EFFECTS OF DYNAMIC AND STATIC STRETCHING ON EXPLOSIVE AGILITY ACTIVITY

By
Nathan Kees

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The faculty of Humboldt State University

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Masters of Science
In Kinesiology Sports medicine
April, 2007
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Approved by:

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Abstract

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A one-way ANOVA revealed no significant differences among the three treatment groups on performance time to complete the Illinois Agility Test: control group ($M = 14.24$ s), static stretching group ($M = 14.50$ s), and dynamic stretching group ($M = 14.15$ s). Results suggest that dynamic stretching does not produce faster test times for explosive agility activity over static stretching.
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ACTIVITY

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Acknowledgements

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Chapter One

Introduction

Many athletes use some type of pre-participation routine in order to prepare themselves for athletic practice or competition. These routines usually consist of a “warm-up” followed by stretching. A typical “warm-up” usually consists of light running or light calisthenics that are designed to increase core temperature, which in turn increases the flexibility and extensibility of muscles and other soft tissues. Stretching is also designed to increase the flexibility and extensibility of muscles and other soft tissues. Athletes and Coaches use many different types of stretching that are usually based only on their personal preference, but no optimal type or amount of stretching has been identified. Static stretching, the holding of a fixed stretched position for 15 to 30 seconds, has long been used as the standard stretching routine. Current literature indicates that dynamic stretching may be more beneficial prior to activities that are explosive in nature (Fletcher & Jones, 2004; Little & Williams, 2006). To date, insufficient evidence exists endorsing either static or dynamic stretching prior to explosive type activities. The current study attempted to further elucidate the issue of using static versus dynamic stretching prior to an explosive type activity. These results may assist athletes and coaches in determining what type of stretching to use when preparing for explosive type, athletic, activities.

Statement of the Problem

While most athletes and coaches are still using static stretching as part of their pre-participation routine, some evidence exists indicating that dynamic stretching may increase performance for explosive type activities. To date no research can be identified
to demonstrate the effectiveness of dynamic stretching on explosive type activities that includes a combination of straight ahead running and cutting, as in agility testing.

**Purpose**

The purpose of this study was to determine if dynamic stretching prior to an explosive type activity would yield decreased performance times on the Illinois Agility Test as compared to static stretching.

**Review of Literature**

*Pre-participation routine.* A pre-participation routine is generally referred in the literature as “warm-up,” but for the purposes of the current research the term “warm-up” requires further partition into two components of warm-up and stretching. Briefly, warm-up is to increase core temperature and stretching is increasing the range of motion of a joint.

A typical “warm-up” usually consists of light running or light calisthenics that are designed to increase core temperature, which in turn increases the flexibility and extensibility of muscles and other soft tissues. Stretching is also designed to increase the flexibility and extensibility of muscles and other soft tissues. Together, these two elements comprise a pre-participation routine.

Young and Behm (2002) referred to three typical components of a pre-participation routine: 1) A relatively low intensity aerobic component that is general in nature to increases core temperature, which improves neuromuscular function, 2) Some stretching of the specific muscles involved in the subsequent activity to achieve a short term increase in range of motion (ROM) at a joint or to induce muscle relaxation and therefore decrease the stiffness of the muscle-tendon system, 3) Rehearsal of the skill
about to be performed at gradually increasing intensities, culminating in some efforts that are equal to or greater than the expected competition intensity to activate or recruit the specific muscle fibers and neural pathways required to achieve optimum neuromuscular performance. Wathen (1987) suggest the following guidelines for a pre-participations routine: 1) increase core temperature one to two degrees, which should cause sweating but not fatigue, 2) include some specific warm-up patterns following general warm-up activities, 3) 10 to 30 minutes of warm-up activity should taper off 10 to 15 minutes prior to competition with cessation of warm-up five minutes prior to competition, 4) well-conditioned athletes require more warm-up than their lesser conditioned counterparts, and 5) some stretching should be included. In order to ensure that an athlete is adequately prepared for optimal performance, a pre-participation routine should include both Young and Behm’s (2002) components and Wathen’s (1987) guidelines for a pre-participation routine.

Following a regimented pre-participation routine that includes these components and guidelines prior to activity should provide the following positive benefits: 1) increased maximum oxygen uptake, 2) reduced need for oxygen, 3) reduced pulmonary blood flow resistance, 4) improved rate of exchange for oxygen going into the tissues and for carbon dioxide removal from the tissues, 5) shunts blood from the skin and viscera to the working muscles, 6) reduced dependency on anaerobic metabolism, 7) allowed second wind phenomenon to occur more quickly in endurance events, 8) improved strength, 9) improved speed and power, 10) increased rate of neuromuscular transmission and muscle fiber recruitment, 11) improved range of motion (ROM), 12) provided
psychological focus, 13) activated muscle memory and coordination in specific warm-up procedures, and 14) hypothetically may reduced soft tissue injury (Wathen, 1987).

Warm-up. A warm-up is designed to increase the core temperature in order to prepare the body for athletic competition or practice, and generally consists of a gradual increase in exercise intensity while also progressing from general toward competition specific type activities. There are two main techniques to perform a warm-up; passive and active. Passive warm-up techniques use heat packs, hydrotherapy, massage, ultrasonics and diathermy (Wathen, 1987), and have traditionally been used in sports medicine and physical therapy setting as a precursor to rehabilitation exercises. Active warm-up is accomplished by using one’s own muscular power to perform light exercises that will increase core body temperature, without fatiguing the participant. The duration of exercises should not be too long or too high intensity. Active warm-up techniques can further be categorized into general and specific (Wathen, 1987).

A general warm-up consists of gross motor activities such as running and calisthenics designed to prepare the body for participation through increasing core body temperature, while not necessarily approximating the movement patterns of the sport to be engaged (Wathen, 1987). No set regimen is required to perform general warm-ups and therefore vary greatly depending on the sport, coach, and athlete. Specific warm-up includes movements that are specific to an activity or sport (Wathen, 1987), and is designed to gradually prepare the athlete for performance through movements that replicate the demands of the specific activity or sport. Whether the warm-up is active or passive, general or specific, the primary purpose of a warm up is to increase the body’s core temperature.


*Stretching.* Stretching is the gradual application of tensile force to lengthen a muscle or group of muscles to increase the range of motion of a joint and is often performed as part of a pre-participation routine to aid in preparing the body for activity. General benefits of stretching include increased flexibility and extensibility of muscles and other soft tissue structures. Stretching may be categorized into two major types; Static and Dynamic.

*Static stretching.* Static stretching is used to stretch muscles or muscle groups while the body is at rest, and is performed by gradually lengthening a muscle or muscle group to an elongated position (to the point of discomfort) and holding that position for 10-30 seconds. While static stretching has long been known for it’s effectiveness to increase joint range of motion (ROM), its effectiveness to promote optimal performance in high intensity explosive type activities has been debated (Moss, 2002).

Moss (2002) has indicated that static stretching prior to high intensity explosive type activities may inhibit performance resulting from a power and strength reduction due to a reduction in muscle activation and contractile properties at the cellular level. Even though this literature discourages static stretching prior to high intensity explosive type activities, it should be noted that static stretching is still recommended as part of a cool down, which serves to facilitate muscular relaxation, promote the removal of waste products, and reduce muscle soreness (Best, 1995).

*Dynamic stretching.* Dynamic stretching uses momentum and active muscular contraction to produce a stretch, and is comprised of movements that are similar to the movements in which the participant will engage (Mann & Jones, 1999). Since dynamic stretching requires balance and coordination, this type of program should start at low
intensities and progress toward higher intensities of the movements. Dynamic stretching may fulfill all of Young and Behm’s (2002) components of a pre-participation routine; aerobic activity to increase core temperature, stretching of musculature and rehearsal of motor skills involved in the activity. This concept may be looked at as an important aspect, something that static stretching cannot achieve. An additional benefit may be that dynamic stretching enables athletes to be involved, actively focusing their energy into their pre-participation routine and activity, whereas static stretching may allow time for conversation, which may hinder the quality of the stretching session. Dynamic stretching protocols may vary in length and exercises performed depending on the time permitted, but the main focus should be on mimicking activity specific movement patterns (Boyle, 2004). Therefore dynamic stretching as part of pre-participation routine prior to high intensity explosive type activities may be beneficial to performance versus static stretching.

**Injury prevention.** Injuries to the musculoskeletal system account for almost half of the injuries in sports (Safran, Garrett, Seaber, Glisson & Ribbeck, 1988). A proper pre-participation routine prior to explosive type activity allows the body to gradually accommodate to the activity and therefore may reduce injuries to the musculoskeletal system. Utilizing dynamic stretching during the pre-participation routine prior to explosive type activities reduces the likelihood of muscle, connective tissue, or ligamentous damage by allowing the muscles to tolerate stresses with a reduced level of strain (Gesztesi, 1999). Therefore an effective pre-participation routine may consist of running followed by a dynamic stretching protocol because running should increase the core temperature and lubricate joints (Roth and Benjamin, 1979) while dynamic
stretches uses sport specific movements used in competition, which may prevent injuries by eliminating awkward and inefficient movements (Hedrick, 2000).

_Hypothesis_

Dynamic stretching, included as part of a pre-participation routine, will yield the fastest time versus static stretching, included as part of a pre-participation routine, or running alone on the Illinois agility test for collegiate women soccer players.

_Limitations_

The following limitations were noted as they may have affected the outcome of the study:

1) How the athletes were feeling mentally and physically prior to the test
2) Previous injuries affecting performance

_Delimitations_

The following delimitations were noted as they may have affected the outcome of the study:

1) Time of day the study was performed
2) Where the study was going to be tested
3) Age
4) Year/Eligibility in school
5) Participants/athletes involved in study (HSU Women’s Soccer team)
6) Group sizes
7) How the test are going to be carried out/given/proctored
8) Amount of time given for testing protocols
9) Amount of time given between tests
11) Sample size

*Operational Definitions*

*Agility* - Agility is the ability to change direction of the body or body parts rapidly under control (Baechle & Earle, 2000).

*Range of Motion (ROM)* - The range at which a joint moves through space.

*Pre-participation routine* - The combination of both a warm-up and stretching protocol prior to activity

*Warm-up* - A warm-up is designed increase the core temperature in order to prepare the body for athletic competition or practice, and usually consists of light running or light calisthenics
Chapter Two

Methodology

In order to determine if dynamic stretching subsequent to a warm-up run would yield the fastest time versus static stretching subsequent to a warm-up run or running alone on the Illinois agility test for collegiate women’s soccer players the following procedures were developed. The Internal Review Committee for the use of human subjects approved the study (05-46) in April, 2006.

Subjects. Twenty subjects were recruited from the Humboldt State University’s Women’s Soccer team, an NCAA Division II program that competed in the Great Northwest Athletic Conference (GNAC) at the time of the study.

Instruments and apparatus. The instrument used to determine the agility of the subjects was the Illinois agility test, which incorporates quick change of direction, straight ahead sprinting, and awareness of body positioning. The validity, reliability, and reproducibility of the Illinois agility test has been established and it has been used repeatedly in sport testing (Pauole, Madole, & Lacourse, 2000; Roozen, 2004). A diagram of the Illinois Agility Test can be seen in Diagram 1.

Timing. Time to complete the Illinois agility test was measured with the Solo Time Electronic Timing System (Type 450), Denver Colorado. Manufactures instructions were followed for the proper set-up with use of a touch pad to start the timer and a laser timing gate to stop the timer (see Diagram 1).

Temperature. Core body temperature was taken using a handheld Braun Thermoscan Pro 4000 (type 6021). The Thermoscan Pro 4000 is a battery operated device designed to take core body temperature via tympanic membrane.
Procedures. At a team meeting, subjects were briefed on the testing procedure and protocols, volunteers were recruited, and those who volunteered signed the informed consent. Subjects were advised that their participation may benefit the team by determining a more effective warm-up protocol for soccer players.

All subjects each completed the following treatment protocols on random testing days; (1) warm-up run alone (CONTROL), (2) static stretching subsequent to a warm-up run (SS), and (3) dynamic stretching subsequent to a warm-up run (DS). The warm-up run for each treatment group consisted of a 10 minute one mile run, monitored every 1:35 seconds to ensure that all subjects completed the one mile run within 9:55 to 10:05.

Immediately following each warm-up run, the core temperature was measured for all subjects. Within two minutes of completing the warm-up run, the CONTROL group
performed the Illinois Agility Test, while the SS and SD groups performed their respective stretching protocols. The SS group completed the following static stretches; Modified Hurdler, Sitting Quadriceps Pull, Butterfly, Figure Eights, and Pyramid. The DS group completed the following dynamic stretches; Walking Lunges, Butt Kickers, Side Lunges, Squats, and Heel-Toe-Walks. Within two minutes of completing their respective stretching protocols, the core temperature was again measured for each subject, and time to complete the Illinois Agility Test was measured.

All treatment protocols were conducted in a random order on three non-consecutive days. Subjects were randomly assigned to one of three treatment order groups, which are as follows; Group 1: CONTROL, SS & DS, Group 2: SS, DS & CONTROL, and Group 3: DS, CONTROL & SS (see Table 1).

_DATA ANALYSIS_

To determine if dynamic stretching prior to an explosive agility test yielded decreased performance times on the Illinois Agility Test as compared to static stretching a one-way ANOVA was used. Multiple comparisons (Scheffe and Tukey) were used as Post Hoc tests to determine where differences existed between the Illinois Agility test times and the core temperature of each group. The statistical program SPSS was used to analyze the collected data. The alpha was set at a p-value of < .05 (p<05).
Table 1

Groups and Treatment Protocols on Randomized Days

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Chapter Three

Results

For this study, 19 subjects from the Humboldt State University Women’s Soccer Team were used to determine whether dynamic versus static stretching would yield a faster time for agility testing. Core temperatures of subjects were measured post warm-up run and post stretching protocols, to determine if the core temperature had an effect on agility test times. A one-way ANOVA was performed on Illinois Agility test times and core temperature with multiple comparisons (Scheffe and Tukey) analyzing time and change in temperature of all three groups (CONTROL, DS, SS) using SPSS 14.0.

No difference existed between the DS, SS, or CONTROL groups for the Illinois Agility test; DS (M = 14.15 seconds), SS (M = 14.50 seconds), and CONTROL (M = 14.24 seconds) (see Figure 2). Based on these results, no statistical difference existed between the stretching protocols on agility test time.

![Figure 2](image_url)  
*Figure 2. Illinois Agility Test times for control, static, and dynamic groups.*
No difference existed for core temperature taken post warm-up run between the CONTROL, DS, or SS groups or post stretching between the DS and SS groups. The mean core temperatures after running were; CONTROL (M = 97.2 °F), DS (M = 97.3 °F) and SS (M = 97.2 °F), and after stretching were; DS (M = 97.6 °F) and SS (M = 97.9 °F) (see Figure 3). Based on these results, no effect due to core temperature could be determined.

Figure 3. Core body temperature readings for control, static, and dynamic groups.
Chapter Four

Discussion

Explosive movements are dominant in many sports and are typically performed at high speeds against resistance provided by the weight and inertia of the body (Gourgoulis, Aggeloussis, Kasimatis, Mavromatis, & Garas, 2003). Properly preparing the body to meet the high demands placed on it by these types of activities may serve to increase performance and reduce the incidence of injuries. An effective pre-participation routine prior to explosive type activities will contribute to the development of balance, core strength, body control, running mechanics, agility, and efficient sport-specific movement (Swanson, 2006). In an attempt to further elucidate on optimal pre-participation protocols for explosive type activities, the current study evaluated the effects of dynamic versus static stretching on explosive agility type activity by comparing the time to complete the Illinois agility test for each group; (1) warm-up run alone (CONTROL), (2) Static Stretching subsequent to a warm-up run (SS), and (3) Dynamic Stretching subsequent to a warm-up run (DS).

Dynamic versus static stretching. Although literature supports the use of dynamic stretching as part of a pre-participation routine prior to high-speed type activities (Little & Williams, 2004), the current study was unable to determine any differences between dynamic versus static stretching protocol for the Illinois agility test. Fletcher and Jones (2004) and Yamaguchi and Ishii (2005) both concluded that dynamic stretching improved performance demonstrated by a decrease in sprint time and increased leg extension power, respectively. Gourgoulis et al. (2003) incorporated half squat jumps into a dynamic pre-participation routine and demonstrated an increase in vertical jump
heights, while Faigenbaum, Bellucci, Bernieri, Bakker, and Hoorens (2005) concluded that static stretching when compared to dynamic stretching decreased vertical jump height. Moss (2002) also concluded that a static stretching routine decrease jumping height in gymnasts by 8.2%. For tasks requiring power and agility, the results suggested that dynamic stretching might offer performance benefits not found with static stretching or with no pre-participation routine (McMillian, Moore, Hatler & Taylor, 2006).

To the contrary, Koch, O’Bryant, Stone, Sanborn, Proulx, Hruby, Shannonhouse, Boros, and Stone (2003), determined that no difference existed on broad jump performance between static and dynamic stretching protocols. While Weimann and Klee (2003) stated that the perceived benefits of static stretching before a maximum performance have not been proven, Little and Williams (2006), stated that the use of short-duration static stretching prior to participation did not appear to be detrimental to subsequent high speed performance. To further elucidate the topic, Gambetta (1997) stated static stretches before warm-up or competition could actually cause tiredness and decrease coordination. For a pre-participation routine prior to an explosive type activity static stretching may not optimally prepare the athlete for the dynamic demands that would be placed on the body.

Results from the current study did not seem to clarify the picture as to whether stretching prior to an explosive agility type performance is beneficial in improving agility test times. Furthermore, this study was unable to determine the differences between static and dynamic stretching protocols prior to an explosive type activity.

*Body temperature.* The results of the current study demonstrated no significant differences for body temperature. Although body temperature did not have an effect on
agility test times, all body temperatures measured were below or at normal body
temperature (98.6°F). The decreased body temperatures from normal may have been due
to two reasons; 1) The ambient temperature of the testing facility is regulated not to fall
below 62 degrees F, and the temperature on experimental days was near 62 degrees F; 2)
Anecdotally the subjects indicated that the warm-up run was “too easy” and subjectively
no subjects were sweating after the warm-up run. This lack of sufficient increase in body
temperature during warm-up may have been one reason for the lack of differences noted
between dynamic and static stretching on explosive agility activity in this study.

*Pre-participation routine.* This study was designed to keep the pre-participation
routine realistic to a game time setting. The stretching protocols were designed to focus
on the main muscles involved in the overall movements of the test, in a timely fashion.
Faigenbaum et al. (2005) used a 10-minute warm-up period when looking at the acute
affects of different warm-up protocols on fitness performance in children, while
Yamaguchi and Ishii (2005) used a 30-second time period of static stretching in their
study analyzing leg power and static stretching. Both of these procedures were adopted
for this study, a 10 minute warm-up run and a 30 second stretching period of muscle
groups for both static and dynamic stretching protocols.

It was hypothesized that dynamic stretching would have resulted in decreased
agility test times, as compared to static stretching, due to the mimicking and the rehearsal
of the activities’ specific movement patterns (Boyle, 2004; McMillian, Moore, Hatler &
Taylor, 2006).

*Physiology of dynamic stretching.* Muscles and tendons are stretched during any
stretching protocol. Viscoelastic properties of the muscle-tendon unit are responsible for
the increased length of the muscle (Taylor, Dalton, Seaber & Garrett, 1990). Within the muscle and tendon, Muscle Spindles and Golgi Tendon Organs protect the muscle from being overstretched. McArdle, Katch and Katch (1996), state both are highly sensitive receptors that provide sensory information about changes in length and tension, protecting the muscle and tendon from injury.

Supporting literature revealed muscular changes during warm-up and stretching happen at the cellular level. It is suggested that increased muscular compliance from static stretching might mean that the muscle may go through a greater period of unloaded shortening before taking up slack to transfer the generated force (Nelson, Guillory, Cornwell & Kokkonen, 2001). In addition to the musculotendinous unit theory, a more compliant muscle, due to static stretching, the less able that muscle is capable of storing elastic energy in its eccentric phase (Wilson, Wood & Elliot, 1991).

However, (Clark, 2000) stated dynamic stretching is an active contractile process, and the performance benefits obtained may stem from facilitated motor control. Shellock and Prentice (1985) state performance benefits come via rehearsal of specific movements, increased muscle blood flow, or elevated core or peripheral temperature, which may increase the sensitivity of nerve receptors and increase the speed of nerve impulses, potentially encouraging muscle contractions to be more rapid and forceful.

Literature supports dynamic stretching protocols prior to explosive type activities for their success in achieving better test scores. This fact may be due to the rehearsal of movements involved in the actual activity (McMillian, Moore, Hatler & Taylor, 2006). Dynamic stretching protocols may be successful because they focus on related movements while removing awkward movements from the routine (Hedrick, 2000).
Dynamic stretching protocols allow for subjects to actively focus energy and attention into the stretching period because of the demands of the protocol. In addition, dynamic stretching protocols allow for constant movement from warm-up to actively keep core body temperature elevated leading into actual competition or testing. Muscle temperature enhances the rate of ATPase activity (Stein, Gordon & Shriver, 1982), which increases the rate of cross bridge cycling (Bergh & Ekblom, 1979). These effects result in an improved maximal shortening velocity and concomitant changes in the force-velocity relationship, which in turn improves maximal dynamic performance (Bennett, 1984).

Even though the current results were not significant, evidence exists to implement dynamic stretching protocols into pre-participation protocols, which may have a positive effect on performance. At this point, it is understood that some type of pre-participation routine should be utilized prior to exercise and that dynamic stretching may seem to be more beneficial for increasing performance, but further research is required to determine volume of warm-up activity (running), intensity of pre-participation routine, and the type of stretching (dynamic versus static).

Conclusion

Although literature supports the idea that dynamic stretching protocols may be beneficial for explosive type of activities, the current study was unable to determine if dynamic stretching would yield the fastest time versus static stretching on the Illinois agility test for collegiate women soccer players. I believe the major limitation of this study was the lack of adequate warm-up, which should have increased the core body temperature by at least one or two degrees. Without adequate warm-up for the subjects,
the study was unable to determine if no difference existed between treatments or if a difference could not be identified.
References


Appendix A

Informed Consent
Informed Consent

This research project will study which warm-up protocol will yield the best time in an agility test. Your participation in the project will be no more than an hour and a half total time. This project will require you to participate in two testing days following the spring season in the month of April. This study involves a 20 minute warm-up consisting of a 10 minute mile and a 10 minute stretching period, followed by testing. On the first day of testing, after the 10 minutes of running, static stretching will be performed. On the second day of testing, dynamic stretching will be performed. These warm-up protocols are not experimental; they are standard practiced procedures of physical fitness. You should experience no pain or discomfort at any time during the warm-up or testing procedures. Confidentiality of your test times will be assured.

Potential Benefits

The conclusion of this research project may help to provide further justification on which warm-up protocol should be used prior to practice/competition/agility testing. By determining which warm-up protocols affect muscle physiology in a manner which enables superior performance through proper muscular function, practitioners and coaches could implement these techniques. This study is going to use techniques that have been widely studied and researched. Upon completion, this study should give justification on whether static or dynamic stretching should be implemented prior to activity/sports participation/agility testing.

Potential Risks

Risks of participation in this study are no more than what a soccer player would encounter in a given day of training. Risks could include muscle strains and joint sprains.

Management of Risks

Performance in the agility testing will be done after a 10 minute warm-up and 10 minute stretching program to reduce the risk of muscle strains. The 10 minutes of running will be performed on synthetic turf, which the team has practiced on the entire spring training season. The stretching session will also be performed on the same synthetic turf. Also, the Illinois agility test pattern will also be implemented on the synthetic turf. By running the entire study project on the synthetic turf allows the athletes to be familiar with the terrain. This will limit the risks of injury to the athlete due to the knowledge of the surface. A certified athletic trainer will be present the entire study to assist if injury occurs.

Confidentiality

All research will be conducted and recorded in a manner that will assure your privacy. All data will be coded with a number to maintain confidentiality. Your name will not be presented in any publication that may result from this project. All raw data will be destroyed at the conclusion of this study.
Contacts
If you have any question about your voluntary participation in this research project, please contact the researcher Nathan Kees at 707-616-8330 (Cell) or at Humboldt State University at 707-826-4106. You may also contact Dave Kinzer at Humboldt State University at 707-826-3557. You may ask questions before your participation begins, or at any time during your participation. If you have any questions about your rights as a research subject, you may contact or ask the researcher, Nathan Kees.

Voluntary Participation
Your participation in the research project is completely voluntary. You may withdraw at any time during the testing.

Participation Consent
Your signature below indicates that you agree to participate in this study. It also indicates that you are aware of the potential risks and benefits as a result of your participation and there will be no monetary benefit for your participation in this study.

Signed: ________________________________

Print Name: ________________________________

Signature of Witness: ________________________________

Date: ________________________________
Appendix B

Injury History Survey
Injury History Survey

This survey will give me an idea of the injuries you as have sustained that may play apart in this research project. If you have sustained an injury and do not wish to participate feeling it is not safe due to your injury, you are not obligated to fill out this Survey, or participate in this research project. If you have sustained an injury recently but still wish to participate in this research project that too is permissible, make sure to discuss this issue with Nathan Kees. Any questions regarding this may be directed towards Nathan Kees, Graduate Student, at (707)-616-8330, or e-mail at nkees15@yahoo.com.

Name: __________________________                     Age: ________________________
Sport: ___________________________                    e-mail: ______________________
Phone: __________________________                    Years in Sport: ________________

1. During spring season have you sustained a; (mark all that apply)?
   ___ Quadriceps strain  ___ Adductor strain
   ___ Hamstring strain  ___ Gluteal strain
   ___ Calf strain

2. Did you return to full practice/participation following rehabilitation of the injury?
   Yes ___ No ___

3. During spring season have you sustained an ankle sprain?
   Yes ___ No ___ R ___ L ___

4. Have you had a serious ligament injury to your knee or ankle within the last year?
   Yes ___ No ___ R ___ L ___ (specify) _______________

5. If so, are you still having pain with the injury?
   Yes ___ No ___

6. Have you ever had a serious fracture in your lower extremity?
   Yes ___ No ___ R ___ L ___ (specify) _______________

7. Is there an injury not previously mentioned that might affect results?
   Yes ___ No ___ (specify) ______________________________