# THE EFFECTS OF KINESIO TAPE ON THROWING VELOCITY AND ACCURACY IN DIVISION II COLLEGIATE SOFTBALL PLAYERS

By

Francesca R. Formisano, B.S.
Cabrini University

A Thesis Submitted in Partial Fulfillment of
the Requirements for the Degree of Masters of Science in Exercise Science
to the office of Graduate and Extended Studies
of East Stroudsburg University of Pennsylvania

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## SIGNATURE/APPROVAL PAGE

**ABSTRACT**

A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in Exercise Science to the Office of Graduate and Extended Studies of East Stroudsburg University of Pennsylvania.

Student's Name: Francesca R. Formisano

Title: The Effects of Kinesio Tape on Throwing Velocity and Accuracy in Division II Softball Players

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Thesis Chairperson: Matthew Miltenberger, Ph.D.

Thesis Member: Shala Davis, Ph.D.

Thesis Member: Gavin Moir, Ph.D.

## Abstract

The purpose of this study is to investigate the effects of Kinesio Tape on throwing velocity, accuracy and range of motion looking at maximum external rotation and the angle of ball release with scapular stabilization. There is little research that looks at Kinesio Tape, female athletes and the dynamic movement of overhead throwing. 9 female NCAA Division II softball players participated in this study. Athletes were randomly assigned to the control group (no Kinesio Tape) or the experimental group (Kinesio Tape) at their first testing session. Each acted as their own control and performed 15 overhead throws, 20 feet from a target each session following a dynamic warmup. There was a 1.45mph increase in throwing velocity from the control, 47.76mph to 49.21 in the experimental group, but no statistically significant difference. There was a 92.78 point increase in throwing accuracy from the control, 81.11 points to 173.83 in the experimental group, but no statistically significant difference. There was a 6.37° increase in maximum external rotation from the control, 79.74° to 86.11° in the experimental group, but no statistically significant difference. There was a 1.17° increase in the angle of ball release from the control, 148.68° to 149.85° in the experimental group, but no statistically significant difference. In conclusion, there was an increase in throwing velocity and accuracy with the addition of Kenisio Tape, although not a statistical difference, it does show practical improvements in athletic performance in game play.

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## INTRODUCTION

### Introduction

The act of overhead throwing is one that endures many kinetic adaptations to its athletes which may become problematic as the overhead throw sequence encompasses multidirectional movements with excessive physiological forces on many musculoskeletal units (Neil, Bakshi, and Freehold T. Michael, 2018).

Musculoskeletal units involved include:

- Deltoid
- Supraspinatus
- Infraspinatus
- Trunk
- Scapula
- Elbow joint
- Humerus
- Subscapularis
- Pectoralis Major
- Latissimus Dorsi

- Biceps
- Brachialis
- Glenohumeral joint

(Neil, Bakshi, and Freehold T. Michael, 2018).

Success of any overhead throwing sport like softball, from a defensive standpoint comes from two main attributes of overhead throwing, velocity and accuracy. Both of these attributes can be improved by incorporating strength training, flexibility training or even with the aid of an external tactile cue such as Kinesio Tape ®.

Overhead throwing is broken down into six phases through which the biomechanics of overhead throwing can be assessed; wind-up, early cocking, late cocking, acceleration, deceleration, follow-through (Neil, Bakshi, and Freehold T. Michael, 2018).

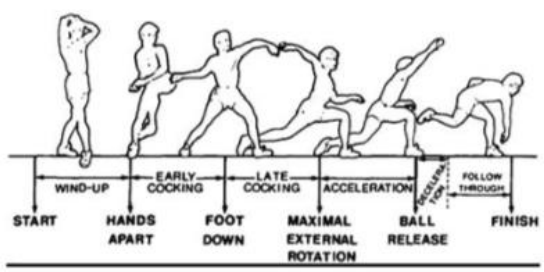


**Figure 1**: Phases of throwing. Adapted from Neil, Bakshi, and Freehold T. Michael, 2018

<u>Wind-up</u>

Begins as the lead leg begins to move until it reaches its highest point, lower extremities then begin to prepare to stabilize the body as the energy from the upper body is transferred through the center of mass, over the back leg to generate the most momentum where the risk of injury to the shoulder is relatively low (Neil, Bakshi, and Freehold T. Michael, 2018).

Early Cocking

Begins, as the wind-up ends, at the point where the lead leg is at its highest until the point at which the lead leg touches down on the mound. In the early cocking phase, there is a large amount of stability, balance and control needed by the trunk of the body as the lead leg is in stride. During the late portion of the early cocking phase, before we move into the late cocking phase, the deltoid, supraspinatus and infraspinatus are activated – this allows for external rotation of the shoulder (Neil, Bakshi, and Freehold T. Michael, 2018).

Late cocking

Occurs when the lead foot touches down on the mound through the point of maximal external rotation of the throwing arm where there is retraction of the scapula, elbow joint flexion, and abduction and external rotation of the humerus. There is then eccentric contraction of the subscapularis, pectoralis major and the latissimus dorsi that act as a stabilizing force for the anterior portion of the glenohumeral joint as the shoulder reaches maximal external rotation (Neil, Bakshi, and Freehold T. Michael, 2018).

Acceleration

As the glenohumeral joint undergoes hyperexternal rotation this allows for the accelerating forces to have a greater elastic energy transfer to the ball which then in-turn means greater velocity on the ball. The time at which maximal external rotation is reached and the time the ball is then released is categorized as the acceleration phase. At this point in the throwing sequence, there is now protraction of the scapula as the subscapularis, pectoralis major and latissimus dorsi are all in full activation to adduct and internally rotate the humerus (Neil, Bakshi, and Freehold T. Michael, 2018).

Deceleration

This is considered to be the most violent of the sequence as it includes subsequent loading of the joint while throwing. There is subsequent eccentric force placed on the posterior rotator cuff along with biceps and brachialis activity to rapidly slow the elbow as it is extending and any excess energy that is not transferred through the ball is placed on the glenohumeral joint. This phase occurs from the point of release of the ball to maximal humeral internal rotation (Neil, Bakshi, and Freehold T. Michael, 2018).

Follow-Through

This is last and final phase of the throwing sequence where body weight is transferred forward and the arm continues to swing down and then ends movement (Neil, Bakshi, and Freehold T. Michael, 2018).

The deceleration phase is considered the most dangerous and violate phase due to the greatest amount of joint loading and excessive distraction and shear forces placed on the glenohumeral joint. Any energy that is not transferred through the ball is displaced through the shoulder creating significant eccentric loading of the posterior rotator cuff (Neil, Bakshi, and Freehold T. Michael, 2018). The early, late-cocking, acceleration and the deceleration phase are the four phases that are seen to have the highest risk of injury due to the elevation of the humerus (Kristin, M. E., et.al).

Proper scapular motion is crucial for normal shoulder mechanics which is believed to be a large determinant of how the glenohumeral joint will function during the overhead throw (Kristin, M. E., et.al). It is also important to look at movement of the humerus when assessing proper scapulohumeral rhythm, if the ratio of movement is proportional in humoral elevation with scapular upward rotation. Adaptive and altered scapular kinematics is known as “scapular dykinesis” and is mainly seen to be the cause of most shoulder injuries. This alteration in kinematics can be seen with the fatigue, impingement and instability that come with overuse and participation in overhead sports (Forthomme, B., Crielaard, J., & Croisier, J., 2008).

As the scapula externally, upwardly rotates and posteriorly tilts, the humorous externally rotates to elevate the arm and allow for maximal clearance in the subacromial space of the head of the humorous.

When it comes to physical activity and overhead throwing, the scapula is important for four main roles:

1) To move in conjunction to the humerus (scapulohumoral rhythm)
2) The movement of the scapula will adapt to the task being performed by moving along the thoracic wall
3) To elevate the acromion, to clear it out of the path of the rotator cuff  to possibly decrease any potential impingement or compression
4) To link the energy and force transfer from proximal to distal

(Forthomme, B., Crielaard, J., & Croisier, J., 2008)

As the scapula provides a large, stable base for the regulation of forces proximal to distal, the fourth role may be the largest contributor to the study at hand as we measure velocity with the addition of Kinesio Tape to the supporting muscles of the scapula. The Institutional Society of Biomechanics describes scapular kinematics as tilting in the sagittal plane, upward/downward rotation in the frontal plane, internal (protraction)/external (retraction) rotation in the transverse plane and elevation/depression in a transition motion along the thoracic wall as shown in **Figure 2** (Forthomme, B., Crielaard, J., & Croisier, J., 2008). In those who perform repeated overhead throwing, proper scapular kinematics are believed to be the most important factor of how the glenohumeral joint functions (Kristin, M. E., et.al).

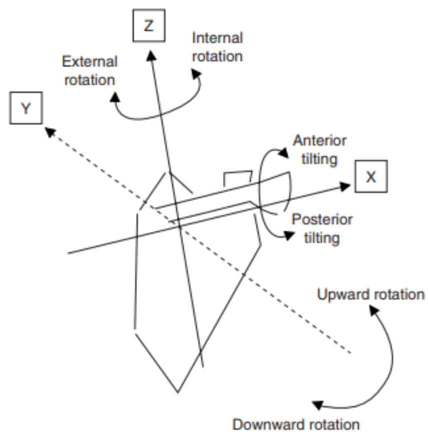


**Figure 2**: Movements of the scapula about the x, y and z axis (Forthomme, B., Crielaard, J., & Croisier, J., 2008).

In looking at scapular motion during sports activity, professional baseball players were seen to have a greater degree of scapular rotation on the throwing side with a shift in upward rotation which may be a functional kinematic adaptation during overhead throwing. Electromagnetic tracking was used to assess scapular plane humeral elevation. As the results showed, a group of 21 throwing athletes were matched with 21 control athletes that showed increased upward rotation and retraction of the scapula during humeral elevation in healthy throwing athletes which is important to keep the shoulder healthy as it follows the third role of the scapula as previously stated, raising the acromion and preventing impingement, along with no difference in anterior/posterior tilt or elevation/depression (Forthomme, B., Crielaard, J., & Croisier, J., 2008).

It has been shown, that with fatigue of the shoulder muscles, comes alterations in the normal throwing pattern and scapulohumeral rhythm which is commonly linked with most injuries. Following different fatiguing protocols, it is still unsure if the changes in the scapula's motion are directly related to muscle alteration or if it is more of a compensative effect of the scapulothoracic muscles that act to stabilize the scapula. This is important to think about as when referenced back, the decoration phase of an overhead throw is the most problematic when it comes to injury potential. Having weakness in the musculature that holds the scapula in its place, becomes problematic as the force that is being transferred proximal to distal as referenced earlier as the fourth role of the scapula, is far greater than the weak muscles can withstand which is when we see injuries. Being that there are 17 different muscles that do attach to the scapula, it is very important to strengthen all and maintain flexibility evenly so there is no abnormal compensation which may lead to further dyskinesis (Forthomme, B., Crielaard, J., & Croisier, J., 2008).

"The Kinesio Taping Method is designed to facilitate the body's natural healing process while allowing support and stability to muscles and joints without restricting the body's range of motion." Kinesio Tapes four main purposes are to aid in the reduction of swelling and inflammation, provide support in muscle elasticity, allow for lymphatic drainage and to aid in joint stability (KINESIO). Kinesio Tape® was created by Dr. Kenzo Kase, who has a background in chiropractic and acupuncture, in the 1970s as a way to assist his elderly patents in keeping their repositioned joints in place in a safer way that traditional tape. Through trial and error, a flexible, waterproof, lightweight tape was developed that would mimic the elasticity of human skin while providing additive support that would not diminish with overuse like traditional tape (About Us).

Due to the various types of possible injuries attributed with the complexities of overhead throwing, some external intervention may be taken with the use of Kinesio

Tape®. The Kinesio Tape® method used as seen in **Figure 3**, as a way to provide stability to the scapula as velocity, accuracy and range of motion is measured to test if the addition of the tape has any effect on any of the three variables.

Purpose

The purpose of this study is to investigate the effects of Kinesio Tape® on velocity, accuracy and range of motion in NCAA Division II collegiate softball players at East Stroudsburg University using two throwing protocols; no tape as the control and Kinesio Tape® as the experimental condition.

Hypothesis

There will be no difference in accuracy between the control (no tape condition) and the experimental (Kinesio Tape®) condition.

There will be no difference in velocity between the control (no tape condition) and the experimental (Kinesio Tape®) condition.

There will be no difference in maximum external rotation between the control (no tape condition) and the experimental (Kinesio Tape®) condition.

There will be no difference in ball release angle between the control (no tape condition) and the experimental (Kinesio Tape®) condition.

Limitations

- Athlete dropout due to injury/muscle soreness due to practice and game schedules
- Motivation of the athletes to perform well
- Throwing mechanics differ from athlete to athlete

Delimitations

- NCAA Division II rostered East Stroudsburg University softball players

- College age females 18-23
- Athletes whom are free from injury

Operational Definitions

- Kinesio Taping – specific taping technique used to promote muscle activation of the shoulder girdle.
- Ball Velocity – highest measured velocity of the ball
- Accuracy – the ability of the athlete to hit a bullseye shaped target with a softball
- Range of Motion – measured at the shoulder joint, specifically external rotation of the glenohumeral joint was measured

**CHAPTER 2**

# LITERATURE REVIEW

The purpose of this study is to evaluate the effects of Kinesio Tape on throwing velocity and accuracy while also addressing its effects on the angle of the glenohumeral joint maximum external rotation, measured at the point in the late cocking phase at the point when the lead leg makes contact with the ground, before the center of mass begins to shift to the lead leg, along with the angle at ball release. This chapter will cover the literature reviewed for reference information along with comparing and contrasting the literature to the current study.

## Overhead Throwing

Overhead throwing is a multidirectional movement with excessive physiological forces and involves multiple joints in-which success comes from a combination of velocity and accuracy. As stated and shown previously in **Figure 1**, there are six phases of the overhead throwing sequence; wind-up, early cocking, late cocking, acceleration, deceleration and follow through.

Roles of the Scapula

From the review by Forthomme, Crielaard, and Croisier in 2008, it is described that there are four main roles for the scapula function into the shoulder. The first and primary role being that the scapula moves in conjuncture with the humerus, keeping the scapulohumoral rhythm within the physiological pattern through the full range of motion of the glenohumoral joint. The muscles of the rotator cuff allow for proper positioning of the glenoid to allow for optimal stabilization during dynamics movements such as the overhead throw. The second role of the scapula is that the movement of the scapula will adapt to the task being performed by moving along the thoracic wall, meaning that it will adapt to the forces being applied during any type of upper extremity movement. The third role of the scapula is to elevate the acromion, to clear it out of the path of the rotator cuff to possibly decrease any potential impingement or compression. Professional baseball players showed a greater degree of scapular rotation in their throwing shoulder which may be seen as an adaptation to ensure the maintenance of the subacromial space which supports the second and third role of the scapula. The fourth role of the scapula is that it serves as the main link in the proximal to distal transfer of energy and velocity during shoulder functions. The scapula provides a sturdy and stable base for regulation of forces (Forthomme, B., Crielaard, J., & Croisier, J., 2008).

Kinesio Tape

In a study by Shaheen, A. F., Villa, C., Lee, Y., Bull, A. M., & Alexander, C. M. (2013), it was shown that in 13 healthy overhead athletes, that were asked to perform movements in the sagittal and scapular plane under two different conditions (taping and no taping), the taping did improve scapular external upward rotation along with posterior tilt when elevating the arm in the sagittal plane and improved scapular external rotation in the scapular plane. With these results, it shows that taping could be used at preventive measures but results were only measured in two planes of motions where the results may vary for other planes (Shaheen, A. F., Villa, C., Lee, Y., Bull, A. M., & Alexander, C. M.,2013).

In a study by Cools, A. M., Witvrouw, E. E., Danneels, L. A., & Chambier, D. C. (2002) that looked at the influence of taping on muscle activity using electromyography. As stated, there is little research done on the muscle activity of the scapular rotators using taping, as taping is most commonly used to aid in instability and impingement rehabilitation. In this study, it was not mentioned as to what taping technique was used but tape was applied to three parts of the trapezius and the serratus anterior as the muscles worked through dynamic full range of motion abduction and forward flexion. The results of this study showed that there was no significant difference with the application of tape on EMG activity but is stated that this information does provide a platform for further research to look at different proprioceptive changes that may affect muscle activation with the application of a tape. This provides the gap to investigate taping the supporting and stabilizing muscles of the scapula (Cools, A. M., Witvrouw, E. E., Danneels, L. A., & Chambier, D. C., 2002).

Velocity/Accuracy

Muscular strength is a key component in sports like handball and soccer with accuracy and velocity of both kicking and throwing determining performance of the athlete. In a study by Muller, the purpose being to evaluate the effects of Kinesiotape application on ball velocity and accuracy in 26 amateur soccer players and 32 amateur handball players at different distances from the target. With the application of tape in soccer players, the results show that there was a significant increase in ball speed in soccer players along with accuracy from a shorter distance. When looking at ball velocity in handball players, throws significantly increased in speed while accuracy decreased from a greater distance from the target. The gain in ball velocity in amateur handball players may be at the expense of accuracy (Muller C., Brandes M., 2015). This article supports the addition of Kinesiotape to increase throwing velocity in handball players using a technique that supported the subscapularis while disagreeing with the use of this method to increase throwing accuracy.

In previous research on Kinesio Tape and the shoulder joint, it focuses mainly on static movements and muscle activities but does not focus on dynamic movements like overhead throwing and the movements that are involved in archery. Archery is unique in the aspect that it requires a static and stable front arm to stabilize the bow but also a dynamic pull from the back arm to shoot the arrow. Similar to the overhead throw, there are six phases of shooting; bow hold, drawing, full draw, aiming, release and then follow through. It is important for archers to create back tension in order to perform all these movements without losing sight of the target. Again, similar to baseball, the main muscles that create tension in the back are the major and minor rhomboids, levator scapula, trapezius and latissimus dorsi. The purpose of this study was to investigate how four weeks of training with the addition of Kinesio Tape effected shooting accuracy. From 18 meters away, archers performed ten series of three shots. There was a statistically significant difference between the pre and post test scores showing that training for four weeks with the addition of Kinesio Tape on the shoulder does increase shooting accuracy in young archers.

Joint Angle - Maximum External Rotation/Ball Release

In a study by Miyashita, K., et al., passive external rotation, maximum external rotation during the performance of a throw along with the ratio of the two measures were evaluated to identify the relationship to elbow injury. Two groups of 20 high school baseball players (20 with medial elbow pain in the past 2 months but not on the day of testing, 20 with no previous elbow pain) were recruited for the study. Given the excess demand of the sport, it is known that medial elbow pain is linked to the repetitive stresses and overuse syndromes.

From the review by Neil, and Freehold in 2018, as seen in **Figure** 1, as the athlete moves from the late cocking phase, to the acceleration phase, the forearm remains back leading to increased valgus stress and is thought to be the leading cause of elbow injury. This may be due to the torque required to bring the arm from its point of maximum external rotation to transition it forward into the acceleration phase. Results of the Miyashita, K., et al., study show that those in the elbow-injured group showed greater amounts of valgus stress in the elbow which may be associated with the medial elbow pain experienced by the athletes. A limitation mentioned in this study was the difference in throwing mechanics that may have been adapted by those with previous injury versus those without and these findings may be due to other range of motion restrictions.

## CHAPTER 3

## METHODOLOGY

The purpose of this study is to evaluate the effects of Kinesio Tape on throwing velocity and accuracy while also addressing its effects on the angle of the glenohumeral joint maximum external rotation, measured at the point in the late cocking phase at the point when the lead leg makes contact with the ground, before the center of mass begins to shift to the lead leg, along with the angle at ball release. This chapter will cover the methodology of the current study. None of the athletes who participated in this study have had previous experience with this technique of taping.

Athletes

12 athletes were asked to participate in the study, but there athlete drop out was experienced due to injury during the season in which one athlete injured her shoulder, another sprained their ankle and the third sprained their wrist. 9 rostered members of the National Collegiate Athletic Association (NCAA) Division II, East Stroudsburg University (ESU) softball team were recruited to participate in this study.

Inclusion Criteria:

- College-ages females
- Rostered member of the ESU softball team (NCAA Division II)

- Free from upper extremity injury in the past 6 months
- Willingness to participate

Exclusion Criteria:

- Any preexisting injury that may become exacerbated or made worse with participation
- Pitchers were excluded from the recruitment as their adaptive musculature is different from those who are habitual overhead throwers like other positional players.

Design

The design of the study is randomized and counterbalanced. Each athlete will act as their own control which is an advantage of this study. Two taping protocols were assessed, the control being no taping application and the experimental group, receiving the taping application using Kinesio Tape. All testing occurred over two testing sessions. Assignment of the protocol was randomly assigned as the athletes arrived for the first testing session. Athletes participated in three sets of five throws with two minutes of rest between sets and about ten seconds between throws. Athletes were instructed to a starting point that was 20 feet from the target. Video recording was used throughout the duration of the testing session in order to asses accuracy.

Accuracy was measured using a target with concentric circles with different point values assigned to each circle. The highest point value of 25 points were given if the athlete hit the smallest center circle, 10 points were given if the athlete hit the second middle circle, 5 points were given if the athlete hit the third and largest circle and 0 points were given if the athlete missed any of the three circles. Video recordings were assessed following each testing session to evaluate the points each athlete obtained and averaged out per athlete.

Velocity of the ball was measured using a radar gun pointed at the target from the side of the athlete. Velocities were recorded following each throw and the average velocity was found following each testing session for each athlete.

Maximum external rotation was measured using DartFish video analysis to place markers on the center of the shoulder and the medial point of the wrist at the point of maximum external rotation when the throwing arm is extended fully behind the body, as the lead leg makes contact with the ground, before the center of mass begins to shift to the lead leg. The angle of the arm at ball release was measured at the point that the athlete released the ball toward the target and measurements were taken from the center of the shoulder joint to the lateral point of the wrist. Angles were recorded and averaged for each athlete.

Procedure

Approval from the East Stroudsburg University Institutional Review Board (IRB) was obtained for this study, **APPENDIX A**. Taping is applied by the same Certified Athletic Trainor to ensure validity and reliability. Athletes received an informed consent, **APPENDIX B**, PAR-Q, **APPENDIX C**, at recruitment session to bring with them to the first testing session and must have passed the Athletic Training physical. Athlete height and weight measurements were obtained from the Athletic Training files.

The athletes were asked to wear black spandex pants, a black spandex long sleeve shirt and a black sports bra or camisole. Athletes participated in a warm-up protocol prior to any application of taping or markers. The taping technique was explained to the athletes pre-taping and tape was applied by a female Certified Athletic Trainer to help the athletes feel more comfortable along with having the option to have the tape applied in the privacy of the restroom.

When the athlete was participating in the taping protocol, they were asked to be in the sports bra or camisole then the taped was applied first. They were instructed to replace their spandex long sleeve shirt then the Vicon markers were applied and those who were in the control group that did not receive the taping application and only had the application of the Vicon markers, following the warm-up. Athletes performed a series of three trials of five throws with two minutes of rest between trials.

Two strips of pre-cut tape were used for this study. The athlete is standing and in slight retraction of the shoulder blades. Reference points were marked at the acromioclavicular joint of the throwing arm, the inferior angle of the scapula, and then another in line with the previous two markers, just lateral to the spine, on the same side. The first strip of tape is anchored to the skin with no stretch at the reference point closest to the spine and stretched at 25% and angled toward the reference point at the inferior angle of the scapula. The end of the tape is placed down with no stretch or tension, creating another anchor at the top of the strip. The second strip is anchored just above the first strip, and stretched to 50% and angled toward the reference point at the acromioclavicular joint. The end of the tape is placed following the same steps as the first, with no stretch. Following application of both strips, rubbing the tape creates friction which is what activates the adhesive of the tape. (Tape, K) Changing posture was associated with a significant increase in the range of motion in shoulder flexion and abduction in the scapular plane (Forthomme, B., Crielaard, J., & Croisier, J., 2008).

**Figure 3:** Taping technique as applied by a female Certified Athletic Trainer.

Instruments

- Radar gun
- Throwing target
- Vicon-3D motion analysis camera system
- Kinesio Tape
- Official NCAA regulation softball
- Data collection sheet
- Computer

Warm-Up Protocol

- Arm Circles
  - Standing upright with arms outstretched, 10 small circles forward, 10 large circles forward, 5 second rest, 10 small circles backwards, 10 lard circles backward.
- Arm Swings
  - Standing upright with arms outstretched, swing the arms across the body, crossing arms in front of the body 10 times

- Shoulder Circles
    - Standing upright, just moving the shoulders in a circular motion 10 times forward, 5 second rest, 10 times backwards
- Anterior Shoulder Stretch
    - Standing upright, hands clasp behind back, slowly lift hands up and away from the ground, 15 second hold
- Cross-body Stretch
    - Standing upright, one arm laterally across body, pull arm closer to body using forearm of other arm, 15 second hold
    - 5 second rest
    - Repeat with other arm, hold for 15 seconds
- Arm Over Head Stretch
    - Standing upright, raise one arm over and behind head, grab elbow of bent arm with the other arm, pull for 15 seconds
    - 5 seconds rest
    - Repeat with other arm, hold for 15 seconds

Data Analysis

The first five throws were excluded from data analysis of each athlete for all variables. Data of the last 10 throws was analyzed with an ANOVA using SPSS ($p=<0.05$) to test for statistical significance. Comparisons will be made between the control and experimental group

**CHAPTER 4**

RESULTS

The purpose of this study is to evaluate the effects of Kinesio Tape on throwing velocity and accuracy while also addressing its effects on the angle of the glenohumeral joint maximum external rotation, measured at the point in the late cocking phase at the point when the lead leg makes contact with the ground, before the center of mass begins to shift to the lead leg, along with the angle at ball release. This chapter will cover the specific results for each variable analyzed; velocity, accuracy, maximum external rotation and the humeral angle at ball release.

| | Athlete Demographics | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Athlete 1 | Athlete 2 | Athlete 3 | Athlete 4 | Athlete 5 | Athlete 6 | Athlete 7 | Athlete 8 | Athlete 9 |
| Height (in) | 62.4 | 66.1 | 68 | 65.4 | 64 | 67.5 | 63.8 | 60.4 | 65.5 |
| Weight (lb) | 142.3 | 152.7 | 137 | 206.8 | 124.6 | 165 | 153.1 | 146.8 | 139 |
| Class Rank | 2 | 1 | 2 | 1 | 2 | 1 | 3 | 1 | 4 |

**Table 1:** The athletes height, weight and class rank (1=freshman, 2=sophomore, 3=junior, 4=senior)

Velocity

Velocity is defined as the rate of change of position of an object in motion, taking the distance divided by the amount of time it takes from and object to get from its starting position to its end position (Biomechanics Definitions), in the case of the current study, how long it takes for the ball to reach the target once it is released from the athletes hand. As seen in **Figure 4,** although there was a slight increase in speed, there was no statistically significance difference in velocity (p=0.480) between the control and experimental group. Although there was no statistical significance, the increase in velcoity can be seen as practically significant in terms of athletic performance in the sport of softball. Six of the nine athletes saw improvement in their throwing velocity, exceeding the smallest worth-while change (.942mph).

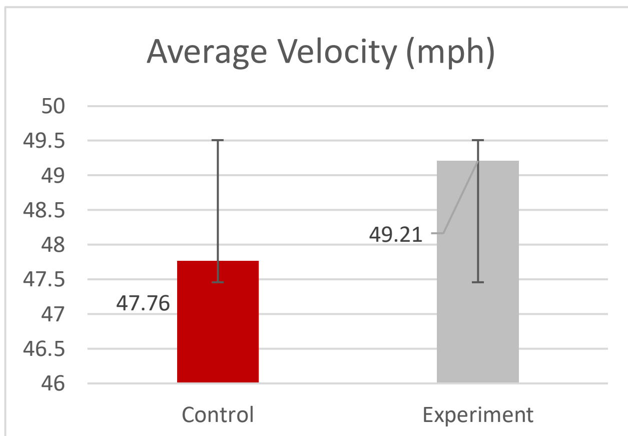


**Figure 4:** The average velocity of the control (left), 47.76 miles per hour and the experimental (right), 49.2 miles per hour (right) group.

| | Velocity | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Athlete 1 | Athlete 2 | Athlete 3 | Athlete 4 | Athlete 5 | Athlete 6 | Athlete 7 | Athlete 8 | Athlete 9 |
| Control | 45.6 | 48.8 | 48.4 | 41.5 | 45.9 | 50.8 | 50.7 | 56.4 | 41.7 |
| Experiment | 48.2 | 49.9 | 47.7 | 43.6 | 51.6 | 50.2 | 49.1 | 56.9 | 45.7 |

**Table 2**: The average velocities of each athlete. Six out of nine athletes saw improvements in throwing velocity with the application of Kinesio Tape.

**2a.**

| Velocity Means | | |
|---|---|---|
| Control | N | 9 |
| | Mean | 47.76 |
| | SD | (±4.71) |
| Experiment | N | 9 |
| | Mean | 49.21 |
| | SD | (±3.77) |

**2b.**

| Velocity | |
|---|---|
| Significance | 0.480 |
| F | 0.523 |
| Mean Squared | 9.534 |
| Smallest Worth-While | 0.942 |

**Table 2a:** The means table for velocity. For the control group, the group that did not receive the taping protocol, n=9 with a mean of 47.76mph ±4.71mph. For the experimental group, the group who received the taping protocol, n=9 with a mean of 49.21 points ±3.77mph.
**Table 2b.** Significance Table for velocity. There was no statically significant difference (p=0.480) between the control and the experimental group with an F value of 0.523, a mean square of 9.534 and a smallest worth-while change of 0.942 mph.

Accuracy

Accuracy in this study is defined as how close the ball that was thrown from 20 feet away was to hitting the center of the designated target. Athletes were given a hanging target with a red circle in the middle and two wider white rings around it and were instructed to aim for the center. Points were awarded in conjecture with the area on the target that was hit with each throw, 25 being the center, 10 for the second circle, 5 for the third circle and 0 if their throw hit outside the third circle. As seen in **Figure 5,** when looking at the increase in accuracy by point value, there was no statically significant difference (p=0.092) between the control and the experimental group. Although there was no statistical significance, the increase in accuracy can be seen as practically significant in terms of athletic performance in the sport of softball. Six of the nine athletes saw improvement in their throwing accuracy, exceeding the smallest worth-while change (11.28 points).

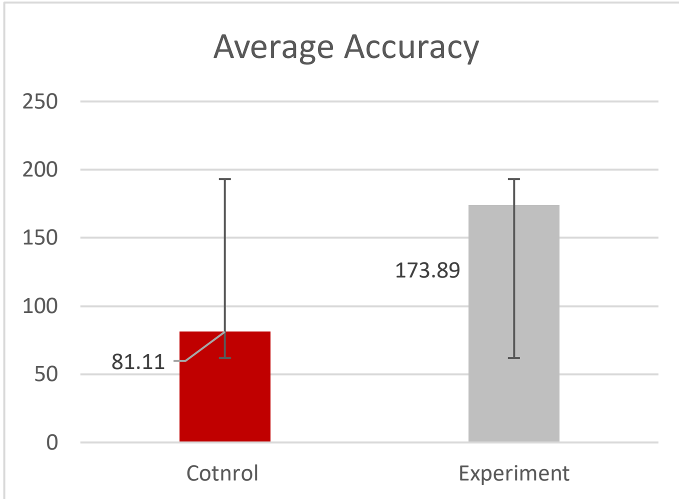


**Figure 5:** The average accuracy of the control (left), 81.11 points and experimental (right), 173.89 points group.

| | Accuracy | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Athlete 1 | Athlete 2 | Athlete 3 | Athlete 4 | Athlete 5 | Athlete 6 | Athlete 7 | Athlete 8 | Athlete 9 |
| Control | 10 | 85 | 40 | 175 | 85 | 45 | 160 | 35 | 95 |
| Experiment | 440 | 160 | 0 | 250 | 25 | 205 | 175 | 20 | 290 |

**Table 3:** The average accuracies of each athlete. Six out of nine athletes saw improvement in throwing accuracy with the application of Kinesio Tape.

**3a.**

| Accuracy Means | | |
|---|---|---|
| Control | N | 9 |
| | Mean | 81.11 |
| | SD | (±56.39) |
| Experiment | N | 9 |
| | Mean | 173.89 |
| | SD | (±144.63) |

**3b.**

| Accuracy | |
|---|---|
| Significance | 0.092 |
| F | 3.215 |
| Mean Squared | 38734.72 |
| Smallest Worth-While | 11.28 |

**Table 3a:** The means table for accuracy. For the control group, the group that did not receive the taping protocol, n=9 with a mean of 81.11 points ±56.39 points. For the experimental group, the group who received the taping protocol, n=9 with a mean of 173.98 points ±144.63 points.
**Table 3b:** The significance table for accuracy. There was no statically significant difference (p=0.092) between the control and the experimental group with an F value of 3.215, a mean square of 38734.72 and a smallest worth-while change of 11.28 points.

Maximum External Rotation and Ball Release

For this study, maximum external rotation was measured from the point when the throwing arm is extended fully behind the body, as the lead leg makes contact with the ground, before the center of mass begins to shift to the lead leg. Measurements using DartFish were taken from the center of the shoulder joint to the medial point of the wrist. The angle of the arm at ball release was measured at the point that the athlete released the ball toward the target and measurements were taken from the center of the shoulder joint to the lateral point of the wrist. Although there was an increase in joint angle, there was no statistically significant difference (p=0.621) in maximum humeral external rotation, **Figure 6,** along with the angle of the glenohumeral joint at ball release (p=0.732), **Figure 7**. Four of eight athletes saw increases in maximum external rotation, exceeding the smallest worth-while change for maximum external rotation (4.058°). Four of eight athletes saw increases in the angle of ball release although these results did not exceed the smallest worth-while change (1.30°). Although previously mentioned in the study by Miyashita. et al. that excessive maximum external rotation may lead to potential medial elbow pain, the difference between groups does not greatly exceed the amount of maximum external rotation seen in their study between groups with and without medial elbow pain showing that although there was an increase in maximum external rotation, it is not a direct cause of the Kinesio Tape.

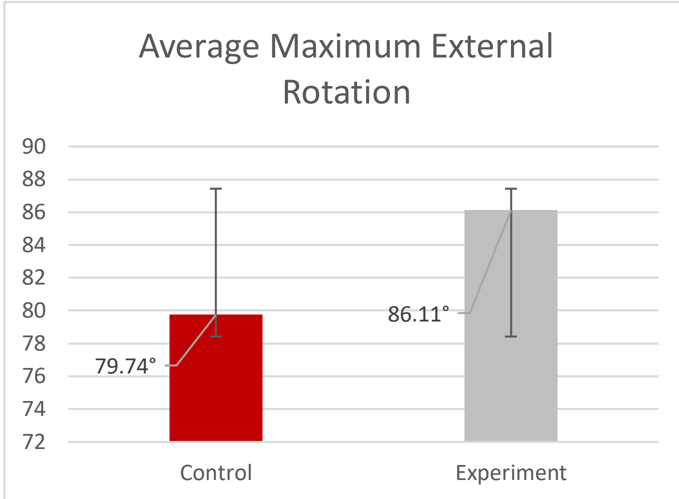


**Figure 6:** The average angle of the glenohumeral joint at maximum humeral external rotation of the control (left), 79.74° and experimental (right), 86.11° group.

| | Maximum Exerternal Rotation | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Athlete 1 | Athlete 2 | Athlete 3 | Athlete 4 | Athlete 5 | Athlete 6 | Athlete 7 | Athlete 8 | |
| Control | 83.78 | 62.23 | 87.59 | 95.83 | 111.92 | 55.44 | 88.61 | 56.57 | |
| Experiment | 79.49 | 62.65 | 126.44 | 100.01 | 94.98 | 50.23 | 111.84 | 52.23 | |

**Table 4:** The average maximum external rotation angles of each athlete. Four of the eight athletes saw improvements in maximum external rotation with the application of Kinesio Tape.

**4a.**

| Maximum External Rotation Means | | |
|---|---|---|
| Control | N | 8 |
| | Mean | 80.25 |
| | SD | (±20.29) |
| Experiment | N | 9 |
| | Mean | 86.11 |
| | SD | (±26.72) |

**4b.**

| Maximum External Rotation | |
|---|---|
| Significance | 0.621 |
| F | 0.255 |
| Mean Squared | 145.845 |
| Smallest Worth-While | 4.058 |

**Table 4a:** The means table for maximum external rotation. For the control group, the group that did not receive the taping protocol, n=8 with a mean angle of 80.25°±20.29°. For the experimental group, the group who received the taping protocol, n=9 with a mean angle of 86.11°±26.72°.
**Table 4b:** the significance table for maximum external rotation. There was no significant difference in joint angle (p=0.621) at maximum external rotation between the control and experimental group with an F value of 0.255, a mean squared of 145.845° and a smallest worth-while change of 4.058°.

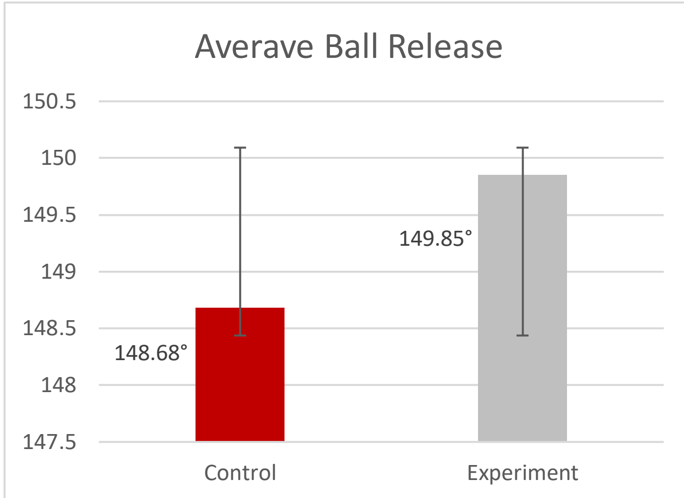


**Figure 7:** The average angle of the glenohumeral joint at ball release of the control (left), 148.86° and experimental (right), 149.85° group.

| | Ball Release | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Athlete 1 | Athlete 2 | Athlete 3 | Athlete 4 | Athlete 5 | Athlete 6 | Athlete 7 | Athlete 8 | |
| Control | 148.63 | 150.94 | 140.47 | 139.16 | 153.2 | 155.56 | 156.07 | 145.37 | |
| Experiment | 148.84 | 150.23 | 138.15 | 148.41 | 157.59 | 150.65 | 160.58 | 140.15 | |

**Table 5:** The average ball release angles of each athlete.

**5a.**

| Ball Release Means | | |
|---|---|---|
| Control | N | 8 |
| | Mean | 148.68 |
| | SD | (±6.50) |
| Experiment | N | 9 |
| | Mean | 149.85 |
| | SD | (±7.31) |

**5b.**

| Ball Release | |
|---|---|
| Significance | 0.732 |
| F | 0.122 |
| Mean Squared | 5.869 |
| Smallest Worth-While | 1.3 |

**Table 5a:** The means table for ball release. For the control group, the group that did not receive the taping protocol, n=8 with a mean angle of 148.68°± 6.50°. For the experimental group, the group who received the taping protocol, n=9 with a mean angle of 149.85°± 7.31°.

**Table 5b:** The significance table for ball release. There was no significant difference in joint angle (p=0.732) at ball release between the control and experimental group, with an F value of 0.122 and a mean squared of 5.869.

# CHAPTER 5

## DISCUSSION

Success of any overhead throwing sport, like softball, from a defensive standpoint comes from two main attributes, throwing velocity and accuracy. Knowing that overhead throwing is a strong dynamic movement that endures many kinetic adaptations along with physiological forces all many different directions simultaneously, if not exceptional, these attributes can be detrimental to the performance and health of an athlete. While both velocity and accuracy can be improved by incorporating strength training, flexibility training, potentially introducing an external stimulus or cue like Kinesio Tape may also be beneficial to enhancing performance. The purpose of this study is to evaluate the effects of Kinesio Tape on throwing velocity and accuracy while also addressing its effects on the angle of the glenohumeral joint maximum external rotation, measured at the point in the late cocking phase at the point when the lead leg makes contact with the ground, before the center of mass begins to shift to the lead leg, along with the angle at ball release. Kinesio Tape was created by Dr. Kenzo Kase who has a background in chiropractic and acupuncture in the 1970s as a way to assist his elderly patents in keeping their repositioned joints in place in a safer way that traditional tape. Through trial and error, a flexible, waterproof, lightweight tape was developed that would mimic the elasticity of human skin while providing additive support that would not diminish with overuse like traditional tape. There are four main purposed of Kinesio Tape, to aid in the reduction of swelling and inflammation, provide support in muscle elasticity, allow for lymphatic drainage and to aid in joint stability (About Us). As stated by Cools, A. et. al, some studies suggest that along with providing actual stability, taping can be seen to have a proprioceptive effect proposing that the traction on the skin or the pressure of the tape provides sensory cues that provides additional input into the central nervous system.

When looking at previous research using Kinesio Tape, it was very limited when it came to a dynamic motion like overhead throwing. A lot of the research was looking at electromyographical data of which muscles were active at what point of the overhead throw. Although this data did not directly look at the effects of Kinesio Tape, this research laid a foundation and a direction as to what taping technique was to be used for this study, as stated previously that providing stability is one of the main purposes of Kinesio Tape.

Overhead throwing is broken down into six phases; wind-up, early cocking, late cocking, acceleration, deceleration, follow-through. The wind-up phase begins with the initial movement of the lead leg until it is at its highest elevation. This allows the kegs to prepare a stable base for energy transfer and creating momentum. The early cocking phase begins once the lead leg is at its highest point and ends when the lead leg lands on the pitching mound or ground. During this phase, the deltoid, supraspinatus and infraspinatus activate to externally rotate the shoulder. The late cocking phase is when the lead foot contacts the mound or ground and there is maximum external rotation of the throwing shoulder. During the late cocking phase, the scapula retracts, the elbow flexes and the humerus abducts and undergoes extreme maximum external rotation. On top of the scapula retracting, elbow flexing and humeral abduction, the subscapularis, pectoralis major and latissimus dorsi eccentrically contract as the shoulder approaches maximum external rotation. As the shoulder is approaching maximum external rotation, it is preparing to provide a stabilizing anterior force for the glenohumeral joint but as shown in an article by Miyashita, K., et al., increased maximum external rotation has been shown as a cause for medial elbow pain (Neil, Bakshi, and Freehold T. Michael, 2018). Insufficient upward rotation of the scapula causes a lack of necessary acromial elevation during overhead shoulder motion such as throwing may contribute to secondary subacromial impingement (Cools, A. M., Witvrouw, E. E., Danneels, L. A., & Chambier, D. C., 2002).

The acceleration phase is from the point of maximum external rotation of the shoulder to the point of ball release. At this phase, the scapula protracts as the humerus undergoes horizontal adduction and internal rotation. Subscapularis, pectoralis major and latissimus dorsi reach maximum activity to produce internal rotation of the humerus. Early in this phase, as the throwing arm is moving forward, yet the hand has stayed back and hasn't moved through the final stages, it is known as "lagging". The deceleration phase is from ball release to maximum humeral internal rotation and elbow extension. This is considered the most dangerous phase of the overhead throw when it comes to potential for injury. Any energy that is not displaced through the ball is transferred through the shoulder creating significant eccentric loading of the posterior rotator cuff. The final stage of the overhead throwing sequence, the follow-through, is the body continuing to move forward with the arm after releasing the ball until it has stopped its motion (Neil, Bakshi, and Freehold T. Michael, 2018).

In looking at scapular motion during sports activity, professional baseball players were seen to have a greater degree of scapular rotation on the throwing side with a shift in upward rotation which may be a functional kinematic adaptation during overhead throwing. Electromagnetic tracking was used to assess scapular plane humeral elevation. As the results showed, a group of 21 throwing athletes were matched with 21 control athletes that showed increased upward rotation and retraction of the scapula during humeral elevation in healthy throwing athletes which is important to keep the shoulder healthy as it follows the third role of the scapula as previously stated, raising the acromion and preventing impingement, along with no difference in anterior/posterior tilt or elevation/depression (Forthomme, B., Crielaard, J., & Croisier, J., 2008).

With fatigue of the shoulder muscles comes alterations in the normal throwing pattern and scapulohumeral rhythm which is commonly linked with most injuries. Weakness of the scapular musculature will affect normal scapular positioning which could leave to muscular imbalances in throwing athletes. This usually consists of overcompensation of the scapular elevators leading to tension overload and increased stress leading to greater instability(Cools, A. M., Witvrouw, E. E., Danneels, L. A., & Chambier, D. C., 2002). In the 42 athletes mentioned from Forthomme, B., et.al., following different fatiguing protocols, it is unsure if the changes in the scapula’s motion are directly related to muscle alterations or if it is cumulative effect of the scapular stabilizers and knowing this is important when we think about the deceleration phase of the throwing sequence being the most problematic when it comes to potential for injury.

Being that there are 17 different muscles that do attach to the scapula, it is very important to strengthen all and maintain flexibility evenly so there is no abnormal compensation which may lead to further dyskinesis (Forthomme, B., Crielaard, J., & Croisier, J., 2008).

When it comes to physical activity and overhead throwing the scapula play a part in four main roles, the first being to move in conjuncture to the humerus and follow normal scapulohumeral rhythm. In a review by Forthomme, B., this allows the humeral head to follow the normal physiological pattern through full range of motion and allows the muscles of the rotator cuff to provide optimal stabilization. The second main role of the scapula is that the scapula will adapt to the task being performed by moving along the thoracic wall. The third rule being that it elevates the acromion, to clear it out of the path of the rotator cuff to possibly decrease any potential impingement or compression. As seen in a study by Cools, A. et. al., the lack of scapular stability has also been identified as a cause of secondary subacromial impingement syndrome. The fourth role being that the scapula serves as a link in the kinetic chain for force and energy transfer from proximal to distal. As the scapula provides a large, stable base for the regulation of forces proximal to distal, the fourth role may be the largest contributor to the current study at hand as we measure velocity with the addition of Kinesio Tape to the supporting muscles of the scapula.

The scapula provides a stable base for the kinetic chain and energy and force transfer from proximal to distal and allows any excess forces that are transferred from the arm to continue through the ball. By introducing a taping technique to improve scapular stability, it was hypothesized that reducing any excess movement, this will allow less energy to be lost within the throwing sequence and increase throwing velocity. As seen in a study by Mulazimoglu, O. et.al., the theory that increasing stabilization will increase velocity, is show to increase shooting accuracy in young archers, by taping the deltoid of the grasp arm, which is the arm that holds the bow steady.

Results show that there was an increase in throwing velocity from the control group with no tape application with a mean speed of 47.76 mph and the experimental group with the tape application with a mean speed of 49.2 mph and a mean increase of 1.45 mph difference. Although there was only a 1.45 mph increase in throwing velocity, it was not statistically significant. When looking at this result from a practical standpoint, the increase in throwing velocity exceeded the smallest worth-while change for velocity (0.942 mph), this increase could potentially be the difference between winning and losing a game. By increased the velocity of the throw, means the ball could reach the infield faster from the outfield, or the ball getting to the catcher faster from the infield and preventing a run from scoring.

In the sport of softball, being able to throw accurately is also just as important as being able to throw the ball fast. Results show that there was in increase in throwing accuracy from the control group with no taping application with a mean score of 81.11 points and the experimental group with taping application with a mean score of 173.89 points and a mean difference of 92.78 points. Although there was a somewhat large increase in points, there was no statistically significant difference in the two groups. Again, when we look at these results from a practical standpoint, the increase in throwing accuracy exceeded the smallest worth-while change for accuracy (11.28 points), and being able to hit their target could also be the difference in winning or losing a game. A throw could be coming in from the outfield or the infield to the catcher at home and if that throw is too far off target, it causes the catcher to move from the position she was set in to get the last out, to having to stop the ball from getting lose and creating potentially more of a problem.

When looking at maximum humeral external rotation, as stated in the study by Miyashita. et al., an increase in maximum external rotation may lead to increased medial elbow pain. The results of the current study show that there was an increase in the joint angle from the control group with a mean of 79.74° and the experimental group with a mean of 86.11° with a mean difference of 6.37° and there was no statistically significant difference. These results exceed the smallest worth-while change (4.058°) for maximum external rotation. When looking at results from both studies, the degree of difference is marginally different with their mean difference only being 6°. Any chance of medial elbow pain could potentially linked to the age of the athletes where Miyashita. et al, evaluated high school aged players and this current study evaluated college aged players, some with four more years of repetitive use. The results of this study show an increase in the angle of the humerus at ball release from the control group with no taping application with a mean of 148.68° and the experimental group with taping application with a mean of 149.85° with a mean difference of 1.17°. Although there was an increase in joint angle at ball release, there was no statistically significant difference in results. These results do not exceed the smallest worth-while change (1.30°) for ball angle.

Limitations arise during the course of any type of research. The sample size used is one of the limiting factors for results of this study. There were only 9 athletes eligible to participate in the study. The sample size may have also be limited by the timing of the study. The current study was conducted in-season which lead to drop out due to injury, potential fatigue due to game and practice schedule along with effort that the athletes put into the trials. Only having one taping protocol also is a limitation to the study as there was no placebo taping session to determine if there was a neuromuscular change due to the tactile cue or if any differences were due to the actual application of the Kinesio Tape. Athletes were instructed to throw as hard as they could while also being as accurate as possible, this led to athletes wanting to beat their original score or speed if it was not their first testing session along with having other athletes in the room caused some effort to increase speed while not focusing on the accuracy portion.

When looking at the results from the current study, the addition of Kinesio Tape did not statistically change athletic performance in regards to throwing velocity, accuracy, maximum external rotation and the angle of ball release. However, when looking at each variable from a practical standpoint, the increase in velocity and accuracy may show an increase in athletic performance as a result of using Kinesio Tape to aid in scapular stability.

# APPENDIX A

East Stroudsburg University of Pennsylvania
200 Prospect Street
East Stroudsburg, PA 18301-2999

East Stroudsburg University Institutional Review Board
Human Research Review
Protocol # **ESU-IRB-040-1819**

Date: **February 25, 2019**
To: **Matthew Miltenberger and Francesca Formisano**
From: **Shala E. Davis, Ph.D., IRB Chair**
Proposal Title: **"The Effects of Kinesio Tape on Throwing Velocity and Accuracy in Division II Softball Players?"**

| | | | |
|---|---|---|---|
| Review Requested: | Exempted | Expedited **X** | Full Review |
| Review Approved: | Exempted | Expedited **X** | Full Review |

FULL RESEARCH

___ Your full review research proposal has been approved by the University IRB (12 months). Please provide the University IRB a copy of your Final Report at the completion of your research.

___ Your full review research proposal has been approved with recommendations by the University IRB. Please review recommendations provided by the reviewers and **submit necessary documentation for full approval.**

___ Your full review research proposal has not been approved by the University IRB. Please review recommendations provided by the reviewers and resubmit.

EXEMPTED RESEARCH

___ Your exempted review research proposal has been approved by the University IRB (12 months). Please provide the University IRB a copy of your Final Report at the completion of your research.

___ Your exempted review research proposal has been approved with recommendations by the University IRB. Please review recommendations provided by the reviewers and **submit necessary documentation for full approval.**

___ Your exempted review research proposal has not been approved by the University IRB. Please review recommendations provided by the reviewers and resubmit, if appropriate.

EXPEDITED RESEARCH

_**X**_ Your expedited review research proposal has been approved by the University IRB (12months). Please provide the University IRB a copy of your Final Report at the completion of your research.

___ Your expedited review research proposal has been approved with recommendations by the University IRB. Please review recommendations provided by the reviewers and **submit necessary documentation for full approval.**

___ Your expedited review research proposal has not been approved by the University IRB. Please review recommendations provided by the reviewers and resubmit, if appropriate.

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Please revise or submit the following:

# APPENDIX B

## <u>CONSENT FORM TO PARTICIPATE IN RESEARCH</u>

**The Effects of Kinesio Tape on Throwing Velocity and Accuracy in Division II Colligate Softball Players Francesca Formisano**
**Exercise Science Master's Degree Program**
**fformisano@live.esu.edu**

This study involves your participation in research. The **purpose** of the research is to analyze the effects of the addition of Kinesio Tape on throwing velocity and accuracy.

Understand that the results of this study may be published but that all identity will not be revealed. All information will be kept **confidential** by Francesca Formisano, the primary investigator and Matthew Miltenberger, the thesis chairperson will be the only people with access to any confidential records.

There is minimal **risk** associated with participation in this study as you will be asked to conduct 15 overhead throws. **Benefits** include learning more about your throwing velocity and accuracy, along with if the addition of Kinesio Tape may aid in improved throwing performance.

The research involves you conducting a 5 minute warm-up consisting of dynamic movements along with movements that aid in mobility. You will be asked to conduct 3 sets of 5 throws with 30 seconds of rest between throws and 2 minutes of rest between sets. You will be observed using a radar gun, Dartfish application along with the Vicon motion analysis system.

Remember your participation is **voluntary** and you may stop participation at any time. There is no penalty for not participating or withdrawing from the research study. There is no compensation for participation. The alternative to participating is not to participate.

Please contact the primary investigator with questions, concerns, or complaints about the research and any research-related injuries by emailing fformisano@live.esu.edu or the Chair of the Institutional Review Board, Dr. Shala Davis at (570) 422-3336. This research has been reviewed and approved by East Stroudsburg University Institutional Review Board (IRB).

**By signing the following, you give your consent for the primary researcher listed above to use your data in this study. If you wish to withdraw from this study at any time, simply communicate this to the researcher and your data will be destroyed.**

________________________________________
Print Name

________________________________________
Sign Name

________________________________________
Date

**(Detach: Participant gets bottom half)**

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**The Effects of Kinesio Tape on Throwing Velocity and Accuracy in Division II Colligate Softball Players Francesca Formisano**
**Exercise Science Master's Degree Program**
***fformisano@live.esu.edu***

***Please contact the primary investigator with questions, concerns, or complaints about the research and any research-related injuries by e-mailing fformisano@live.esu.edu or the Chair of the Institutional Review Board, Dr. Shala Davis at (570) 422-3336. This research has been reviewed and approved by East Stroudsburg University Institutional Review Board (IRB).***

________________________________________
Primary Researcher Signature Date

**APPENDIX C**

# Physical Activity Readiness Questionnaire (PAR-Q)

Name: ______________________________ Date: _________________

A Questionnaire for People Aged 15 to 69

Regular physical activity is fun and healthy, and more people are starting to become more active every day. Being more active is very safe for most people. However, some people should check with their doctor before they start becoming much more physically active. If you are planning to become much more physically active than you are now, start by answering the seven questions in the box below. If you are between the ages of 15 and 69, the PAR-Q will tell you if you should check with your doctor before you start. If you are over 69 years of age and you are not used to being very active, check with your doctor. Common sense is your best guide when you answer these questions. Please read the questions carefully and answer each one honestly: check YES or NO.

| | |
|---|---|
| YES [] NO [] | 1. Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor? |
| YES [] NO [] | 2. Do you feel pain in your chest when you do physical activity? |
| YES [] NO [] | 3. In the past month, have you had chest pain when you were not doing physical activity? |
| YES [] NO [] | 4. Do you lose your balance because of dizziness, or do you ever lose consciousness? |
| YES [] NO [] | 5. Do you have a bone or joint problem (for example, back, knee or hip) that could be made worse by a change in your physical activity? |
| YES [] NO [] | 6. Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition? |
| YES [] NO [] | 7. Do you know of any other reason why you should not do physical activity? |

**If you answered YES to one or more questions:**

Talk with your doctor by phone or in person BEFORE you start becoming much more physically active or BEFORE you have a fitness appraisal. Tell your doctor about the PAR-Q and to which questions you answered YES. You may be able to do any activity you want – as long as you start slowly and build up gradually. Or, you may need to restrict your activities to those that are safe for you. Talk with your doctor about the kinds of activities you wish to participate in and follow his/her advice. Find out which community programs are safe and helpful for you.

**If you answered NO honestly to all PAR-Q questions, you can be reasonably sure that you can:**

Start becoming much more physically active – begin slowly and build up gradually. This is the safest and easiest way to go. Take part in a fitness appraisal – this is an excellent way to determine your basic fitness so that you can plan the best way for you to live actively. It is also highly recommended that you have your blood pressure evaluated. If your reading is over 144/94, talk with your doctor before you start becoming much more physically active.

**PLEASE NOTE:**

If your health changes so that you then answer YES to any of the above questions, tell your fitness or health professional. Ask whether you should change your physical activity plan.

**DELAY BECOMING MUCH MORE ACTIVE:**

If you are not feeling well because of a temporary illness such as a cold or a fever – wait until you feel better; or if you are or may be pregnant – talk to your doctor before you start becoming more active.

______________________________________________

Signature

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