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The Acute Effects of Upper Extremity Stretching on Throwing Velocity in Untrained Baseball Throwers

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THE ACUTE EFFECTS OF UPPER EXTREMITY STRETCHING ON THROWING
VELOCITY IN UNTRAINED BASEBALL THROWERS

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A doctoral project submitted in partial fulfillment
of the requirements for the

Doctor of Physical Therapy

Department of Physical Therapy

School of Allied Health Sciences

The Graduate College

University of Nevada, Las Vegas

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THE GRADUATE COLLEGE

We recommend the doctoral project prepared under our supervision by

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Jason Melton
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Entitled

The Acute Effects of Upper Extremity Stretching on Throwing Velocity in Untrained
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ABSTRACT

Purpose: The purpose of this study was to examine the effects of static and proprioceptive neuromuscular facilitation (PNF) stretching of shoulder internal rotators on throwing velocity as compared to a typical dynamic warm-up.

Subjects: 27 male untrained throwers (mean age = 25.1 years old, SD =2.4) with basic knowledge of throwing mechanics.

Methods: The study was conducted over a series of three sessions with at least one week between each session. During each session, subjects warmed-up, threw 10 pitches, were randomly assigned to one of three separate stretching protocols, and then threw 10 more pitches. The three protocols were static stretching, PNF stretching, and a control where no stretching was performed. Velocities were recorded after each pitch using a Bushnell Velocity Radar Gun and average and peak velocities were recorded after each session.

Results: Data were analyzed using a 2x3 within factorial ANOVA. There was no significant interaction between stretching and throwing velocity. Main effects for average and peak throwing velocity were not statistically significant. Main effects for the stretching groups were statistically significant. Pearson product moment correlations were used to examine three relationships: 1) throwing velocity and external rotation (ER), 2) years of experience and ER, 3) years of experience and peak and average throwing velocities. The first two relationships were not significant. The relationship between years of experience and peak and average velocities was statistically significant.

Discussion: Results suggest that neither static nor a PNF stretching protocol focusing on increasing ER with no delay before throwing had a significant effect on throwing velocity in untrained throwers. Results may reflect the fact that throwing a baseball requires a

complex neuromuscular pattern. The lack of training in the subjects could have affected the throwing velocity more than a specific stretching protocol. The motor learning needed for the complex task of throwing a baseball could have masked the effects of the stretching protocols.

Conclusions: Results of previous research on upper extremity stretching and its effects on throwing velocity has conflicting results. Further research should be performed in this area using a trained population in overhand pitching and with the use of an objective measure rather than a subjective measure for regulating stretch intensity.

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TABLE OF CONTENTS

Abstract.....	iii
Acknowledgments.....	v
List of Tables	vii
List of Figures.....	viii
Introduction.....	1
Methods.....	4
Results.....	7
Discussion.....	9
Conclusion	14
Appendix A - Tables.....	15
Appendix B – Figures	19
References.....	26
Curriculum Vita	28

LIST OF TABLES

Table 1	Descriptive information for the study sample.....	15
Table 2	Means and standard deviations for average velocity	16
Table 3	Means and standard deviations for peak velocity	17
Table 4	(r) and (p) values for the relationship between external rotation and throwing velocities.....	18

LIST OF FIGURES

Figure 1	Study design flow chart	19
Figure 2	Muscles targeted during stretching protocol.....	20
Figure 3	Demonstration of stretches	21
Figure 4	Bar graph of average throwing velocity.....	22
Figure 5	Bar graph of peak throwing velocity	23
Figure 6	Relationship between average velocity and years of experience.....	24
Figure 7	Relationship between peak velocity and years of experience.....	25

INTRODUCTION

Baseball throwers commonly use stretching to prepare for and improve throwing performance. Performance can be measured in several ways, but one of the most common is throwing velocity. Stretching has long been associated with a typical warm-up for most athletes. Benefits from stretching are thought to include increased range of motion (ROM) and increased flexibility.¹ The neuromuscular mechanisms that may be associated with these effects include reflex inhibition of the Golgi tendon organ (GTO) and lengthening of the musculotendinous unit¹ (MTU) which ultimately is believed to increase overall performance in a desired sport or activity, including throwing. However, research has consistently shown that in lower extremity activities that rely on quick bursts of power, stretching has been shown to negatively affect muscle strength and power output immediately after the stretch.²⁻⁴ Researchers have shown that the observed decrease in power output is most likely due to a decrease in stiffness of the MTU. This results in a decreased ability of the muscle to generate force.²

Little research has been conducted investigating whether these effects would also be observed in the upper extremity. One study, conducted by Haag et al⁵ analyzed the effects of an upper extremity stretching protocol on throwing velocity. This study's stretching protocol consisted of six static stretches performed in the directions of horizontal adduction, horizontal abduction, external rotation (ER), internal rotation (IR), flexion, and extension. The muscles involved in these motions were chosen because they are active in at least one point of the throwing motion. When compared to the control group, which consisted of a team warm-up without stretching, no difference in throwing velocity was found.⁵ This study focused on increasing the overall ROM of the shoulder.

However, based upon results from electromyography (EMG) studies, the internal rotators are the primary muscles involved in generating power during the throwing motion.^{6,7} Therefore, a more targeted stretch to the internal rotators would be more appropriate to investigate the effects of stretching on throwing velocity. The authors of this study also limited their protocol to static stretching even though athletes may utilize several other stretching techniques.⁵ By including other techniques, such as proprioceptive neuromuscular facilitation (PNF) it may be determined if one technique is more effective than another.

Currently, athletes use several techniques of stretching. The most popular of these techniques are static stretching and PNF stretching. Static stretching generally consists of slowly and passively stretching the muscle to a new length. In general the muscle is stretched to the point where tension limits further movement of the muscle. The stretch is then held for a given period of time. In athletes, a thirty-second stretch is most often used.^{8,9} PNF stretching is popular in sports and focuses on using voluntary muscle contractions to increase ROM by minimizing the resistance of the spinal reflex pathway.¹⁰ The common types of PNF techniques include: contract-relax, contract-relax with agonist contraction, hold-relax, and slow-reversal-hold relax.¹¹ Studies have shown conflicting evidence about which stretching technique is best. Wilford et al¹² found there to be no difference between PNF and static stretching on hip flexibility. However, Funk et al¹³ found PNF was better at improving acute hamstring flexibility compared to static stretching.

When implementing a stretching program for throwers, it is important to understand the biomechanics of throwing so that the correct musculature can be targeted.

The throwing motion can be broken down into three distinct phases: cocking, acceleration, and follow-through. The cocking phase consists of the wind-up to maximum ER. The acceleration phase begins with maximum ER to the moment of ball release. An increase in maximal ER at this point is correlated with an increase in throwing velocity.¹⁴ The follow-through phase starts with ball release and ends with the termination of the throw.¹⁵ EMG studies have been conducted on the throwing shoulder to ascertain the muscle activation patterns associated with each phase of throwing. Jobe et al⁶ found that the latissimus dorsi and pectoralis major are most active during the initiation of IR. Another study by Escamilla et al⁷ found the subscapularis and serratus anterior are also involved. These studies demonstrate that these muscles are primarily responsible for accelerating the arm through the acceleration phase. By focusing stretches on these muscles, a change in throwing velocity could be expected due to changes in the MTU.

The purpose of this study was to examine the effects of static and PNF stretching of the internal rotators on throwing velocity as compared to a typical dynamic warm-up.

METHODS

A repeated measures study was conducted to determine the effects of PNF and static stretching on throwing velocity. Random assignment was used to determine the order of the stretching conditions for each participant. Subjects participated in three separate test days with at least one week in between each session. This was done to wash out any effects of the previous stretching protocol.

Sample. The sample consisted of 27 untrained males between the ages of 20-29 who demonstrated a basic knowledge of proper throwing mechanics (see Table 1). Subjects were excluded from the study if they had significant pain or injury in their throwing upper extremity, or if they were in a rehabilitation program for a previous injury while the study was being conducted. All subjects gave informed consent as approved by University of Nevada, Las Vegas Institutional Review Board.¹

Procedures. Each subject participated in three sessions, each with a different stretching protocol. The order of the protocols was randomly assigned for each subject. At the beginning of each protocol, subjects completed a dynamic warm-up that included a light jog of 400 to 600 feet and playing catch for 10 to 15 minutes. The warm-up was concluded when the subject felt comfortable to participate in throwing at maximal velocity. Participants were instructed not to include any stretching as part of their warm-up. After their warm-up, each subject was moved to the bullpen of the baseball field, where they threw from the mound, which was 60 feet away from the person catching the ball, and was instructed to throw 10 overhand pitches at their maximum velocity. The subject then received one of the three stretching protocols.

¹ IRB Protocol #1106-3843

Ten more pitches thrown at maximum velocity followed the stretching protocols. Velocity was measured with each pitch. Average and peak velocities of the 10 pitches were calculated and used for comparison between the different stretching protocols (See Figure 1).

Stretching protocols focused on increasing the range of ER in the shoulder by stretching the internal rotator muscle group. Based on prior EMG studies, the muscles included were pectoralis major, latissimus dorsi, and subscapularis.^{6,7} Although the serratus anterior has been shown to be active during the acceleration phase, stretches specific to the muscle were not included due to the difficulty to stretch it, as well as its primary role as a scapular stabilizer rather than an internal rotator (See Figure 2). The pectoralis major muscle was stretched with the subject lying prone on the treatment table, with the throwing shoulder abducted to 90 degrees and externally rotated with the elbow bent to 90 degrees. The examiner stood on the side being stretched and asked the subject to lift his arm off the table towards the sky while the examiner assisted in reaching end range of motion (See Figure 3). To ensure the quality of the stretch, the examiner made sure the subject's sternum remained on the table and the forearm remained horizontal. The latissimus dorsi muscle was stretched in a side-lying position on the side opposite to the throwing shoulder, with his shoulder abducted behind the head with the elbow bent. The knees were bent for comfort and stability. The examiner stands behind the subject and places one hand on the hip and one on the elbow while pushing the elbow into the table. The subscapularis muscle was stretched with the subject lying supine, the throwing shoulder abducted to 90 degrees and the elbow flexed to 90 degrees with the shoulder externally rotated as far as possible. These stretches were adapted from McAtee et al.¹⁶

In the static stretching protocol, the stretches were held for 30 seconds at end range and repeated three times with 20 seconds of rest in between each stretch. The PNF stretching protocol utilized the contract-relax technique in which the subject was stretched to end range for 5 seconds, they contracted against the examiner for 5 seconds, and stretched to end range again for 20 seconds. The PNF stretches were conducted 3 times with 20 seconds in between each stretch. Total stretching time on each day was about 8 minutes. The same examiner performed the stretching protocols each time to ensure reliability of the stretches. The control protocol involved no stretching with the subject sitting on the stretching table and waited 8 minutes before throwing again.

Instrumentation. Velocity was measured using a Bushnell Velocity Speed gun.² It has been shown to measure the velocity of a baseball from up to 90 feet away and +/- 1.0 mile per hour.¹⁷ The examiner operating the radar gun was trained on its proper use to ensure accuracy. The radar gun operator was standing behind and 1 to 2 feet to the right of the person catching the ball.

Statistical Analysis. The collected data was then analyzed using SPSS version 19.0.³

² Model #101911. Manufactured by Bushnell Outdoor Products, Overland Park, KS.

³ SPSS Inc, Chicago, Illinois.

RESULTS

A 2x3 within-subjects factorial ANOVA was conducted to determine the effect of stretching on throwing velocity. Because no statistical interaction was found for average throwing velocity ($F(2, 50)=0.534$, $p=0.589$) or peak throwing velocity ($F(2,50)=0.058$, $p=0.944$), main effects were analyzed for both (see Tables 2 and 3, Figures 4 and 5).

When analyzing average throwing velocity, the main effect of time was not statistically significant ($F(1,25)=3.075$, $p=0.092$). However, the main effect for the stretching groups was statistically significant ($F(2,50)=5.267$, $p=0.008$). This was due to the fact that when subjects were randomly assigned to the control group, they tended to throw faster both before and after the stretching protocol. This finding is irrelevant due to the random assignment of subjects and the fact that each subject participated in each condition.

Similarly, when analyzing peak throwing velocity, the main effect for time was not statistically significant ($F(1,25)=0.065$, $p=0.800$), but the main effect for the stretching groups was statistically significant ($F(2,50)=4.342$, $p=0.018$). Just as with average throwing velocity, this finding is irrelevant due to the random assignment of stretching conditions for each subject and that all subjects completed all stretching conditions.

Pearson product moment correlation (r) was used to determine if a statistically significant relationship existed between ER range of motion and throwing velocity. No statistically significant relationship was found between any of the velocities and the measured ER of the participants (See Table 4). Pearson product moment correlation was also used to determine if a statistically significant relationship existed between years of experience and ER. No statistically significant relationship was found, $r=0.216$, $p=0.279$, $r^2=0.047$. Lastly, Pearson product moment correlation was used to determine if there was

a statistically significant relationship between years of experience and both peak and average throwing velocities. There was a statistically significant relationship between experience and all peak velocities, and between experience and all average velocities. All of these correlations were significant (See Figures 6 and 7). This indicates that those who had more experience with throwing tended to throw faster than those who had less experience.

DISCUSSION

The results of this study suggest that neither a static nor a PNF stretching protocol designed to increase external rotation had a significant effect on throwing velocity in untrained throwers. This finding is contrary to the hypothesis that a stretching protocol focusing on the internal rotators of the shoulder would have an effect on throwing velocity since the internal rotators are the muscles primarily responsible for power production while throwing. The results also suggested that there was no relationship between those individuals who threw the fastest and an increase in ER range of motion of the throwing shoulder. However, there was a strong correlation between throwing velocity and years of experience.

The finding that stretching prior to throwing had no immediate effect on throwing velocity is inconsistent with previous research conducted on lower extremity activities such as jumping and sprinting²⁻⁴. The decrease in performance observed in these previous studies has been attributed to the effects of stretching on the MTU. Two main theories have been suggested as possible mechanisms for this reduction in performance.¹¹ The first proposed by Wilson et al¹⁸, suggests that a stiff MTU is able to produce more force than a lengthened MTU due to improved contractile component length and rate of shortening. A second proposed theory, states that stretching can reduce muscle performance due to autogenic or reflex inhibition.¹⁹ Autogenic inhibition is a spinal reflex resulting from stimulation of the GTO due to an increase in muscle tension. Once stimulated, the GTO causes inhibition of homonymous motor neurons. These effects can last for up to one hour.¹⁹

There are fewer studies and conflicting evidence regarding stretching and its

effect on upper extremity muscle performance. One study analyzing the effects of static stretching of the biceps brachii found a decrease in torque and mechanomyography during concentric muscle contractions after a static stretch when compared to a control group that did not stretch. Mechanomyography refers to an observable signal from the surface of a contracted muscle.²⁰ On the other hand, a study performed by Torres et al²¹ found that neither a static nor a dynamic stretching protocol had any effect on a one repetition max bench press, an isometric bench press, an overhead medicine ball throw, or a lateral medicine ball throw. However, researchers hypothesized that this was most likely due to the five minutes of rest between application of the stretches and the performance measures. This study also utilized two 15-second stretches during their treatment. It is possible that this amount of stretching was not sufficient to produce the necessary changes in the musculotendinous unit to cause a decrease in force production.²¹

Haag et al⁵ conducted a study examining the effects of static stretching on throwing velocity. The stretching protocol performed in their study focused on improving ROM in all directions rather than targeting the specific musculature responsible for accelerating the upper extremity throughout the throwing motion. Each of their six stretches was performed for 30 seconds and stretching was followed by 5-10 minutes of rest, which was designed to replicate the amount of time a pitcher generally has between warming up and the beginning of the game.⁵ The results of the Haag et al⁵ study indicated that there was no difference in throwing velocity after static stretching and the researchers concluded that stretching had no significant effects on throwing velocity. They attributed this mostly to the fact that any acute effects of stretching would be washed out by the period of rest between stretching and throwing.⁵ Although, the Haag et

al⁵ study was of sound quality, a stronger study design may have been to focus on stretching the muscles responsible for providing power during a throw and eliminating the rest time after stretching. By doing this, the acute effects of stretching on upper extremity muscle performance during throwing could be better analyzed.

The present study was designed to focus on the acute effects of stretching on throwing velocity by eliminating stretches on other musculature and by having the subjects throw immediately after being stretched. The rest time in the current study was less than one minute in most cases. Even by focusing the stretching protocol on the internal rotators and eliminating a rest period, no significant differences were observed in throwing velocity. The results of this study are consistent with the conclusions in Haag et al⁵ and Torres et al²¹ that suggest stretching before upper extremity activity is not harmful to the participant and does not decrease performance in various upper extremity activities. Specifically, in the current study stretching immediately before throwing was not detrimental to the velocity of the throw nor did it cause harm to the participant. Therefore, baseball throwers can include stretching of the shoulder internal rotators without decreasing throwing velocity.

There are several possible explanations that no decrease in throwing velocity was observed in this study. First, throwing a baseball relies on complex neuromuscular patterns.²²⁻²⁴ Current research suggests that skills, which require complex neuromuscular patterns to complete, may not be affected by stretching. This was observed in a study conducted by Young et al²⁵ in which they examined the effects of stretching the hip flexors and quadriceps on foot speed when kicking a football in a group of 16 Australian Rules football players. Despite the quadriceps and hip flexors being the musculature

primarily responsible for accelerating the leg during the kick, there was no statistically significant difference observed in foot speed. The researchers attributed this lack of difference to the complexity of the neuromuscular pattern required to kick a football.²⁵ Likewise, in the current study, the complex task of throwing a baseball was not affected by stretching the musculature responsible for accelerating the arm throughout the throw.

If neuromuscular changes were to be observed, a stretch of 30 seconds should have been sufficient to produce measureable changes. Previous researchers have most often utilized a 30 second stretch. Research has consistently shown that ROM benefits are similar for 15, 30, 45, and 120 second stretches.^{26,27} Changes in force production have also been observed following stretches of 30 seconds.²⁸⁻³¹ In the current study, three stretches held for 30 seconds each should have been sufficient duration to produce a change in force production that would have led to a change in velocity. The stretches utilized also should have been intense enough to produce changes in force production. In the majority of studies, the desired intensity of the stretching protocol was to the point of discomfort, just short of pain.^{2,5,8,32-35} The current study used this guideline to direct the intensity of the stretches to the internal rotators. Even though discomfort and pain are subjective measures, and vary with each subject and stretching intensity may not have been uniform for all participants it should have been of sufficient intensity to elicit the desired neuromuscular effects.

Limitations. The study used an untrained population of throwers. On average, subjects had 0-5 years of throwing experience. For a skilled task such as throwing, this lack of experience may have affected throwing velocity more than a specific stretching protocol would have. When first learning or mastering a new motor skill, individuals tend

to coactivate many muscles simultaneously. This inefficient contraction improves with practice until only the necessary musculature is utilized.³⁶ As the task is mastered, performance is improved.³⁶ It is possible that these motor-learning effects could have masked any effects elicited by the stretching protocols.

CONCLUSION

The primary result of this study was that neither a static nor a PNF stretching protocol of the shoulder internal rotators had any significant effect on an untrained thrower's pitching velocity. This finding indicates that throwers can include stretching of the internal rotators during their warm-ups without any detrimental effects on throwing velocity. Further research in this area should focus on a population that performs overhand pitching at an amateur or professional level. This will help to eliminate any effects of motor learning that might influence the results.

APPENDIX A – TABLES

Table 1. Descriptive information for the study sample.

Number of Participants	27
Avg. Age	25.1 years old (SD = 2.4)
Avg. Height	70.9 inches (SD = 2.1)
Avg. Weight	191.3 pounds (SD = 39.5)
Avg. External Rotation	99.1 degrees (SD = 12.3)
Avg. Years of Experience	0-5 years (SD = 1.4)

Table 2. Means and standard deviations for average velocity in each testing condition.

Average Velocity (mph)	Mean	Standard Deviation
Pre-Static Stretch	57.4	10.869
Post-Static Stretch	56.3	10.840
Pre-PNF Stretch	57.3	10.855
Post-PNF Stretch	56.4	10.631
Pre-No Stretch	58.1	10.589
Post- No Stretch	57.4	10.389

Table 3. Means and standard deviations for peak velocity in each testing condition.

Peak Velocity (mph)	Mean	Standard Deviation
Pre-Static Stretch	60.6	10.725
Post-Static Stretch	59.7	10.469
Pre-PNF Stretch	60.5	10.449
Post-PNF Stretch	59.8	10.141
Pre-No Stretch	61.4	10.747
Post- No Stretch	61.0	10.616

Table 4. (r) and (p) values for the relationship between external rotation and throwing velocities.

	Pre-Static Peak	Post-Static Peak	Pre-Static Avg	Post-Static Avg	Pre-PNF Peak	Post-PNF Peak	Pre-PNF Avg	Post-PNF Avg	Pre-No Stretch Peak	Post-No Stretch Peak	Pre-No Stretch Avg	Post-No Stretch Avg
Pearson Correlation (r)	.165	.138	.175	.158	.216	.194	.241	.197	.181	.122	.217	.197
p-value	.403	.492	.382	.432	.280	.333	.226	.325	.367	.546	.278	.372

APPENDIX B – FIGURES

Figure 1. Each session was conducted according to the following flowchart. Subjects were randomly assigned to a stretching condition each time. The procedure was repeated over three different testing days until the subject completed all stretching conditions. Peak and average velocities were recorded each time.

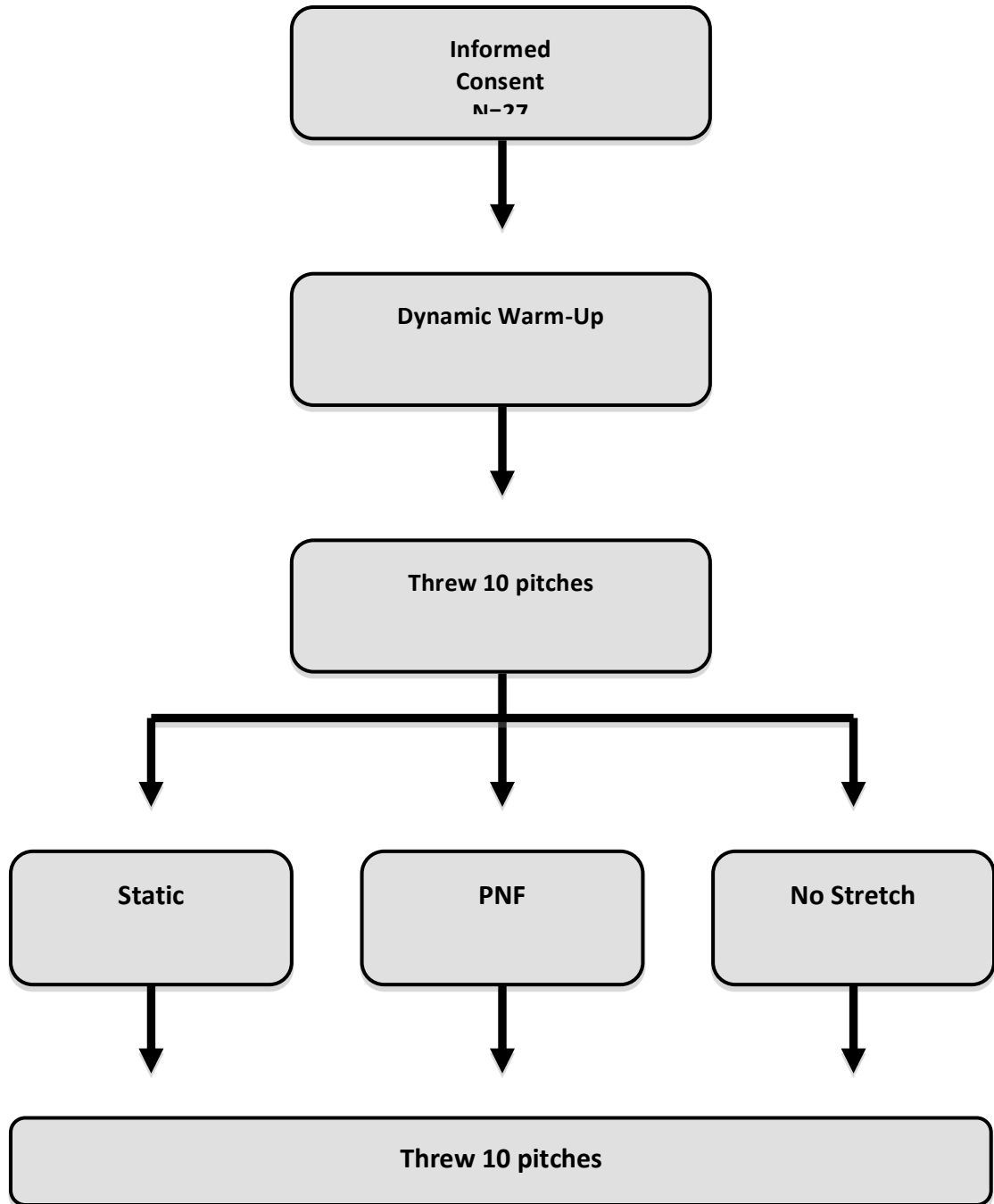


Figure 2. Illustration of the muscles targeted by the stretching protocols. Left to right: latissimus dorsi, pectoralis major, subscapularis, serratus anterior

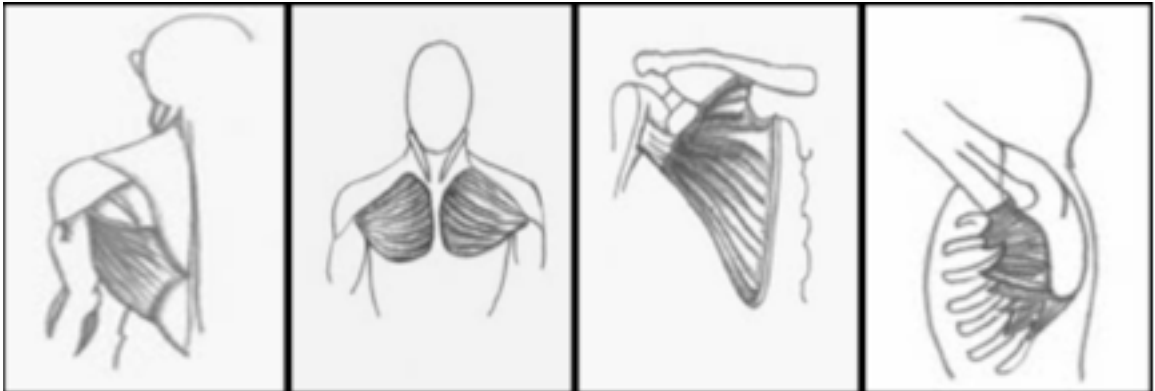


Figure 3. Demonstration of each stretch included in the stretching protocol. Left to right: pectoralis major stretch, latissimus dorsi stretch, subscapularis stretch.



Figure 4. No statistically significant interaction was noted between stretching condition and average velocity, $p=0.589$.

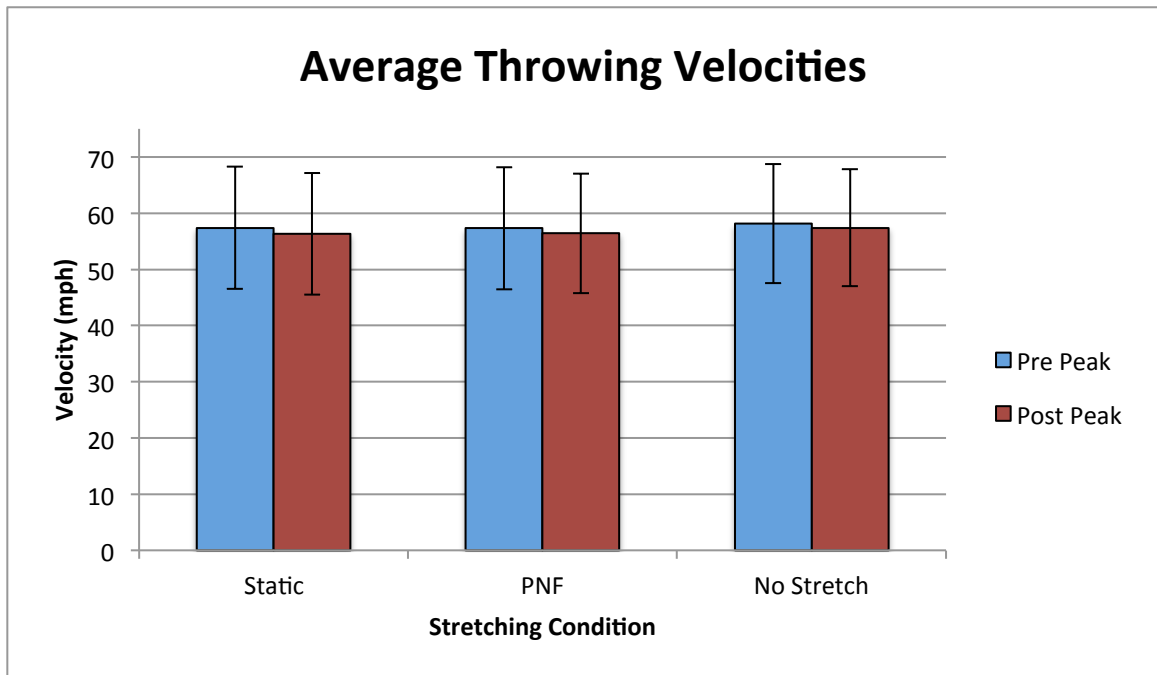


Figure 5. No statistically significant interaction was noted between stretching condition and peak velocity, $p=0.944$.

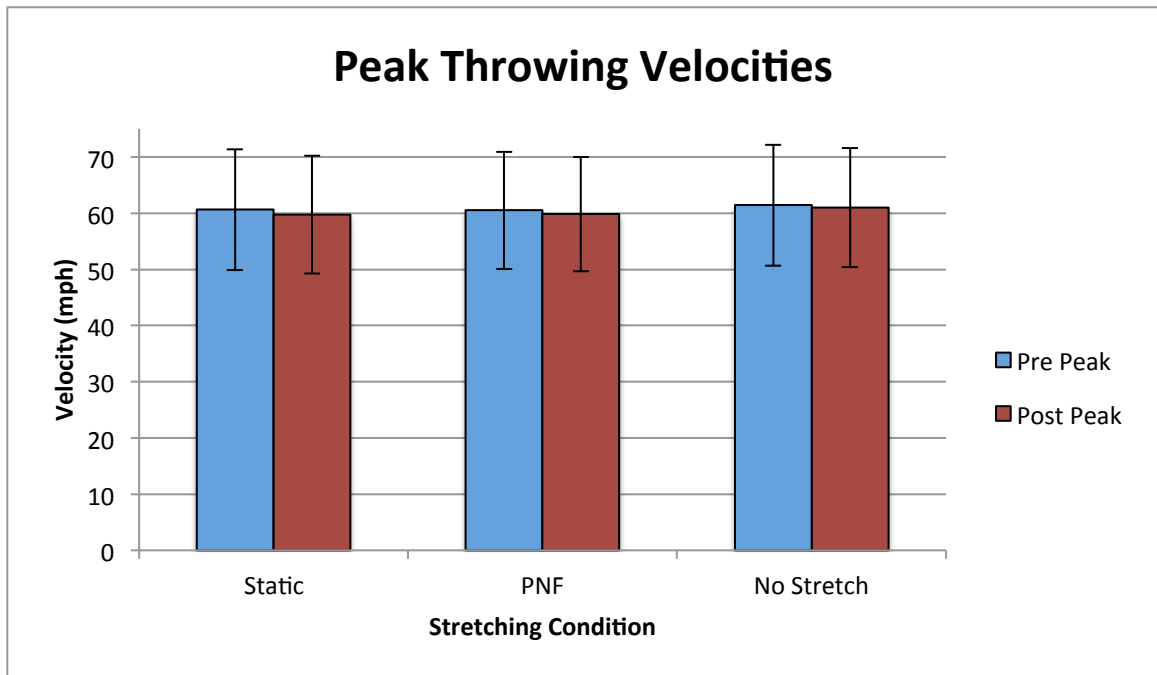


Figure 6. The relationship between average velocity (regardless of stretching condition) and years of experience. 0 = No experience, 1 = 1-5 years of experience, 2 = 6-10 years of experience, 3 = 11-15 years of experience, 4 = 15+ years of experience.



Figure 7. The relationship between peak velocity (regardless of stretching condition) and years of experience. 0 = No experience, 1 = 1-5 years of experience, 2 = 6-10 years of experience, 3 = 11-15 years of experience, 4 = 15+ years of experience.



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CURRICULUM VITAE

ASHLEY DELOBEL

Education

- Doctorate of Physical Therapy, 2013
 - University of Nevada, Las Vegas
- Bachelor of Science in Kinesiology
 - University of Nevada, Las Vegas, 2009
 - Minor in Sports Injury Management

Professional Experience

- Henderson Physical Therapy, Henderson, NV January 2013-April 2013
 - Private Outpatient Clinic
 - Evaluated and treated patients with different orthopedic injuries including: TKA, THA, TSA, reverse TSA, fibromyalgia, ACL repairs, Meniscal Repairs, Rotator Cuff tears and repairs, Low back and cervical spine pain.
 - Sports injuries with local amateur and student athletes
 - Two-day amateur rugby tournament: ankle, patella, finger and wrist taping, stretching hamstrings, quadriceps, and shoulders. As well as trauma injuries.
- Sunrise Rehabilitation Hospital, Las Vegas, NV October-December 2012
 - Rehabilitation Hospital
 - Evaluated and treated patients in a rehab setting with injuries such as: CVA, hip fractures, fear of falling, COPD exacerbation, orthostatic hypotension, and seizures.
 - In-service performed on weight-bearing precautions after THA and hip fractures and it's effect on rehabilitation techniques.
- St. Rose Hospital Siena Campus, Henderson, NV July-September 2012
 - Acute Care Hospital
 - Evaluated and treated patients including: Joint Replacement Classes, cardiac surgeries, neurological injuries (CVA and SDH), ICU experience.
 - In-service performed on Isolation Precautions and PPE
- Carson Valley Medical Center, Gardnerville, NV June-July 2011
 - Outpatient Care
 - Evaluated and treated patients with a variety of orthopedic injuries, including Total Knee Replacements and Rotator cuff repairs.
 - In-service performed on Total Shoulder Replacement surgery and rehabilitation
 - Inpatient Care
 - Evaluated and treated patients with a variety of conditions, including post-surgical leg fractures and stroke.
- Tim Soder Physical Therapy, Henderson, NV April-July 2009
 - Volunteer Physical Therapy Aide
 - Assisted Physical Therapists with treatment of orthopedic patients

- Supervised patients in therapeutic exercise
 - Performed therapeutic modalities
 - Gained skill in educating patients and family members on conditions
- Physiotherapy Associates, Henderson, NV August- November 2009
 - Volunteer Physical Therapy Aide
 - Assisted Physical Therapists with treatment of pediatric patients
 - Gained skill in educating patients and family members on conditions

Research

Experience

- Doctoral Dissertation May 2013: Delobel, Ashley, Harveson, Lanisa, Melton, Jason, Williams, Michael
 - The Acute Effects of Upper Extremity Stretching on Throwing Velocity in Untrained Baseball Throwers

Professional

Memberships/Certifications

- APTA member since 2010
 - Nevada Chapter
- Healthcare Provider CPR and AED certification since April 2011
 - American Heart Association
 - Expires April 2013

Continuing

Education

- Attended NPTA meeting on Radiology for common injuries May 2011
- Attended NPTA meeting on Rotator Cuff surgery and rehabilitation November 2011

Other Relevant Experience

- Taught anatomy class for massage therapy students July 2010
- Organized CPR/First aid class for DPT class of 2013 and professors April 2011 and May 2013

CURRICULUM VITAE
LANISA HARVESON

Education

- **Doctor of Physical Therapy**
May 2013
 - University of Nevada Las Vegas
- **Bachelor of Science Degree in Kinesiological Sciences**
December 2009
 - University of Nevada Las Vegas

Relevant Experience

- **Sunrise Children's Hospital**, Las Vegas, NV
January 2013 – April 2013
 - Clinical Internship
 - Examined and evaluated children with various neurological, orthopedic, and medical conditions in an acute setting
 - Developed effective patient plans of care to enable parents and children to return home with as safe mobility as possible
 - Coordinated patient care with doctors, nurses, occupational therapists, and case managers
 - Evaluated and treated children as part of a NICU follow-up in an outpatient setting
- **Jordan School District Child Development Center**, Riverton, UT
October 2012 - December 2012
 - Clinical Internship
 - Evaluated children aged 0-3 with a variety of neurological and orthopedic diagnoses with emphasis on reaching developmental milestones
 - Provided effective parent education to enable parent's involvement in reaching their child's functional goals
 - Developed IFSP's that focused on developmental milestones and family goals
 - Provided clinical in-service on overall developmental outcomes with intrauterine vs. post-natal surgical repair of myelomeningocele Spina Bifida
- **Utah Valley Regional Medical Center**, Provo, UT
July 2012 – September 2012
 - Clinical Internship
 - Examined and evaluated patients with a variety of neurological diagnoses with an emphasis on balance and gait training
 - Coordinated patient care with other staff members including speech and occupational therapists
 - Provided clinical in-service on implementing pain education into patient plan of care as an effective means to decrease pain levels in patients
- **Sports Therapy and Rehab**, Carson City, NV

June 2010 – July 2010

- Clinical Internship
 - Evaluated and treated a variety of orthopedic diagnoses with patients in an orthopedic outpatient setting
 - Developed and implemented patient's plan of care for duration of treatment
 - Provided clinical in-service on the effects of barefoot running vs. running in traditional running shoes

Research Experience

- **Doctoral Dissertation:** Delobel, Ashley, Harveson, Lanisa, Melton, Jason & Williams, Michael
May 2013
 - *The acute effects of upper extremity stretching on untrained baseball throwers*

Memberships and Certifications

- **APTA member**
June 2010 - present
- **First Aid Certification**
June 2003 - present
 - American Heart Association

**CURRICULUM VITAE
JASON MELTON**

EDUCATION:

- University of Nevada-Las Vegas, Las Vegas, NV** June 2010- May 2013
- Doctor of Physical Therapy
- Utah Valley University, Orem, UT** Aug. 2006- May 2010
- Bachelor of Science in Physical Ed and Recreation

CLINICAL INTERNSHIPS:

Red Cliffs Health and Rehabilitation Feb. 2013- April 2013
Clinical Internship

- Evaluated and treated patients with variety of pathologies and co-morbidities
- Facilitate improvements in physical endurance and strength of patients

Advanced Physical Therapy-Balance Center, St. George, UT Jan. 2013- Feb. 2013
Clinical Internship

- Treated patients with a variety of Balance and Vestibular conditions
- Tested and treated patients with Vertigo using Epley Omniax Chair
- Assessed and evaluated patient's balance using Neurocom

Dixie Regional Medical Center, St. George, UT Nov. 2012-Dec. 2012
Clinical Internship

- Examined and treated patients following elective surgeries
- Treated patients following TKA, THA, TSA, rTSA, and spinal fusions

Dixie Regional Medical Center, St. George, UT Oct. 2012- Nov. 2012
Clinical Internship

- Evaluated and treated patients focusing on functional task specific exercises
- Treated patients following CVA, TBI, transverse myelitis and other orthopedic and neurological conditions

Jackson Physical Therapy, Las Vegas, NV July 2012- Oct. 2012
Clinical Internship

- Evaluated and treated patients with a variety of orthopedic conditions
- Treated patients with whiplash injuries and patients with Complex Regional Pain Syndrome

Meier and Marsh Physical Therapy, Tooele, UT June 2011- July 2011
Clinical Internship

- Evaluated, and treated patients with many different orthopedic conditions

- Provided an in-service on the effectiveness of the McKenzie Method of treatment for musculoskeletal conditions

Spine, Orthopedic, & Sports Physical Therapy, Provo, UT Sept. 2008- Dec. 2009
Physical Therapist Tech

- Assisted patients with completing their treatments
- Instructed patients on proper technique while performing exercises
- Prepared patients to see the Physical Therapist

Utah State Mental Hospital, Provo, UT June 2009- Aug. 2009
Volunteer Physical Therapist Tech

- Helped patients safely perform exercises prescribed by Physical Therapist
- Interacted with and befriended patients who have mental impairments

RESEARCH EXPERIENCE:

Doctoral Dissertation

Student Investigator

- The Acute Effects of Upper Extremity Stretching on Throwing Velocity in Untrained Baseball Throwers

PROFESSIONAL MEMBERSHIPS AND CERTIFICATIONS:

- APTA Member since 2010
- American Heart Association Certified in CPR and AED

ADDITIONAL SKILLS:

- Fluent in Spanish
- Epley Omniax diagnosis and treatment
- Neurocom testing and treatment

**CURRICULUM VITAE
MICHAEL WILLIAMS**

Education:

- **Doctor of Physical Therapy**
 - University of Nevada, Las Vegas, 2013
- **Bachelor of Science, Exercise Science**
 - Brigham Young University, 2010
 - Cum Laude

Relevant Experience:

Concentra, Sandy, UT

- **January 2013 – April 2013**
- Clinical Internship
 - Examined and evaluated patients in an acute orthopedic setting
 - Utilized evidence-based practice and outcome measures in order to facilitate patient's returning to work as soon as possible
 - Educated and trained employers and employees regarding proper ergonomics and how to reduce injuries at the workplace
 - Provided a clinical inservice regarding the use of functional ultrasound by physical therapists in outpatient orthopedic settings

Utah Valley Regional Medical Center, Provo, UT

- **October 2012 – December 2012**
- Clinical Internship
 - Examined and evaluated patients with a variety of neurological, orthopedic and medical conditions in an acute care setting
 - Coordinated patient care with nurses, occupational therapists, case managers and other hospital staff
 - Provided a clinical inservice regarding long term outcomes of cemented versus non-cemented TKA

Life Care Centers of America at Garden Terrace, Murray, UT

- **June 2012 – September 2012**
- Clinical Internship
 - Examined and evaluated patients with a variety of neurological and orthopedic conditions with emphasis on balance and gait training
 - Coordinated patient care with a diverse staff that included physical therapy assistants, occupational therapists, and speech therapists
 - Provided a clinical inservice regarding the effects of poor posture on pain in a geriatric population

Jordan Valley Hospital, West Jordan, UT

- **June 2011 – July 2011**
- Clinical Internship
 - Examined and evaluated patients with a variety of orthopedic conditions with emphasis in rotator cuff repair, ACL repair, and TKA

- Developed appropriate intervention and treatment plans founded on current evidence-based practice
- Coordinated patient care with a diverse staff that included physical therapy assistants and aides
- Provided a clinical inservice regarding the effective use of low-level laser therapy in treating musculoskeletal pain

Utah State Hospital, Provo, UT

- **February 2010 – April 2010**
- Volunteer Physical Therapy Aide
- Assisted in providing interventions to patients with diverse psychological and musculoskeletal conditions with emphasis in pediatrics

Other Professional Experience

University of Nevada, Las Vegas

- **September 2011 – May 2012**
- Graduate Assistant
 - Developed appropriate outcome measures and measurement tools to be used for program evaluation
 - Compiled and analyzed data necessary for program evaluation
 - Tutored students in several classes including orthopedics, evidence-based practice, and anatomy
 - Assisted professors in research in several areas of practice

Doctoral Dissertation: Delobel, Ashley, Harveson, Lanisa, Melton, Jason & Williams, Michael

- The acute effects of upper extremity stretching on throwing velocity in untrained baseball throwers

Professional Memberships/Certifications

- APTA member since 2010
- CPR/AED certified
 - American Heart Association