjured ankle with both ankles wearing a neoprene ankle support. This study failed to reject null hypothesis 6 because no significance was revealed for status [$F(1)=1.09$, $p=0.3003$] (Figure 2).

There was no significant interaction between the within subject factors [$F(2)=1.51$, $p=0.2276$] (Figure 3).

Results from the questionnaire concerning type of rehabilitation activities, amount of rehabilitation, time missed from activity, use of crutches, time between injury and testing,

and dominance of ankle injured can be found in Table 4.

From the questionnaire it was determined that 7 subjects participated in proprioceptive training during their rehabilitation, while 8 subjects did not participate in proprioceptive training. The mean cut-of-balance time for those who participated in proprioceptive training was 5.6 seconds, while the mean out-of-balance time for those who did not participate in proprioceptive training was 9.0 seconds (Figure 4).

The questionnaire also discovered that 8 subjects injured their dominant leg, and 7 subjects injured their non-dominant leg. The subjects who injured their dominant leg had a mean cut-of-balance time of 6.4 seconds. The mean out-of-balance time for the subjects who injured their non-dominant leg was 8.6 seconds (Figure 5).

Table 1: Sport

Sport	N
Basketball	5
Football	5
Soccer	4
Volleyball	1

Table 2: Descriptive Data

N	Height in cm	Weight in kg	Age in yr
15	178.05±12.85	80.42±23.35	18.93±2.34

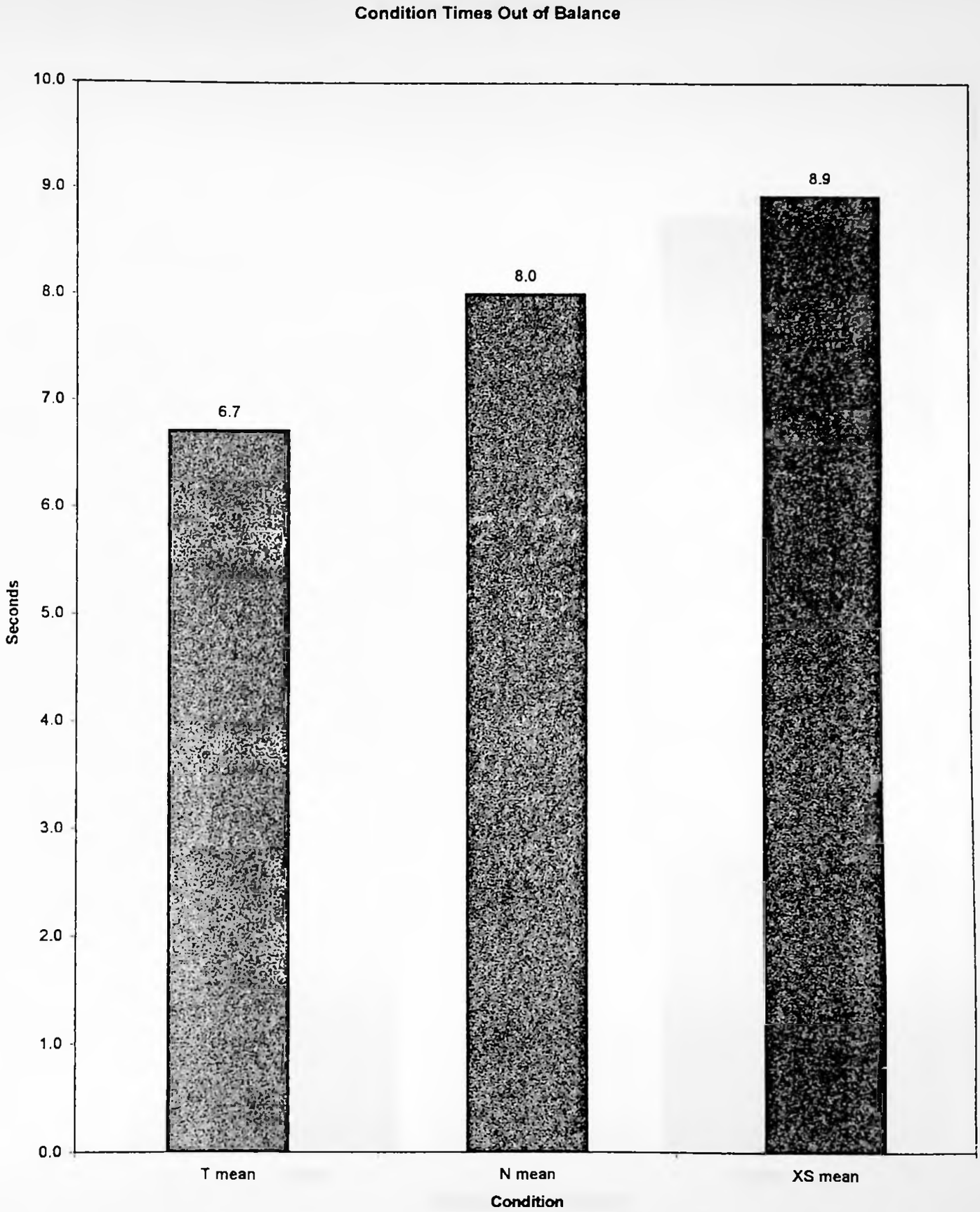
Table 3: F Table for Within Subjects ANOVA

Source	DF	SS	MS	F
Treatment	2	74.39	37.19	1.97
Injury	1	20.54	20.54	1.09
Treat x Injury	2	57.06	37.19	1.51
Error	70	1320.87	18.87	

Table 4: Questionnaire Results

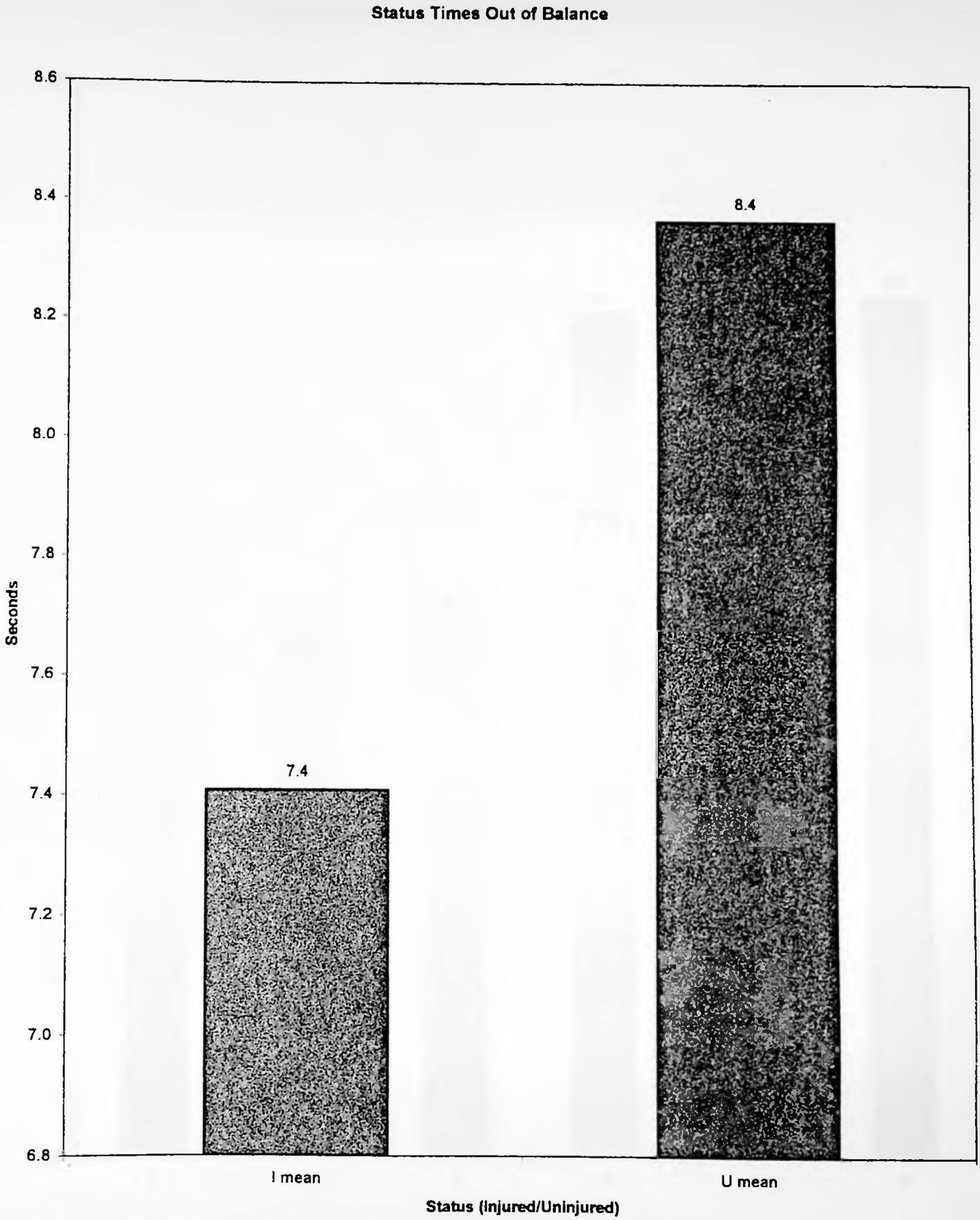
Descriptor	N
Proprioceptive training	7
No proprioceptive training	8
No rehabilitation	2
Under 1 week of rehabilitation	1
1-3 weeks of rehabilitation	9
3-6 weeks of rehabilitation	3
1-7 days missed participation	6
8-14 days missed participation	6
15-21 days missed participation	3
Required crutches	8
No crutches	7
0-10 weeks between injury&testing	3
10-20 weeks between injury&testing	1
20-25 weeks between injury&testing	6
25-30 weeks between injury&testing	5
Dominant ankle injured	8
Non-dominant ankle injured	7

Figure 1



T=taped N=neoprene support XS=unsupported

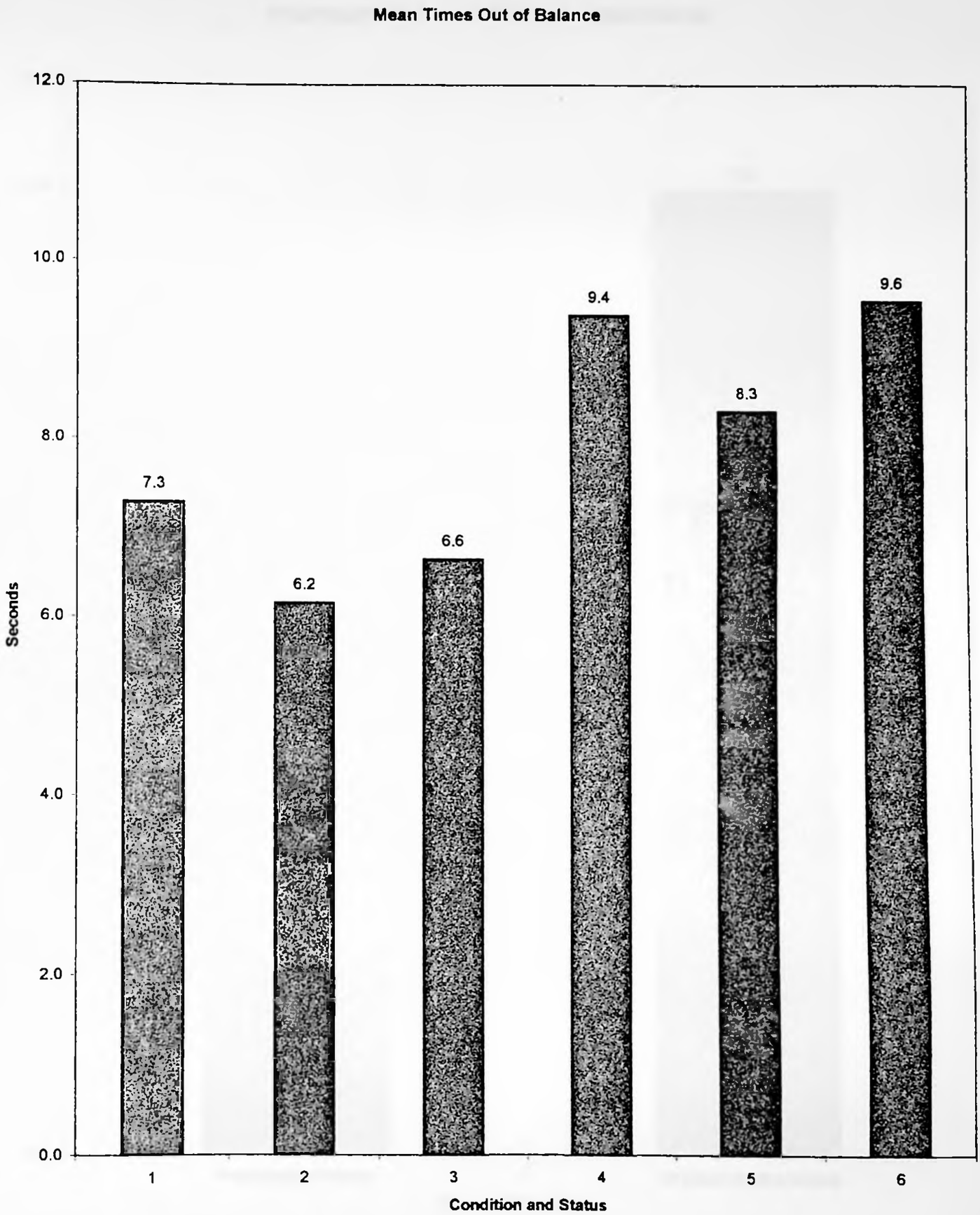
Figure 2



I=injured

U=uninjured

Figure 3



1=taped, injured
2= taped, uninjured
3=neoprene support, injured
4=neoprene support, uninjured
5=unsupported, injured
6=unsupported, uninjured

Figure 4

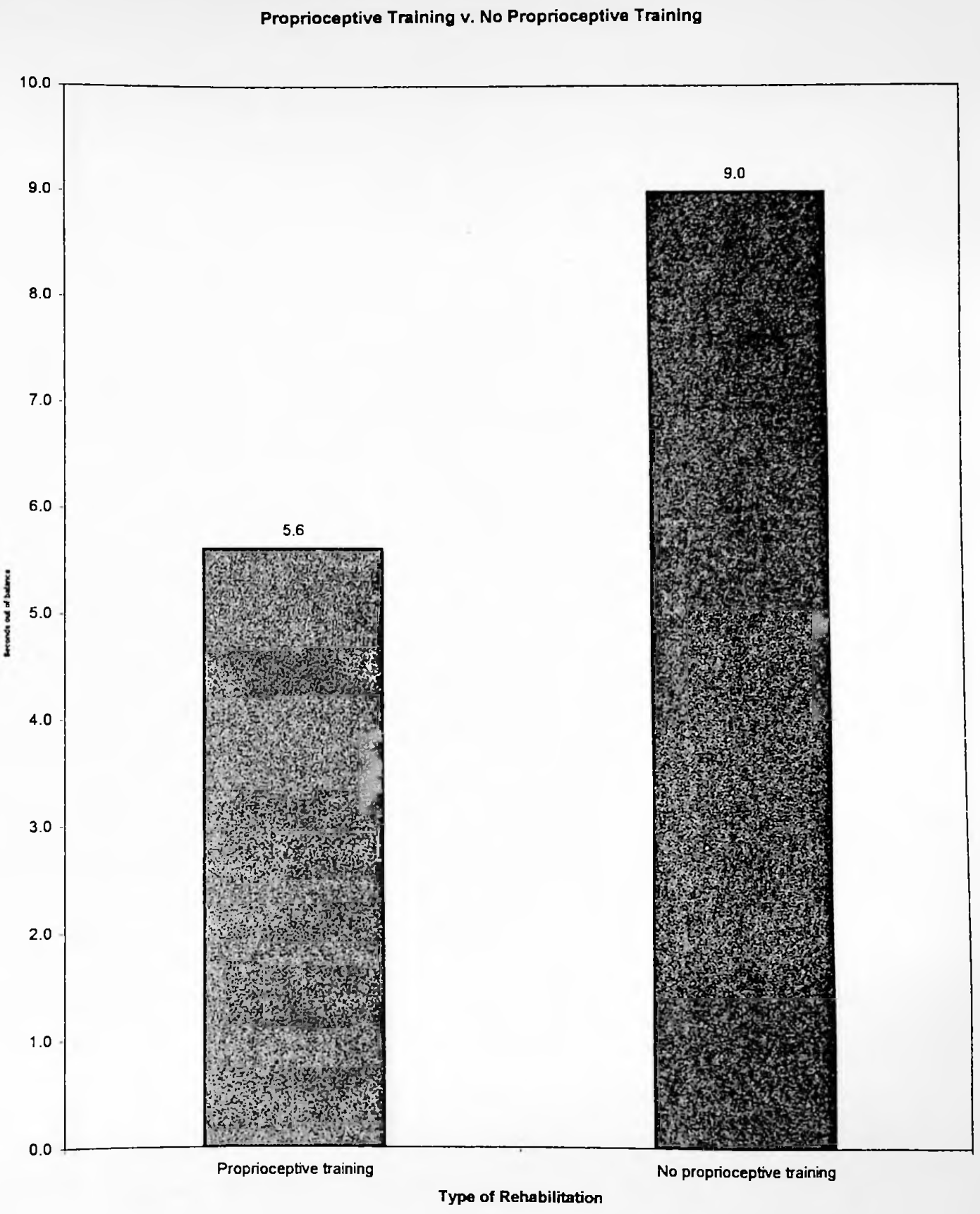
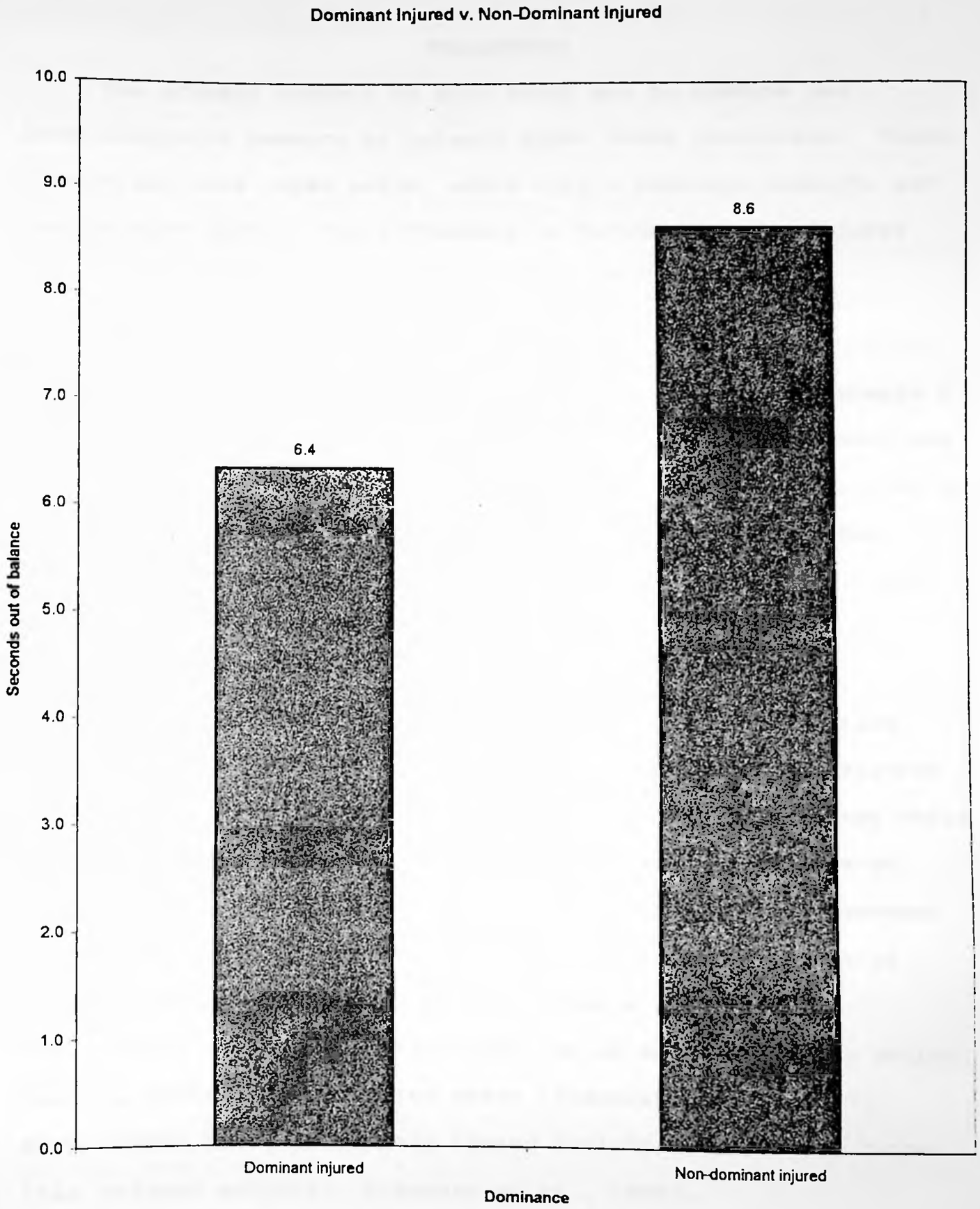

Proprioceptive Training v. No Proprioceptive Training
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
5.6
9.0
Proprioceptive training
No proprioceptive training
Type of Rehabilitation

Figure 5


Dominant Injured v. Non-Dominant Injured
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Seconds out of balance
6.4
8.6
Dominant injured
Non-dominant injured
Dominance

CHAPTER FIVE

Discussion

The primary purpose of this study was to examine the proprioceptive measure of balance under three conditions. These conditions were taped ankle, ankle with a neoprene support, and unsupported ankle. The difference in balance between injured ankles and uninjured ankles was also examined.

Balance Test Results for Condition

Null hypothesis 1, null hypothesis 2, and null hypothesis 3 stated that there would be no differences in balance between the three conditions of taped, neoprene, and unsuppcrted. Because no significant differences were discovered between these three conditions, this study failed to reject null hypothesis 1, null hypothesis 2, and null hypothesis 3.

These results are supported by Simoneau and associates (1997) who found that two strips of athletic tape applied to the ankle did not improve proprioception as measured by ankle joint position sense or ankle joint movement sense while weight bearing. This study also revealed that the strips of athletic tape had no significant effect on ankle joint movement sense while in a non weight bearing position (Simoneau et al., 1997). However, it should be noted that a significant improvement was seen in proprioception as measured by non weight bearing ankle joint position sense (Simoneau et al., 1997). Also, these researchers only tested healthy individuals, rather than injured subjects (Simoneau et al., 1997).

Kaminski and Perrin (1996) determined that prophylactic knee bracing had no significant effect on proprioception as measured by active knee joint position sense or passive knee joint position sense in uninjured males. This study also showed that knee bracing had no significant effect on balance for single or double leg stances for static balance or dynamic inversion/eversion balance (Kaminski & Perrin, 1996). This study only revealed a significant improvement in double leg stance dynamic dorsiflexion/plantarflexion balance (Kaminski & Perrin, 1996).

Several other studies refute these findings. Heit and his colleagues (1996) and Feuerbach and associates (1994) both demonstrated that ankle joint position sense was significantly improved by application of an external ankle support in uninjured subjects. Neither study examined the effects of external ankle supports on injured subjects (Feuerbach et al., 1994; Heit et al., 1996).

Orteza and her associates (1992) conducted a study in which subjects with an acute ankle sprain had improved balance with a molded ankle orthotic as compared to balance without an ankle orthotic; however, unmolded orthotics showed no significant improvement in balance scores for subjects with acute ankle injuries.

Balance Test Results for Status

Null hypothesis 4, null hypothesis 5, and null hypothesis 6 stated that there would be no differences in balance between the

status of injured and uninjured ankles in any of the three conditions. No significant difference was seen between injured and uninjured ankles; therefore, null hypothesis 4, null hypothesis 5, and null hypothesis 6 can not be rejected.

A study conducted by Gross (1987) supports these findings. The results of the study showed that ankle sprains had no significant effect on ankle joint proprioception as measured by ankle joint position sense (Gross, 1987).

Orteza and colleagues (1992) determined that subjects with an acute ankle injury had decreased ability to balance when compared to subjects who had no ankle injuries. One explanation for the difference between the findings of Orteza and her colleagues (1992) and this study is the subject pool. Orteza and associates (1992) compared subjects with an injured ankle to subjects who did not have a history of ankle injury, while this study compared a single subject's injured ankle to the uninjured ankle. The subject could have had a proprioceptive deficit before ankle injury. Because the subjects were not tested before injury, it is not known if the injury caused the deficit or the deficit caused the injury (Gross, 1987).

Improvements/Future Research

One possibility for the discrepancies between this study and other similar studies could be that this study does not account for other injuries which could be affecting balance. The questionnaire for this study did not ask about past injuries to other joints, such as the knee or hip, which could be affecting

balance (Kaminski & Perrin, 1996; Perlau et al., 1995). It also did not take into account the possibility of any previous head injuries which could be affecting balance.

Another improvement could be made to this study by expanding the subject pool. Due to the given number of ankle injuries in the testing time period, the number of subjects for this study was limited. However, a study spanning a longer period of time could test more subjects.

The many contrasting results in studies involving proprioception could be due to the many ways in which proprioception is tested. Further research should be conducted in determining the most appropriate methods of evaluating proprioception, including which have the highest intertester reliability.

Summary and Conclusions

The major findings of this study were that there were no significant differences in balance between the conditions of taped, neoprene, and unsupported; nor were there significant differences in balance between injured and uninjured ankles. These results led to the conclusions that neither ankle injury nor type of ankle support had an effect on proprioception as measured by balance.

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APPENDIX A

Informed Consent

Tara M. Gerlach, ATC

INFORMED CONSENT TO PARTICIPATE IN A RESEARCH STUDY ENTITLED:
The effect of tape and neoprene ankle supports on balance in athletes with injured ankles

INTRODUCTION:

I am invited to participate in a research study which will take place at Marshall University. All individuals who volunteer to participate in the study must know that: a) participation is entirely voluntary; b) I may not personally benefit from the results of this study, but results of this study may benefit people in the future; c) I may end my participation in the study at any time without penalty.

The specific facts of this study are described in the attached research protocol. A simplified summary of this information is given below. If I have any questions I may ask the person who has discussed this study with me.

NATURE OF THE STUDY:

I will be asked to perform a balance test. Initially, I will perform a practice trial with both feet on the platform of an electronic balance board. I will then perform six individual balance test trials. I will perform the test on both ankles under each of the three conditions (taped, unsupported, neoprene support). For each trial I will stand on one foot in the center of the platform and try to hold a balanced position for 30 seconds. During the testing I will be asked to wear ankle length socks and low cut athletic shoes

RISKS:

The only potential risk is falling while I am on the balance board. In order to alleviate this risk, the tester will always act as a spotter while I am on the balance board.

RESEARCH-RELATED INJURY:

In the event that my participation in this study results in illness or injury, I or my insurance company and/or other hospital provider will be asked to pay for costs of treatment. No other compensation, financial or otherwise will be provided by the investigators, Marshall University, University Physicians and Surgeons, Inc.

WHO TO CONTACT:

1. If I have any questions regarding this study, I may contact Tara M. Gerlach, ATC at (304) 697-2238.
2. If I have questions regarding research subjects' rights, I may contact Dr. Nancy Scher, IRB Chairman at (304) 696-7320 during regular working hours (8:00am-4:00pm).

_____ _____

Subject's initials/date Parent/Guardian's initials/date

CONFIDENTIALITY:

I understand that confidentiality of my records will be maintained and that my identity on research forms, presentations, and in public articles will not be revealed. I understand that the Marshall University IRB, the Food and Drug Administration, or other appropriate Federal or State Agencies may inspect the records in the ordinary course of carrying out their functions. Except as noted above or as may be required by law or hospital policy, my identity will remain confidential.

I will not receive any payment for my participation in this study.

This is to certify that I have read the explanation of the above research study and agree to participate in the work as described in this protocol and consent form.

_____
Subject's name (please print)

_____ _____
Subject's signature Date

If subject is under 18 years of age, the subject's parent or guardian must also sign this form.

_____
Parent/Guardian's name (please print)

_____ _____
Parent/Guardian's signature Date

_____ _____
Investigator's signature Date

APPENDIX B

Data Collection Sheet

DATA COLLECTION

Name: _____

ID#: _____

Date of testing: _____

Height: _____

Weight: _____

Age: _____

Sex: M F

Sport: _____

Dominant leg (leg used to kick a ball): R L

Injured ankle: R L

Neoprene ankle support size: S M L XL

Date of injury: _____

How much time did you miss from your athletic activity? _____

_____

Were you required to use crutches? Y N
If yes, for how long? _____

Who directed your treatment/rehabilitation?
Physician Y N
Physical Therapist Y N
Athletic Trainer Y N

How long did you participate in rehabilitation?
_____ Not at all
_____ Under one week
_____ 1-3 weeks
_____ 3-6 weeks
_____ 6-12 weeks

In which rehabilitation activities did you participate?
_____ Stretching
_____ ROM exercises
_____ Strengthening exercises
_____ Proprioceptive training

_____ **Injured Ankle** R L

_____ Unsupported
Test 1 time _____
Test 2 time _____
_____ Taped
Test 1 time _____
Test 2 time _____
_____ Neoprene
Test 1 time _____
Test 2 time _____

_____ **Uninjured Ankle** R L
_____ Unsupported
Test 1 time _____
Test 2 time _____
_____ Taped
Test 1 time _____
Test 2 time _____
_____ Neoprene
Test 1 time _____
Test 2 time _____

APPENDIX C

Raw Data

Subject	TI	TU	NI	NU	XSI	XSU
1	12.1	2.2	10.5	6.8	11.9	4.1
2	8.3	1.6	8.4	6.4	9.1	11.6
3	0.6	10.0	1.8	11.3	1.7	14.9
4	21.6	16.7	16.1	15.2	19.6	27.1
5	7.1	12.4	6.4	15.5	8.3	18.8
6	1.5	3.1	3.7	9.2	12.8	13.2
7	1.2	20.4	2.9	23.8	9.7	12.9
8	9.2	2.0	10.6	3.0	9.3	2.7
9	2.3	0.2	1.9	1.7	2.7	3.8
10	11.0	4.8	11.9	11.5	13.5	6.5
11	3.7	0.8	1.5	0.0	6.5	3.7
12	5.0	2.3	5.8	4.4	6.0	3.8
13	1.1	0.6	1.2	0.3	0.8	0.9
14	5.4	1.1	8.3	10.9	2.4	7.3
15	19.1	14.1	8.6	20.8	10.3	12.1
Total	109.2	92.3	99.6	140.8	124.6	143.4
Mean	7.3	6.2	6.6	9.4	8.3	9.6

APPENDIX D

ANOVA Results

Variable totals (checking data input) appears OK

Variable	N	Sum
TII	15	109.2000000
TIU	15	92.3000000
TSI	15	99.6000000
TSU	15	140.7000000
YSI	15	124.6000000
YSU	15	143.4000000

General Linear Models Procedure
Class Level Information

Class	Levels	Values
SUBJ	15	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
STATUS	2	I U I(njured) U(ninjured)
SUPPORT	3	N T X N(eoprene) T(ape) X(no support)

Number of observations in data set = 90

Dependent Variable: Y

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	19	2154.3513333	113.3869123	6.01	0.0001
Error	70	1320.8726667	18.8696095		
Corrected Total	89	3475.2240000			

Source	DF	Type III SS	Mean Square	F Value	Pr > F
SUBJ	14	2002.3540000	143.0252857	7.58	0.0001
STATUS	1	20.5444444	20.5444444	1.09	0.3003
SUPPORT	2	74.3886667	37.1943333	1.97	0.1470
STATUS*SUPPORT	2	57.0642222	28.5321111	1.51	0.2276

Tukey's Studentized Range (HSD) Test for variable: Y

Alpha= 0.05 df= 70 MSE= 18.86961
Critical Value of Studentized Range= 3.386
Minimum Significant Difference= 2.6857

Means with the same letter are not significantly different.

Tukey Grouping	Mean	N	SUPPORT
A	8.933	30	X
A			
A	8.010	30	N
A			
A	6.717	30	T

ABSTRACT

Ankle joint injuries are among the most common in athletics. An improvement in proprioception is one factor in reducing the incidence of these injuries. It has been theorized that external ankle supports increase proprioception in the ankle joint. The purpose of this study was to compare the effects of ankle taping and neoprene ankle supports on proprioceptive responses in the ankle joint as measured by balance. Fifteen injured athletes (age 18.93±2.34 yrs; height 178.05±12.85 cm; weight 80.42±23.35 kg) from the high school and college levels participated in this study. The 16020 Stabilometer (Lafayette Instrument Co., Lafayette, IN) was used to measure the time the subject was out-of-balance. Time was measured to one tenth of a second. Subjects stood with one foot in the center of the balance platform and the other limb slightly flexed. The subject attempted to hold this position while keeping the platform in a balanced position for 30 seconds. Both the injured and uninjured ankles were tested. Both ankles were tested under the three conditions of unsupported, taped, and neoprene support. Each ankle was tested under each condition twice. A 2x3 repeated measures ANOVA was used to analyze the data from the balance tests. No significant difference in balance was shown between the conditions of unsupported, taped, and neoprene [$F(2)=1.97$, $p=0.1470$]. The status of injured and uninjured also showed no significant difference [$F(2)=1.09$, $p=0.3003$]. There was no significant interaction between the within subject factors [$F(2)=1.51$, $p=0.2276$]. These results led to the conclusions that

neither tape and neoprene nor injury affect balance. However, these findings do not take into account other injuries which could be affecting balance. These findings could also be affected by the error from a small subject pool.