THE ACUTE EFFECTS OF KINESIOTAPE ON THROWING ACCURACY IN COLLEGIATE BASEBALL PLAYERS

A THESIS

Submitted to the Faculty of the School of Graduate Studies and Research
of
California University of Pennsylvania in partial fulfillment of the requirements for the degree of

Master of Science

by
Erin Podroskey, ATC, PES

Research Advisor, Dr. Ellen West

California, Pennsylvania
2013

CALIFORNIA UNIVERSITY of PENNSYLVANIA
CALIFORNIA, PA

THESIS APPROVAL

Graduate Athletic Training Education

We hereby approve the Thesis of

Erin Podroskey
Candidate for the degree of Master of Science

Date	Faculty
5/17/13	Ellen J. West, EdD, ATC (Chairperson)
5/6/13	Jason Edsall, MEd, ATC, CSCS
5/6/13	Thomas F. West, PhD, ATC

ACKNOWLEDGEMENTS

I would like to thank everyone who has helped me along the way of completing my thesis. First, I would like to thank my committee for guiding me through this process and showing me that I am capable of doing anything on my own. I would also like to thank Ryan Davis for going through this entire process with me and helping me work out any issues we came upon.

Thank you to the Cal U baseball players who participated in this study and who I also got to work with this whole year. It has been a great experience and honor to work with their team. I would also like to thank Chase Kreger for helping me out during my data collection and supporting me when I had my doubts. Last but not least, I would like to thank my mother for always believing in me and helping me to stay confident in myself and my abilities not only as an athletic trainer and student, but as a person in general. She has been there for me every step of the way and never stopped believing in me. I would not be where I am today without her.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

All athletes want to be able to perform to the best of their ability which requires them to be in the best physical condition possible to be able to do so. With overhead sport athletes, such as baseball players, improving the accuracy of throwing can help to improve performance ability greatly.

Kinesiotape is becoming a very popular treatment in sports medicine for athletes. This tape is a porous fabric, non-medicated adhesive tape that can be stretched up to 130-140% of its original length before returning to its resting length after application.[1-8] The tape is said to simulate qualities of human skin with a thickness roughly the same as the epidermis.[1,2,5,7] There are many different theories about its effects on the body. One theory is that kinesiotape claims to improve accuracy of fine motor movements. Another claim made is that kinesiotape facilitates joint and muscle realignment by improving the stability of the joint.[1-3,8]

The effects of kinesiotape on injuries vary as well. This tape has been reported to support injured muscles and

joints while relieving pain.[1-4] When a muscle is affected by injury or fatigue, the interstitial space between the skin and the connective tissue becomes compressed which then constricts the flow of lymphatic fluid preventing the healing process to occur properly.[1-4,7,8] Kinesiotape is said to decompress the space allowing the lymphatic fluid to penetrate the injured area allowing a faster recovery time.

Two common factors of how kinesiotape affects the body are strength and pain. Tieh-Cheng et al[2] assessed strength in athletes using an isokinetic dynamometer on the quadriceps muscle on the dominant leg. The results determined that kinesiotape does not enhance or inhibit strength in healthy athletes. A similar study was conducted on healthy, non-athlete women. Vithoulka et al[9] determined that there is a small increase in eccentric strength. William et al[8] examined several studies regarding the effects of kinesiotape on strength and concluded that there is a slight increase in strength.

Pain levels due to injuries have also been studied by researchers. Kinesiotape has been determined to be effective in decreasing pain levels when applied shortly after sustaining an injury.[1,4,6] However, there are several other studies where the researchers determined that there was no significant effect on pain due to kinesiotape.[5,7,8]

Overall there is a lack of research on the true effects of kinesiotape in overhead throwing. As an athletic trainer, this study will help to determine if kinesiotape has an effect on performance. The purpose of this study is to examine the acute effects of kinesiotape on throwing accuracy in overhead sport athletes.

METHODS

The primary purpose of this study is to examine the effect of kinesiotape on throwing accuracy in overhead sport athletes. This section will include the following subsections: research design, subjects, instruments, procedures, hypotheses, and data analysis.

Research Design

This research is a quasi-experimental, within subjects, repeated measures design. Two independent variables will be studied in this project. One of the independent variables is tape condition. This condition will have three levels. These levels consist of kinesiotape, placebo tape, and no tape (control). The second independent variable is position the athlete plays in his sport. For the purpose of this project, position will be broken into pitchers and non-pitchers. The dependent variable will be accuracy measured by throwing at a target. An advantage of this research study is that each subject will serve as their own control making the statistical data more relevant and accurate.

Subjects

The subjects used for this study were 30 volunteer male and female athletes from California University of Pennsylvania who participated in varsity baseball and softball. A minimum of 15 volunteers was needed. Club baseball players were also to be used if necessary. All subjects were between the ages of 18 to 25 and were screened for any disability or dysfunction to the upper extremities. Athletes who were not within this age range were not allowed to participate in this study.

Additionally, individuals who had any upper extremity injury that caused pain while throwing were excluded from the study. Subjects who had shoulder or elbow surgery within six months of the study or not medically cleared by the team physician for competition were also excluded. Any subjects who had a history of or experienced an allergic reaction to tape were excluded from the study as well.

Preliminary Research

A preliminary study was conducted with this research project. Up to three subjects, with no aforementioned injuries, were used to review the protocol. The subjects

performed all of the testing procedures. The researcher was looking for each of the subject's ability to understand directions, the amount of time used to complete the tasks and if the warm-up protocol before service testing is accurate. Data was collected on the data collection sheet (Appendix C3). Included on the data collection sheet were the subject number, gender, position in sport, taping condition, and training session number. The measurement of the distance from the center of the mark where the ball hit the target to the center of the target was recorded for each individual throw. Velocity was also measured as part of a separate study. A comment and note section was included on the data sheet to make note of throwing mechanics for each individual subject for consistency throughout the course of the study.

Instruments

The instruments used for this study included a target made by the researcher of this study, Kinesio Tex Gold, a warm up protocol, official NCAA baseballs, and a tape measure.

Procedure

The researcher applied and received approval from the IRB at California University of Pennsylvania before research was conducted. Subjects were recruited from an informational meeting held prior to any testing. Each participant's identity remained confidential and was not included in the study. All subjects had the option to remove themselves from the study at any point in time if they felt it was necessary. All volunteer subjects received an informed consent form (Appendix C2) which they read, signed, and dated. After the informed consent form was obtained by the researcher, the testing protocol was verbally explained to all subjects to minimize any confusion that might occur.

The subjects were to report to testing on three separate occasions for the randomly assigned taping conditions. Testing was held at inside the Hamer Gymnasium at California University of Pennsylvania. Each session lasted 15 minutes and was a minimum of 24 hours apart from the first session. The kinesiotaping techniques used were pectoralis major inhibition and rhomboid major facilitation. For the pectoralis major inhibition taping, the researcher measured and cut a Kinesio Tex Y strip and

anchored the tape to the greater tubercle of the humerus with the shoulder in neutral with no tension. For the superior tail of the Y strip, the shoulder was placed in 90 degrees of flexion, horizontal abduction and external rotation. The tape was placed over the clavicular portion of the muscle along the medial third of the clavicle with a tension of 15-20% ending with no tension at the sternum. For the inferior tail of the Y strip, the shoulder was placed in 110-130 degrees of flexion with external rotation and full horizontal abduction. This portion of the tape was placed along ribs 5-6 with a tension of 15-25%, ending with no tension above the nipple line. Both tails of the Y strip were then rubbed to activate the adhesive of the tape completing this application. This taping technique can be seen in Figure 1 (Appendix C1).

For the rhomboid major facilitation taping, the researcher measured and cut a Kinesio Tex X strip with splayed tails. One end of the tails was anchored at T2-T5 with no tension on the tape. The shoulder was placed in full horizontal adduction and 15-35% of tension was applied to the tape. The other end of the tail was splayed at the medial border of the scapula below the spine of the scapula with no tension on the tape. The tape was then rubbed to activate the adhesive of the tape, completing this

application. This taping technique can be seen in Figure 2 (Appendix C1). For the placebo tape, 2-inch Elastikon was applied in the same manner that the kinesiotape was applied. All three taping conditions (no tape, placebo tape, and kinesiotape) were used on the subjects in a counter balanced order with six different combinations. The subjects were blinded to the taping condition before completing the warm-up protocol prior to testing.

The warm-up was the same standardized warm-up used in the weight room with the strength and conditioning coaches at California University of Pennsylvania, which consisted of continuous, dynamic components. All stretches in the warm-up were 15 yards long. First, the continuous portion of the warm-up was started where the subjects jogged, backpedaled, shuffled left and shuffled right. Then the subjects completed high knee skips, butt kicks, high knee carioca left and right, and straight leg skips. The dynamic portion was performed next that started with a super lunge series followed by a Cossack squat. Then the subjects moved on to a spider lunge with outside hand thoracic rotation, hamstring stretch, inside hand thoracic rotation, and hamstring with calf stretch.

Next an overhead lunge was performed. Once these movements were completed, the subjects repeated the

previously described continuous portion. A copy of the warm-up can be seen in Figure 3 (Appendix C1). After the warm-up was complete, each subject was allowed five practice throws at the target before measurements were taken. The target used was a 0.9-meter circle with a height from the floor to the center of the target at 2 meters replicated from a study by Zahradnik, Vaverka, and Gajda. [10] Paper with foam padding was placed on the target for the ball to be able to leave a visible mark. Figure 4 shows the target used for this study (Appendix C1). The subjects each threw from a distance of sixty-feet six-inches to the designated target. This distance was used since it is the distance from the pitcher's mound to home plate for baseball. The subjects were instructed to throw whichever way is most comfortable to him and to perform all test throws in the same manner. The throws must have been thrown hard enough to leave a visible mark on the target for the data to be counted on the data collection sheet. A line was placed at the distance the subjects were required to throw from. All subjects had to perform the throws from behind the line in order for the throws to be considered. If any subject stepped on or over the line, that throw was not included in the data collection for that particular subject.

After the practice throws were complete, the subjects threw five balls at the target with a thirty-second rest in between each throw. The researcher made note of how each subject performed the throws in order to keep consistency within the research design. The distance from the center of the mark where the ball hit the target to center of the target was measured using a tape measure after the testing was completed. If a subject missed the target completely, a distance of 45 centimeters was given for that throw. This distance is the outer limit of the target. All five distances of the throws from the center of the target were averaged together and collected on the data sheet. After the testing for that session was completed, the subjects were allowed to remove any tape and leave. The data collected on the data sheets was then transferred to a Microsoft Excel® spreadsheet.

Hypotheses

The following hypotheses were formed from the current research and the researcher’s intuition based on the literature review:

1. Kinesiotape will have no significant difference on throwing accuracy as compared to the control, and placebo taping groups.
2. The position in which the subject plays will not have a significant difference on throwing accuracy with all three taping groups.

Data Analysis

All data will be analyzed by SPSS version 18.0 for Windows at alpha level of 0.05 ($\alpha = p \leq 0.05$). The research hypotheses will be analyzed using a repeated measures analysis of variance (ANOVA).

RESULTS

The primary purpose of the study was to examine the acute effects of kinesiotape on throwing accuracy in NCAA Division II baseball players. Kinesiotape for pectoralis major inhibition and rhomboid major facilitation was applied to the dominant shoulder of each subject. Throwing accuracy was measured for each subject by taking the average distance of five throws from the center of the target under each taping condition.

Demographic Information

A total of sixteen NCAA Division II collegiate baseball players (N=16) from California University of Pennsylvania participated in the study after the informed consent forms were collected. All of the subjects were cleared to participate by their athletic trainer. 12 of the subjects were right-handed and 4 were left-handed. 3 of the subjects were pitchers and 13 were position players. All subjects were between the ages of 18 and 24.

Hypotheses Testing

Hypotheses testing were performed from the results of the 16 subjects that participated in the study. All hypotheses were tested with a level of significance set at $\alpha \leq 0.05$ and SPSS software was used to analyze for the significance of the hypothesis.

Hypothesis 1: The application of kinesiotape will not have a significant effect on throwing accuracy when compared to a placebo tape and no tape. Table 1 shows the means of throwing accuracy under each taping condition.

Table 1. Means of Throwing Accuracy Under Each Taping Condition

Taping Condition	**Mean (cm)**	**Std. Deviation**
No tape	37.2	6.18
Placebo tape	35.8	6.98
Kinesiotape	37.6	4.62

A one-way repeated measure ANOVA was used to compare the mean difference of the three taping conditions: no tape, placebo tape, and kinesiotape. There was no significant difference due to the three separate taping conditions ($F(2, 30) = .512$, $p > .05$). Table 2 shows the

ANOVA for throwing accuracy with no tape, placebo tape, and kinesiotape.

Table 2. ANOVA for Average Throwing Accuracy Under Taping Conditions

Source	Type III Sum of Squares	df	Mean Square	F	Sig
Tape	28.666	2	14.333	.512	.604
Error (Tape)	839.594	30	27.986		

Hypothesis 2: The position the subject plays in his sport will not have a significant effect on throwing accuracy under all three taping conditions. Table 3 shows the ANOVA for throwing accuracy between pitchers and position players.

Table 3. ANOVA for Average Throwing Accuracy between Pitchers and Position Players

Source	Type III Sum of Squares	df	Mean Square	F	Sig
Position	.309	1	.309	.006	.942
Error (Position)	787.088	14	56.211		

A 3 x 2 mixed-design ANOVA was calculated to examine the effects of the tape (no tape, placebo tape, and

kinesiotape) and position (pitchers and position players) on throwing accuracy. No significant main effects or interactions were found. The tape x position interaction ($F(2, 28) = .219$, $p > .05$), the main effect for tape ($F(2, 28) = .632$, $p > .05$), and the main effect for position ($F(1, 14) = .006$, $p > .05$) were all not significant. Throwing accuracy was not influenced by either tape or position. Table 4 shows the ANOVA for throwing accuracy between tape and position.

Table 4. ANOVA for Average Throwing Accuracy for Tape and Position

Source	Type III Sum of Squares	df	Mean Square	F	Sig
Tape	37.341	2	18.670	.632	.534
Tape and Position	12.956	2	6.478	.219	.804
Error (Tape)	826.638	28	29.523		

DISCUSSION

This study was meant to examine the acute effects of kinesiotape on throwing accuracy in overhead sport athletes. Many studies have found positive physiological effects with kinesiotape such as pain free range of motion, increased strength, overall function of the joint and increased proprioception. [1,5-8] Other studies found no significant differences from the kinesiotape on the previously stated effects. [4,7,11] The majority of studies used subjects with injuries instead of healthy populations. [1,5,6,11] For the studies that used healthy populations, there was no significant difference from the effect of the kinesiotape on the factors being studied. [2,9]

Discussion of Results

The findings of this study support the hypotheses that kinesiotape does not have a significant effect on throwing accuracy and that the position played in the sport does not have a significant effect on throwing accuracy.

Multiple studies have been performed that examined the effects of kinesiotape have found positive results in regards to injury prevention, balance, and muscle strength.[2,12,13] This particular study did not examine those effects. The purpose of the study was to examine how kinesiotape affects performance in the form of throwing accuracy in overhead sport athletes.

A study performed by Marban et al determined that kinesiotape is effective in injury prevention to avoid contractures or cramps during competition which in turn would help to increase performance in triathletes and dualathletes. Kinesiotape was applied to the lower extremities in for the study on triathletes.[13] For this study, kinesiotape was applied to the upper extremity. Since the upper body and lower body can be assumed to mimic their counterparts, it could be said that kinesiotape would have similar effects in both the lower extremities and upper extremities. However, this study shows that there is no improvement in performance in the form of throwing accuracy with kinesiotape as the intervention.

Cortesi, Cattaneo, and Jonsdottir examined how kinesiotape effects balance. It was determined that kinesiotape may be useful in establishing body posture when it is applied at the ankle.[12] Since the shoulders can affect

body posture, it could be assumed that kinesiotape applied to the shoulder and upper back musculature would also help to improve posture. An improvement in body posture could potentially have an effect on throwing accuracy.

Escamilla and Andrews looked at muscle activity during different types of overhead throws. One of the overhead throws was baseball pitching. The researchers determined which muscles were the most active at the different phases of throwing.[14] It was stated that peak maximum voluntary isometric contraction (MVIC) for rhomboid activity during the arm cocking and arm deceleration phase was 41-45%. When the kinesiotape was applied to the shoulder for this study, the pectoralis major was inhibited and the rhomboid major was facilitated. Since this muscle was being facilitated by the kinesiotape, it could be assumed that this factor may have had an effect on its muscle activity. This could then lead to a differing effect on throwing accuracy.

Recommendations

From the findings of this study, there are no acute effects of kinesiotape on throwing accuracy. No significant changes were found between the application of kinesiotape, a placebo tape, and no tape.

Sixteen subjects were used in this study which could be a limiting factor. A higher number of subjects could have helped better determine the effects of the kinesiotape. The subjects were also NCAA Division II baseball players which could mean that there is a possibility that higher skilled athletes at the NCAA Division I or professional level could possibly see a positive effect on throwing accuracy from the kinesiotape. Elite level pitchers may also be more accurate in their throws compared to position players.

The number of pitchers versus position players in this study was also disproportionate. More pitchers should be used in order to find if there is a true difference in position on throwing accuracy. Also, no females were used in this study. It could be suggested that females be used to see if there is a difference from gender.

The subjects used for this study were also healthy athletes. Future studies could look at injured athletes to see if the tape improves their performance. Another factor that could contribute to the findings of the research is that the subjects participating in the study were in their competitive season. Since testing was done in the evenings, the subjects' arms could have been tired from practicing earlier in the day. The center of the target

was also 2 meters high which could have also been a contributing factor since baseball players typically try to aim lower. This study used only two kinesiotape techniques for the shoulder out of the numerous techniques available. A different technique of kinesiotape for the shoulder could have had a different effect on throwing accuracy. The kinesiotape was also applied directly before the testing began. If the tape were to be applied for a longer period of time, the tape may have an effect. Also, the subjects only had 5 throws at the target. A higher number of throws could have made a difference in the average throwing accuracy for each subject. Baseball players were the only subjects used in this study. Other overhead sport athletes such as softball, volleyball, or football players could be used as subjects in future research.

Implications to the Profession

As an athletic trainer, this research can be useful in different ways. First, it helps to show that kinesiotape has no effect on performance in overhead sport athletes. This can mean that if an athlete has an injury and kinesiotape is used as the intervention, the tape itself will not harm or help the performance of overhead sport

athletes. Since athletic trainers are always looking for new ways to keep athletes active in their sport, this research shows that using kinesiotape for performance enhancement is not effective.

Conclusions

The results from this study conclude that kinesiotape has no significant effect on throwing accuracy in overhead sport athletes. This study also suggests that pitchers are no more accurate than position players in baseball with the application of kinesiotape. These conclusions are made specifically from the acute effects of kinesiotape. Longer lasting effects of kinesiotape have not been determined from this study.

References

1. Thelen MD, Dauber JA, Stoneman PD. The clinical efficacy of kinesio tape for shoulder pain: a randomized, double-blinded, clinical trial. *J Orthop Sports Phys Ther.* July 2008;38:389-395.

2. Tieh-Cheng F, Wong AMK, Yu-Cheng P, Wu KP, Shih-Wei C, Yin-Chou L. Effect of kinesio taping on muscle strength in athletes – a pilot study. *J Sports Sci Med.* 2008;11:198-201.

3. Kahanov L. Kinesio taping, part 1: an overview of its use in athletes. *Athl Ther Today.* May 2007;12:17-18.

4. Zajt-Kwiatkowska, J, Rajkowska-Labon E, Skrobot W, Bakula S, Szamotulska J. Application of kinesio taping for treatment of sports injuries. *Research Yearbook.* 2007;13:130-134.

5. Aytar A, Ozunlu N, Ozgur S, Baltaci G, Oztop P, Karatas M. Initial effects of kinesio taping in patients with patellofemoral pain syndrome: a randomized, double-blind study. *Isokinet Exerc Sci.* 2011;19:135-142.

6. Garcia-Muro F, Rodriguez-Fernandez AL, Herrero-de-Lucas A. Treatment of myofascial pain in the shoulder with kinesio taping: a case report. *Man Ther.* 2010;15:292-295.

7. Bassett KT, Lingman SA, Ellis RF. The use and treatment efficacy of kinaesthetic taping for musculoskeletal conditions: a systematic review. *NZ Journal of Physiotherapy.* 2010;38:56-62.

8. Williams S, Whatman C, Hume PA, Sheerin K. Kinesio taping in treatment and prevention of sports injuries: a meta-analysis of the evidence for its effectiveness. *Sports Med.* 2012;42:153-164.

9. Vithoulka I, Beneka A, Aggelousis N, Karatsolis K, Diamantopoulos K. The effects of kinesio-taping on

quadriceps strength during isokinetic exercise in healthy non athlete women. *Isokinet Exerc Sci.* 2010;18:1-6.

10. Zahradnik D, Vaverka F, Gajda V. Optimisation of the size of a target and the throwing distance during a throw at a target for adults. *Acta Univ. Palacki. Olomuc, Gymn.* 2008:38;39-45.

11. Kaya E, Zinnuroglu M, Tugeu I. Kinesio taping compared to physical therapy modalities for the treatment of shoulder impingement syndrome. *Clin Rheumatol.* 2011;30:201-207.

12. Cortesi M, Cattanero D, Jonsdottir J. Effect of kinesio taping on standing balance in subjects with multiple sclerosis: a pilot study. *NeuroRehabilitation.* 2011;28:365-372.

13. Marban RM, Rodriguez EF, Navarrete PI, Vega DM. The effect of kinesio taping on calf's injuries prevention in triathletes during competition. Pilot experience. *J Hum Sport Exerc.* 2011;6:305-308.

14. Escamilla RF, Andrews JR. Shoulder muscle recruitment patterns and related biomechanics during upper extremity sports. Sports Med. 2009;39:569-590.

APPENDICES

APPENDIX A

Review of Literature

REVIEW OF LITERATURE

Understanding the biomechanics of an overhead throw is an important factor to understanding what tape and type of tape, if any, may be beneficial to improving accuracy. Kinesiotape is becoming a very popular treatment in sports medicine for athletes. One reason is that kinesiotape claims to improve accuracy of fine motor movements.[26] Overall there is a lack of research on the true effects of kinesio tape in overhead throwing. The purpose of this literature review is to examine the effects of kinesiotape and compare those effects to the biomechanics of throwing and throwing accuracy.

Biomechanics of Throwing

Recognizing the biomechanics of throwing for elite female and male baseball pitchers was the main purpose of the study done by Chu et al. Eleven female and eleven male pitchers were chosen for the study. The researchers studied various kinematic elements of pitching as well as velocity of the pitches. Results of the study stated that

female pitchers have very similar throwing biomechanics with significant differences in certain kinematic elements including instant of stride foot contact, foot contact to ball release, and ball velocity. This study concludes that more research should be performed on female pitchers to help improve the kinematic elements found to be different among elite male pitchers.[1]

In another article, Fleisig discuss the biomechanics of throwing and what factors could cause injury or harm. With the different phases of throwing, there is a possible risk for injury to the shoulder or elbow. The arm cocking phase is where the most potential for injury lies because of the load of force as well as the position of the arm.[2]

Muscle activity of various activities overhead sports such as the baseball pitch, football throw, windmill softball pitch, volleyball serve and spike, tennis serve and volley, baseball hitting and golf swing were examined by Escamilla and Andrews to determine muscle recruitment patterns. The different phases of throwing such as the wind-up, stride, arm cocking, arm acceleration, and arm deceleration were discussed. The researchers concluded that high rotator cuff muscle activity was generated to help resist distractive forces in the overhead throw. Also, peak scapular muscle activity is high during the arm

cocking phase and arm deceleration phases of baseball pitching. The researchers stated that knowing how much the shoulder muscles are active during upper extremity sports is important for training and rehabilitation of injuries.[3]

Flesig, Chu, Weber, and Andrews compared individual variability in baseball pitching among various levels of competition. Ninety-three male baseball pitchers of all age groups were chosen for this study. Eleven kinematic, four temporal, and six kinetic parameters were examined for this study. The results showed the largest standard deviations tended to be with younger pitchers and lowered as the pitchers increased in age. Pitchers who pitched at higher levels had less variability in their motions. The researchers concluded that no particular skill level has an increased risk of injury due to the variations in joint kinetics.[4]

The objective of a different study was to determine the incidence of shoulder injuries in Division I athletes to determine which injuries were among the most common for overhead sport athletes. Three hundred seventy-one male and female athletes who participated in overhead sports were chosen as subjects for the study. Each of the athletes' medical histories was examined to see what types of injuries they had reported throughout their careers.

The results showed different types of injuries resulting from playing different sports. Researchers concluded that prevention techniques are needed to lower the incidence of the various shoulder injuries in overhead sport athletes.[5]

Taping for Injuries

The method of the recovery process following an injury and presenting the application of Kinesio Tex tapes on the example of chosen injuries and strains of the motor system was the goal of the Zajt-Kwiatkowska et al. Subjects chosen for their study were people with recent injuries. The injuries included ankle sprains, tennis elbow, inflammation of the biceps brachii tendon, tightness of the front and lateral tibia fascial compartment, and inflammation of the plantar aponeurosis. The expected results were that the application of the kinesio tape would enhance the rehabilitation process by regulating the blood and lymph circulation by decreasing their concentration in the injured areas of the body. Results from the study were that all subjects had decreased pain and visible reduction of edema. This study concluded that kinesio tape reduces pain, increases functional capability, and is a reliable method of treatment.[6]

Another article written by Thelen et al examines the short-term efficacy of kinesio tape for shoulder pain. Forty-two college students with rotator cuff tendonitis or impingement were selected for the study. Subjects were randomly assigned to two different groups. One group received therapeutic kinesio tape while the other group received sham kinesio tape. Self-reported pain and active range of motion was measured. The tape was worn for two consecutive 3-day intervals. Reported results consisted of immediate improvement in pain-free shoulder abduction. The conclusion was made that kinesio tape can be of assistance to improving pain-free range of motion.[7]

McMonnell et al investigated whether different shoulder taping affects the kinematics of the shoulder in both injured and previously injured athletes. The subjects used for this study were twenty-six college athletes who participated in overhead sports. Markers were placed on the upper limbs and trunk during a seated throw. The athletes threw a handball into a net three different times. McConnell’s tapings and McIntosh tapings were used for the overhead athletes. Different measures such as external rotation, internal rotation, and range of motion were measured. The study reported that there was no significant difference from the shoulder taping on external rotation

and internal rotation. There was a significant difference in external rotation, internal rotation, and range of motion in the group of previously injured athletes. When taped, all three measurements were decreased. The researchers concluded that shoulder taping will have an effect on external rotation, internal rotation, and range of motion depending on previous injury status.[8]

The effects of elastic taping on throwing kinematics, muscle activity, and strength of the scapular region in baseball players who currently had shoulder impingement were examined by another set of researchers. Seventeen baseball players who had shoulder impingement were chosen for this study. All of the subjects received kinesio taping and a placebo taping. Three-dimensional scapular motion was measured along with EMG activities of the upper and lower trapezius muscles, and the serratus anterior muscle during arm elevation. Strength of the lower trapezius was obtained before and after the tapings were applied. The results of this study showed that there was an increase in scapular posterior tilt during arm raising and increased lower trapezius muscle activity in the arm lowering phase with kinesio tape compared to the placebo tape. These researchers concluded that kinesio tape has a positive effect on scapular motion and muscle performance.[9]

Acute effects of kinesio taping on pain, strength, joint position sense and balance in patients with patellofemoral pain syndrome were examined by Aytar et al. Twenty-two subjects were used for this study and were separated into two groups. One group received kinesio tape while the other group received a placebo tape. The subjects were assessed before and 45 minutes after the application of the tape. Significant differences were reported between the strength of the quadriceps muscle at 60 and 180 degrees and static and dynamic balance scores before and after the taping application. The researchers concluded that kinesio tape is not an effective treatment for patients with patellofemoral pain syndrome when trying to decrease pain and improve joint position awareness.[10]

The goal of the researchers who wrote this review was to evaluate the effectiveness of kinesio tape in the treatment and prevention of sports injuries. Numerous databases were searched to find articles relating to the topic. The topics of discussion for this review were the benefits of kinesio taping and its effects on pain, range of movement, strength, proprioception, and muscle activity. The review concluded that kinesio tape could have a beneficial effect on strength, force sense error, and active range of motion. There was little evidence to

support kinesio tape for pain, ankle proprioception, or muscle activity. The researchers suggest that future studies focus on the efficacy of kinesio tape in the treatment of injuries in sporting cohorts. They also suggest appropriate blinding of subjects should be used as well.[11]

The effects of kinesiotape for patellar tendinopathy were examined by Pope et al. They state that kinesiotape is thought to assist overworked muscles. The wave pattern of the tape has been believed to help reduce inflammation, improve circulation, reduce edema, and reduce pressure on pain receptors. The U-Strip technique was used in this application article.[12]

The researchers of this article wanted to examine the effects of kinesio tape and exercise as treatment for a brachial plexus injury. A two-year old female was used as the subject. Treatment consisted of a brace, electric stimulation, parent education on exercise and taping, and kinesio tape. The results of the study showed that after two weeks, four weeks, ten weeks, and twenty weeks, the child had shown improvements in various different aspects. The researchers concluded that kinesio tape and parent education on exercise made a significant difference in the child’s function.[13]

Examining the relationship between fastball velocity and variations in throwing mechanics was the main idea from the researchers of this article. Nineteen baseball pitchers were chosen as subjects for this study. Six to ten fastball pitch trials were observed. Different independent effects were measured. Seven of these effects were kinetic, eleven were temporal, and twelve were kinematic. The results showed that elbow flexion torque, shoulder proximal force, and elbow proximal force were the only kinetic factors associated with ball velocity. Only two temporal parameters had an effect on ball velocity. These were increased time to max shoulder horizontal adduction and decreased time to max shoulder internal rotation. Three kinematic factors had an effect on ball velocity as well. These factors were decreased shoulder horizontal adduction at foot contact, decreased shoulder abduction during acceleration, and increased truck tilt forward at release. The study concluded that pitchers should focus on consistent mechanics to produce high fastball velocities. Also, shoulder and elbow musculature should be strengthened to help prevent injuries.[14]

The objective from the authors of this particular article is to assess the effectiveness and cost-effectiveness of physical therapy care in combination with

a particular tape technique for sub acromial impingement syndrome when compared to only physical therapy care. For the study 140 patients were chosen. They were then split into two groups. One group received the intervention of the taping technique with physical therapy care and the other group received only physical therapy care with no tape. The researchers studied shoulder-specific function using the Simple Shoulder Test and pain severity using an eleven-point scale. Data was collected at baseline, four weeks, twelve weeks, and twenty-six weeks as a follow-up. The taping had proved to have promising outcomes dealing with pain relief and function improvement, however, there needs to be much more research done on the topic.[15]

Identifying strength deficits of isokinetic muscle performance of the scapular muscles between overhead athletes with impingement symptoms and uninjured athletes was the goal of the researchers of this article.[16] Thirty overhead athletes with impingement symptoms and thirty overhead athletes with no history of shoulder pain were selected for this study. The intervention was a linear-retraction movement in the scapular plain at two different velocities. Isokinetic strength for protraction and retraction ratios for the two different velocities was measured. The results showed that athletes with impingement

syndrome showed decreased force output at both velocities in the protractor muscles. Researchers for this study concluded that overhead athletes with impingement symptoms did have strength deficits and muscular imbalance of the scapular muscles when compared to uninjured athletes.[16]

The purpose of the article written by Laudner et al was to compare the relationship between glenohumeral external-rotation strength and posterior shoulder tightness measured by glenohumeral horizontal-adduction and internal-rotation range of motion. Forty-five professional baseball players were used as subjects. External-rotation and horizontal-adduction and internal-rotation range of motion were measured. The results showed that there was no relation between external-rotation strength and horizontal-adduction or internal-rotation range of motion. The researchers concluded that there is little relationship between external-rotation strength and posterior shoulder tightness in professional baseball players.[17]

Throwing Accuracy

One study was used to determine the kinematic differences between dominant and non-dominant arm throwing techniques. Subjects for the study were seven high

performance cricket players in the under seventeen and under nineteen age groups. Three-dimensional kinematic variables were measured for each throw. The results showed that speed of the throws were significantly faster than throws for accuracy with both the dominant and non-dominant arms. Throws for accuracy were significantly more accurate with the dominant arm compared to the non-dominant arm. For the event timing, speed was much quicker for dominant arm throws than non-dominant arm throws. Stride length was also significantly longer compared to non-dominant arm throws. Lower body kinematics were better when measuring speed than accuracy for both the dominant and non-dominant arm throws. More elbow flexion was present in the dominant arm throws for both speed and accuracy when compared to non-dominant arm throws. Trunk rotation was also much greater with the dominant arm throws. The researchers concluded that dominant arm throws are able to maintain a higher speed and still be accurate. Non-dominant arm throws can be accurate but have a much lower speed.[18]

The main idea of the article by Escamilla et al was to find out how throwing velocity and accuracy are affected by throwing overweight and underweight baseballs. They looked at multiple different studies that had been performed on this topic. Two studies reported in their article stated

that throwing with overweight baseballs helped to improve throwing accuracy and velocity while other studies referred to in this article proved that there was no significant difference. Escamilla et al stated that there are many different factors to look at and that more evidence is needed to come to a true conclusion.[19]

The effects of resisted and assisted training using different weight balls on ball speed and accuracy in baseball pitching was examined by Morimoto et al. Eight college baseball players were chosen as the subjects of this study. A standard 145-gram baseball was used along with either two heavier or lighter balls with weights increased or decreased by 10% respectively. Each subject pitched under four different conditions. The first condition was pitching the weighted ball only. The subjects pitched the only the lightened ball as the second condition. Subjects then pitched the standard ball only. The last condition was pitching all three balls in order of weighted, standard, and lightened. The subjects pitched six to eighteen pitches under each condition followed by throwing five pitches using the standard ball. A radar gun was used to measure the ball speed and the accuracy was measured using video digitizing system. The results showed that ball speed increased when ball weight decreased, and

ball speed also increased after throwing the lightened ball and after throwing all three types of balls. No significant difference was found for accuracy among any trial. The researchers concluded that these results clarify the immediate effects of throwing different. [20]

Van Den Tillaar and Ettema wanted to examine the effects of instruction on performance and kinematics of overarm throwing. The emphasis was on velocity, accuracy or both. Subjects for this study were nine experience male team handball players. Five different types of instructions were used in this study. The first one was having the subjects throw the ball as hard as possible with no concern of accuracy. The second instruction was for the velocity to be more important than the accuracy. For the third instruction, velocity and accuracy were both important. The fourth instruction was for accuracy to be the main concern and the velocity to be the second concern. For the fifth and final instruction, accuracy was the main concern. Ball velocity was measured using a three-dimensional digital video movement analysis system. Markers were placed on various sports to help determine the velocity. Accuracy was measured with a video camera twelve meters from the goal. Under the instructions, ball velocity was significantly affected but no significant

change occurred for accuracy. The conclusion was made that regardless of the type of instruction, the subjects did not change their kinematics.[21]

The main objective from the researchers of an additional study was to determine the effects of a cryotherapy application on shoulder proprioception and throwing accuracy. Twenty-two college-aged participants were selected for the study. An ice pack was placed on the dominant shoulder for twenty minutes. The researchers evaluated active joint position replication, path of joint motion replication, and the Functional Throwing Performance Index. The results of the study showed that there was an increase in deviation for path of motion replication. There was also a decrease in functional throwing performance after the ice pack was used. The researchers then concluded that proprioception and throwing accuracy are decreased after application of an ice pack to the shoulder.[22]

Lust et al wanted to determine the effects of a six-week training program on throwing accuracy, proprioception, and core endurance in baseball athletes. Nineteen baseball players and a control group of fifteen baseball players were used for this study.[23] Two six-week training programs including open kinetic chain, closed kinetic chain, and

core stabilization exercises were progressed each week. The researchers measured functional throwing performance index, closed kinetic chain upper extremity stability test, back-extensor test, forty-five degree abdominal fatigue test, and right and left side bridging test. The results state that there was no significant increase between the groups but an increase was marked in all pretest and posttest results. This study concluded that the training programs could be used to help throwing accuracy, proprioception and core endurance in baseball.[23]

Throwing velocity and accuracy in elite and sub-elite cricket players was evaluated by another set of researchers. One hundred and ten cricket players were selected for the study. Subjects were assessed by a specific cricket throwing test that looked at maximal throwing velocity and throwing accuracy at maximal throwing velocity. The results showed that there were high speeds when no accuracy was involved. Speed was lower when having to throw for accuracy. The researchers also concluded that sex, training experience, and training volume have an effect on velocity and accuracy.[24]

Effects of Kinesiotape

The perception of pain after competition in triathletes using kinesiotape was evaluated by Marban et al. Six male triathletes were used for this study. Kinesio tape was applied to their calves one to two hours before their competition. After the race was over the triathletes were evaluated about the pain they felt and/or soreness of the gastrocnemius and soleus muscles. The results were that none of the triathletes had experienced any cramps or contractures of the calf muscles as well as rating pain at a two or less. Researchers of the study concluded that kinesio tape helped prevent cramps and contractures during competition as well as helped decrease perceived pain.[25]

One set of authors wanted to examine the effects of kinesiotape on body stability. The fifteen subjects selected for this study were patients with multiple sclerosis. Kinesiotape was applied to both calves of the patients and was to be kept on for two days. Researchers measured static balance as well as made an assessment of calf muscles at the beginning of the study. A visual analogic scale was also used to assess the patients walking perception. All measurements were taken before, during,

and after the kinesiotape had been applied. The results of the study showed no statistically difference in the mediolateral axis for sway. However, there was a significant difference with the length of sway. The researchers concluded that the use of kinesiotape does have a positive effect in helping establish better body posture.[26]

Other researchers performed a study to examine the effects of kinesiotape on muscle strength in the quadriceps and hamstring muscles. Seven male and seven female athletes were used in this study. All of these athletes had no current knee injuries. An isokinetic dynamometer measured strength of the subjects without taping, immediately after taping, and twelve hours after taping. The results determined that there was no increase or decrease in muscle strength in healthy athletes. The researchers stated that this study on kinesiotape does not support that its effects will increase strength.[27]

A group of authors from another study were examining the failure and fatigue properties of commonly used athletic tape. Johnson & Johnson tape, Leukotape, and Jaylastic tape were the materials used for this study. A hydraulic mechanical testing system (MTS) was used testing load-to-failure, fatigue testing under load control, and

fatigue testing under displacement control. There were significant differences in failure load, elongation at failure, and stiffness in failure tests. Significant differences were also found in fatigue behavior under both modes of control. The researchers of this study concluded that knowing the shortcomings of available tape and the results of these tests can help to produce better tape designs of the future.[28]

The efficacy of kinesiotape compared to physical therapy modalities in patients with shoulder impingement syndrome was the main goal of another set of authors. A total of fifty-five subjects were used in this study. Thirty of the patients received kinesiotape as their treatment while the rest received the physical therapy modalities. The kinesiotape group received the tape three times in intervals of three days while the modalities group received the modality treatment daily for two weeks. The Disability of Arm, Shoulder, and Hand Scale was used to evaluate treatment. Evaluations were performed at baseline, week one and week two of the study. Results of the study showed that kinesiotape had been found to be more effective than modalities at the first week of treatment and similar results were found during the second week. The conclusion

was made that kinesiotaping may be used as an alternative treatment option for shoulder impingement syndrome.[29]

Kahanov wanted to familiarize and enhance health care professionals with kinesiotaping. It discusses the theory of the effects it has on injuries in athletes. This article concluded that kinesiotape could be used as an effective form of treatment for various different things but more research needs to be performed. [30]

Summary

After reviewing the literature, it is apparent that more research is needed to prove whether or not kinesiotape is effective in increasing overhead throwing accuracy. The literature also states that the biomechanics of throwing may have an effect on throwing accuracy. If this is the case, kinesiotape may potentially have an effect on biomechanics which would indirectly affect throwing accuracy. When it comes to baseball and softball players, each athlete will have their own individual way of throwing. If an athlete has an injury to the upper extremity, it is possible that kinesiotape could affect throwing accuracy when it is being used as an intervention.

APPENDIX B

The Problem

STATEMENT OF THE PROBLEM

The purpose of the study is to examine the effect of kinesiotape on overhead throwing accuracy in baseball and softball players. Possible benefit to using this type of tape for injuries as well as performance enhancement will be examined.

Definition of Terms

The following definitions of terms will be defined for this study:

1) Kinesiotape – thin, cotton, permeable fabric that has non-mediated qualities. It is latex free with acrylic adhesive that allows it to be worn for multiple days at a time. Kinesiotape is theorized to help with numerous physiological effects after injury.[30]
2) Throwing accuracy – the average distance from all throws to the center of the target.

Basic Assumptions

The following are basic assumptions of this study:

1) The subjects will be honest when they complete their demographic sheets.

2) The subjects will perform to the best of their ability during testing sessions under all conditions.
3) The tape application will be consistent from subject to subject.
4) Because the subjects are NCAA Division II baseball players, they are expected to be accurate in throws.

Limitations of the Study

The following are possible limitations of the study:

1) The validity of the target has not been established.
2) The accuracy of throws from the subjects may vary based upon many variables.

Delimitations of the Study

The following are possible delimitations of the study:

1) Only two of several different kinesiotape applications for the shoulder were used in this study.
2) The subjects used were California University of PA NCAA Division II baseball players.
3) All targets were hand-drawn by the researcher.

Significance of the Study

The significance of the study is crucial to the up and coming use of kinesiotape in athletics.[30] With all of the

possible positive effects of kinesiotape, it is important to know how this tape affects performance. [6,7,10,11,27,30-33] Since baseball players require their throwing mechanics to be accurate at all times, it is essential that their performance not be hindered by a therapeutic intervention.

APPENDIX C

Additional Methods

Appendix C1

Figures and Target

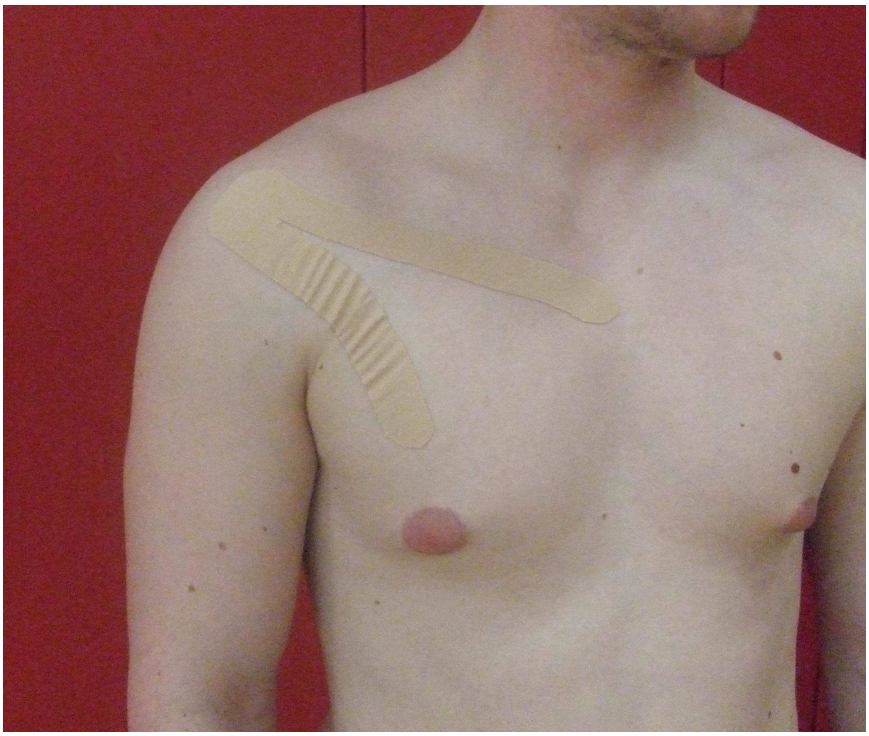

Figure 1. Kinesiotape Pectoralis Major Inhibition

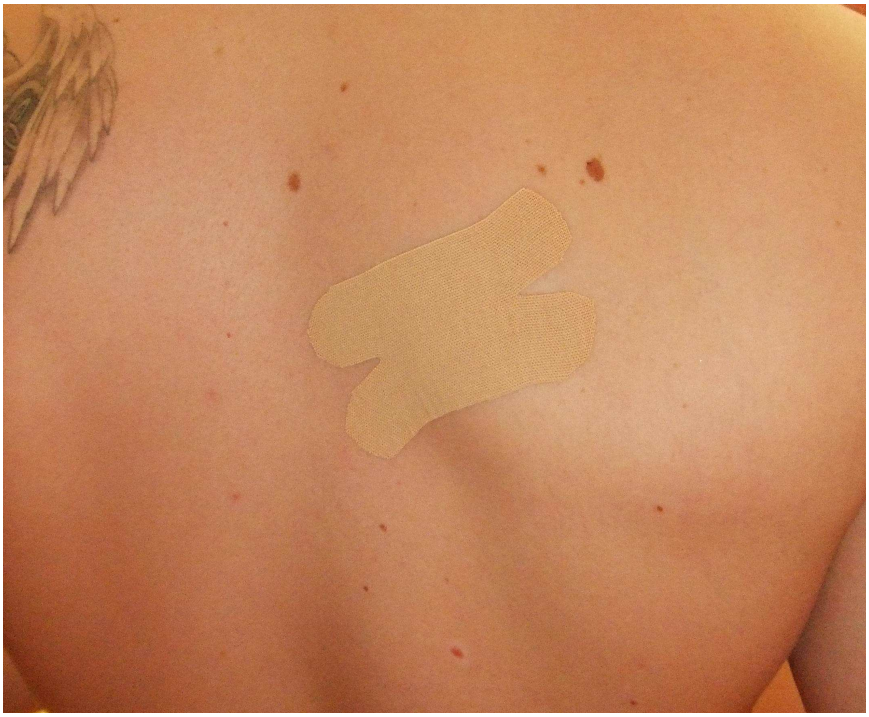

Figure 2. Kinesiotape Rhomboid Major Facilitation

Warm-up

Listed in a down/back format

Perform 2 times before preceding to throwing

1. Jog/Backwards Run
2. Side Shuffle/Side Shuffle (Face the same way)
3. High Knees/Butt Kicks
4. Leg Over Carioca/Leg Over Carioca (Face the same way
5. High Leg Kicks/Jog
6. Yoga Movements

Figure 3. Warm-up Protocol

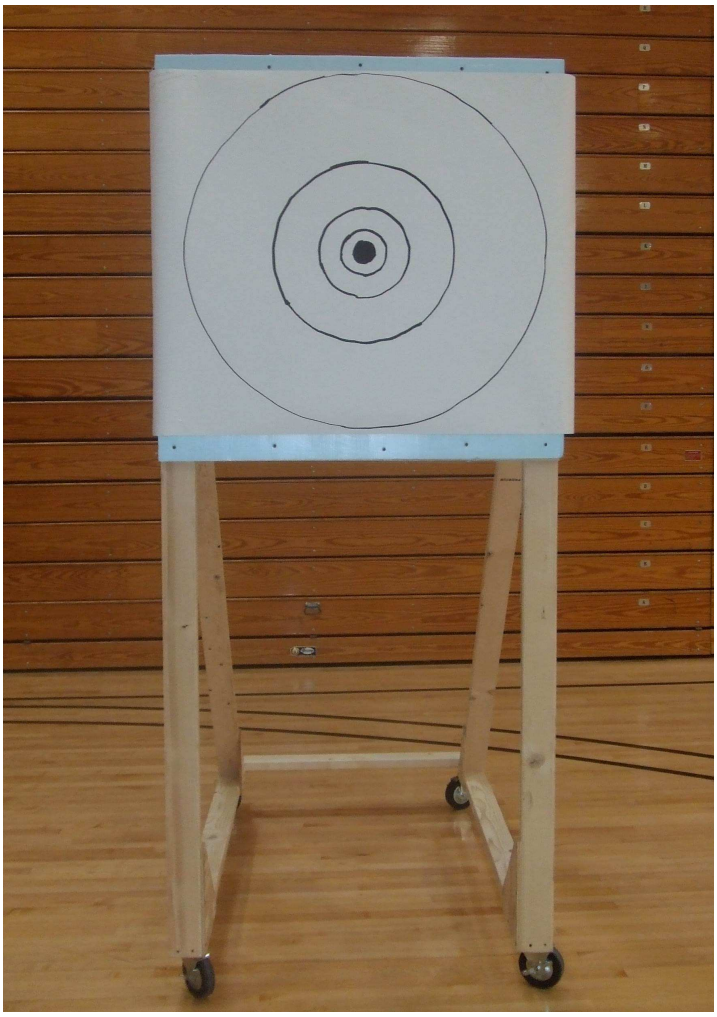

Figure 4. Target

APPENDIX C2

Informed Consent Form

California University of Pennsylvania

Informed Consent Form

1. Ryan Davis and Erin Podroskey, Graduate Assistant Athletic Training Students at California University of Pennsylvania, have requested my participation in research titled "The Acute Effects of Kinesiotape on Throwing Velocity and Throwing Accuracy in Overhead Sport Athletes".

2. I have been informed that the purpose of the research is to determine if kinesiotape application used for this study will have an effect on throwing velocity and throwing accuracy.

3. My participation will involve three testing sessions with three taping conditions. Two of these taping conditions will require tape to be applied directly to my skin.

4. Each testing session will consist of a warm up involving dynamic stretching as well as a cardiovascular component, followed by 5 accuracy warm up throws,5 measured accuracy throws, 5 velocity warm up throws and 5 measured velocity throws with a 30 second rest period between each throw. I will be randomly assigned to one of the three testing groups in each session by the researchers. The expected duration of the participation will be a total of one and a half hours.

5. I understand that there are foreseeable risks or discomforts to me if I agree to participate in the study. The possible risks include discomforts due to application of tapings, which will be minimized by the researchers using a test strip of all tapes before any testing session commences. I may experience muscle soreness following the testing session. These risks are no more than normal physical activity that a collegiate athlete would be exposed to during a regular exercise.

6. I understand that, in case of injury or prolonged muscle soreness, I can expect to receive treatment or care in Hamer Hall's Athletic Training Facility which will be provided by the researchers Ryan Davis and Erin Podroskey, or another Certified Athletic Trainer, any of whom can administer emergency and immediate care. Additional necessary care past three days will be referred to Student Health Services with California University of Pennsylvania.

7. I understand that there are no feasible alternative procedures available for this study.

8. I understand that the possible benefits of my participation in the research are a contribution to existing research which may aid in the development of kinesiotape related protocols.

9. I understand that the results of the research study may be published but that my name or identity will not be revealed. In order to maintain confidentiality of my records, Ryan Davis and Erin Podroskey will maintain all documents in a secure location in which only the researchers and research advisors can access them.

10. I have been informed that I will not be compensated for my participation.

11. I have been informed that any questions or concerns I may have about the research or my participation in it will be answered any time, and that my individual scores o the abstract of this study will be informed after completion of this study by:

Ryan F. Davis, ATC
139 Spring Street
Coal Center, PA 15423
607-341-2650
dav3356@calu.edu

Erin Podroskey, ATC
512 Locust St.
Belle Vernon, PA 15012
724-317-1064
pod2829@calu.edu

Or by the graduate thesis advisors:
Thomas F. West, PhD, LAT, ATC
115 Hamer Hall
California University of Pennsylvania
California, PA 15419
West_t@calu.edu

Ellen J. West, EdD, LAT, ATC
California University of Pennsylvania
Box #114
California, PA 15419
West_e@calu.edu

12. I understand that written responses may be used in quotations for publications but my identity will remain anonymous.

13. I have read the above information. The nature, demands, risks, and benefits of the project have been explained to me. I knowingly assume the risks involved, and understand that I may withdraw my consent and discontinue at any time without penalty or loss of benefit to myself. In signing this consent form, I am not waiving any legal claims, rights, or remedies. A copy of this consent form will be given to me upon request.

Subject's signature:_____ Date:_____

Witness signature:_____ Date:_____

14. I have provided the subject/participant a copy of this signed consent document if requested.

Investigator #1 Signature_____Date_____

Investigator #2 Signature_____Date_____

Appendix C3

Data Collection Sheet

Subject Number_____ Gender_____

Position_____ Taping Condition_____

Training Session Number_____

Throwing Condition	Warm Up Complete	5 Warm Up Throws Complete	Throw 1	Throw 2	Throw 3	Throw 4	Throw 5
Accuracy (CM)							
Velocity (KPH)							

Comments:

Notes:

Appendix C4
IRB Approval

From: instreviewboard
Sent: Friday, March 01, 2013 5:57 PM
To: POD2829 - PODROSKEY, ERIN
Cc: West, Thomas
Subject: IRB approval for proposal # 12-042

Institutional Review Board
California University of Pennsylvania
Morgan Hall, Room 310
250 University Avenue
California, PA 15419
instreviewboard@calu.edu
Robert Skwarecki, Ph.D., CCC-SLP,Chair

Dear Erin Podroskey and Ryan Davis:

Please consider this email as official notification that your proposal titled "The Acute Effects of Kinesiotape on Throwing Accuracy in Overhead Sport Athletes" & "The Acute Effects of Kinesiotape on Throwing Velocity" (Proposal #12-042) has been approved by the California University of Pennsylvania Institutional Review Board as submitted.

The effective date of the approval is 3-1-2013 and the expiration date is 2-28-2014. These dates must appear on the consent form .
Please note that Federal Policy requires that you notify the IRB promptly regarding any of the following:

(1) Any additions or changes in procedures you might wish for your study (additions or changes must be approved by the IRB before they are implemented)
(2) Any events that affect the safety or well-being of subjects
(3) Any modifications of your study or other responses that are necessitated by any events reported in (2).
(4) To continue your research beyond the approval expiration date of 2-28-2014you must file additional information to be considered for continuing review. Please contact instreviewboard@calu.edu

Please notify the Board when data collection is complete.
Regards,
Robert Skwarecki, Ph.D., CCC-SLP
Chair, Institutional Review Board

REFERENCES

1. Chu Y, Fleisig G, Simpson K, Andrews J. Biomechanical comparison between elite female and male baseball pitchers. *J Appl Biomech.* 2009;25:22-31.

2. Fleisig, G. Biomechanics of baseball pitching: implications for injury and performance. Sports Biomech. July 2010:46-50.

3. Escamilla RF, Andrews JR. Shoulder muscle recruitment patterns and related biomechanics during upper extremity sports. Sports Med. 2009;39:569-590.

4. Flesig, G, Chu, Y, Weber, A, Andrews, J. Variability in baseball pitching biomechanics among various levels of competition. *Sports Biomech.* 2009;8:10-21.

5. Laudner K, Sipes R. The incidence of shoulder injury among collegiate overhead athletes. *Journal of Intercollegiate Sport.* 2002;2:260-268.

6. Zajt-Kwiatkowska, J, Rajkowska-Labon E, Skrobot W, Bakula S, Szamotulska J. Application of kinesio taping for treatment of sports injuries. Research Yearbook. 2007;13:130-134.

7. Thelen MD, Dauber JA, Stoneman PD. The clinical efficacy of kinesio tape for shoulder pain: a randomized, double-blinded, clinical trial. *J Orthop Sports Phys Ther.* July 2008;38:389-395.

8. McMonnell J, Donnelly C, Hamner S, Dunne J, Besier T. Effect of shoulder taping on maximum shoulder external and internal rotation range in uninjured and previously injured overhead athletes during a seated throw. *J Orthop Res*. 2011;29:1406–1411.

9. Yin-Hsin H, Wen-Yin C, Hsiu-Chen L, Wang W, Yi-Fen S. The effects of taping on scapular kinematics and muscle performance in baseball players with shoulder impingement syndrome. *J Electromyogr Kinesiol.* 2009;19:1092-1099.

10. Aytar A, Ozunlu N, Ozgur S, Baltaci G, Oztop P, Karatas M. Initial effects of kinesio taping in

patients with patellofemoral pain syndrome: a randomized, double-blind study. *Isokinet Exerc Sci.* 2011;19:135-142.

11. Williams S, Whatman C, Hume PA, Sheerin K. Kinesio taping in treatment and prevention of sports injuries: a meta-analysis of the evidence for its effectiveness. *Sports Med.* 2012;42:153-164.

12. Pope ML, Baker A, Grindstaff TL. Kinesio taping technique for patellar tendinopathy. *Athletic training and sports health care.* 2010;2:98-99.

13. Walsh SF. Treatment of a brachial plexus injury using kinesiotape and exercise. *Physiother Theory Pract.* 2010;26:490-496.

14. Stodden DF, Fleisig GS, McLean SP, Andrews JR. Relationship of biomechanical factors to baseball pitching velocity: within pitcher variation. *J Appl Biomech.* 2005;21:44-56

15. Kalter J, Apeldoorn AT, Ostelo RW, Henschke N, Knol DL, van Tulder MW. Taping patients with clinical signs of subacromial impingement syndrome: the design of a randomized controlled trial. BMC Musculoskelet Disord. 2011;12:1-8.

16. Cools AM, Witvrouw EE, Mahieu NN, Danneels LA. Isokinetic scapular muscle performance in overhead athletes with and without impingement symptoms. *J Athl Train.* 2005;40:104-110.

17. Laudner KG, Moline M, Meister K. Lack of a relationship between glenohumeral external-rotation strength and posterior shoulder tightness in baseball players. *J Sport Rehabil.* 2012;21:12-17.

18. Sachlikidis A, Salter C. A biomechanical comparison of dominant and non-dominant arm throws for speed and accuracy. *Sports Biomech.* September 2007;6:334-344.

19. Escamilla RF, Speer KP, Fleisig GS, Barrentine SW, Andrews JR. Effects of throwing overweight and underweight baseballs on throwing velocity and accuracy. *Sports Med.* April 2000;29:259-272.

20. Morimoto Y, Ito K, Kawamura T, Muraki Y. Immediate effect of assisted and resisted training using different weight balls on ball speed and accuracy in baseball pitching. *International journal of sport and health science.* October 2003;1:238-246.

21. Van Den Tillaar R, Ettema G. Instructions emphasizing velocity, accuracy, or both in performance and kinematics of overarm throwing by experienced team handball players. *Percept Mot Skills.* 2003;97:731-742.

22. Wassinger CA, Myers JB, Gatti JM, Conley KM, Lephard SM. Proprioception and throwing accuracy in the dominant shoulder after cryotherapy*. J Athl Train.* 2007;42:84-89.

23. Lust KR, Sandrey MA, Bulger SM, Wilder N. The effects of 6-week training programs on throwing accuracy, proprioception, and core endurance in baseball. *J Sport Rehabil.* 2009;18:407-426.

24. Freeston J, Ferdinands R, Rooney K. Throwing velocity and accuracy in elite and sub-elite cricket players: a descriptive study. *European Journal of Sport Science.* December 2007;7:231-237.

25. Marban RM, Rodriguez EF, Navarrete PI, Vega DM. The effect of kinesio taping on calf's injuries prevention in triathletes during competition. Pilot experience. *J Hum Sport Exerc.* 2011;6:305-308.

26. Cortesi M, Cattanero D, Jonsdottir J. Effect of kinesio taping on standing balance in subjects with multiple sclerosis: a pilot study. *NeuroRehabilitation.* 2011;28:365-372.

27. Tieh-Cheng F, Wong AMK, Yu-Cheng P, Wu KP, Shih-Wei C, Yin-Chou L. Effect of kinesio taping on muscle strength in athletes – a pilot study*. J Sports Sci Med. 2008;11:198-201.*

28. Bragg RW, MacMahon JM, Overon EK, Yerby SA, Matheson GO, Carter DR, Andriacchi TP. Failure and fatigue characteristics of adhesive athletic tape. *Med Sci Sports Exerc.* 2002;33:403-410.

29. Kaya E, Zinnuroglu M, Tugeu I. Kinesio taping compared to physical therapy modalities for the treatment of shoulder impingement syndrome. *Clin Rheumatol.* 2011;30:201-207.

30. Kahanov L. Kinesio taping, part 1: an overview of its use in athletes. *Athl Ther Today.* May 2007;12:17-18.

31. Garcia-Muro F, Rodriguez-Fernandez AL, Herrero-de-Lucas A. Treatment of myofascial pain in the shoulder with kinesio taping: a case report. *Man Ther.* 2010;15:292-295.

32. Vithoulka I, Beneka A, Aggelousis N, Karatsolis K, Diamantopoulos K. The effects of kinesio-taping on quadriceps strength during isokinetic exercise in healthy non athlete women. *Isokinet Exerc Sci.* 2010;18:1-6.

33. Bassett KT, Lingman SA, Ellis RF. The use and treatment efficacy of kinaesthetic taping for musculoskeletal conditions: a systematic review. *NZ Journal of Physiotherapy.* 2010;38:56-62

ABSTRACT

TITLE: The Acute Effects of Kinesiotape on Throwing Accuracy in Collegiate Baseball Players

RESEARCHER: Erin Podroskey, ATC, PES

ADVISOR: Ellen J. West, EdD, ATC

DATE: May 2013

RESEARCH TYPE: Master's Thesis

PURPOSE: The purpose of this study was to examine the effects of kinesiotape on throwing accuracy in overhead sport athletes.

PROBLEM: The effects of kinesiotape have not been examined for its outcomes on performance enhancement.

METHOD: This research is a quasi-experimental, within subjects, repeated measures design. All subjects threw 5 throws at a target under three taping conditions (no tape, placebo tape, and kinesiotape). Application of kinesiotape was applied for pectoralis major inhibition and rhomboid major facilitation. After the tape was applied, a warm-up was performed prior to testing. Throwing accuracy was measured by taking the average distance from the center of the target for all five throws.

FINDINGS: Kinesiotape had no significant effect on throwing accuracy compared to no tape and placebo tape. The position played in sport with the addition of kinesiotape also had no significant effect on throwing accuracy.

CONCLUSION: Based on the findings from this study, there are no acute effects of kinesiotape on throwing accuracy in overhead sport athletes.