EFFECT OF MYOFASCIAL DECOMPRESSION ON SHOULDER RANGE OF MOTION AND STRENGTH OF HEALTHEY OVERHEAD ATHLETES

By

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Title of Study: EFFECT OF MYOFASCIAL DECOMPRESSION ON SHOULDER RANGE OF MOTION AND STRENGTH OF HEALTHEY OVERHEAD ATHLETES

Major Field: Health and Human Performace

Abstract: Background: Muscular and anatomical adaptations occur with repetitive overhead movements and are commonly associated with pathologies that can lead to missed practice and competition time. The knowledge of interventions to improve range of motion and strength of the shoulder are beneficial to the sports medicine team, athlete, and coaches.

Hypothesis/Purpose: The purpose of this study was to understand the immediate effects of myofascial decompression therapy (MFD) has on range of motion (ROM) strength of internal (IROT) and external rotation (EROT) of the shoulder, and to explore MFD as an effective treatment for overhead athletes.

Study Design: 30 total subjects, 15 control, 15 experimental. The study was a randomized, experimental design with repeated measure one-way ANOVAs.

Methods: There was one session that lasted 20-30 minutes. The subjects for the control group had their range of motion and strength tested followed by a 10 min rest period and then re-tested. The subjects in the experimental group were tested, had a cupping treatment performed, and then retested.

Results: Mean ROM scores were as follows: control pre IROT= 73.7º (9.9), post=79.3º (12.9), experimental pre IROT= 72.3º (13.7), post= 83.1º (13.9) with no statistical differences between measure and group. Statistical significance (F=5.728, Sig=0.024) was found with the control pre EROT=101.6° (6.2), post=102.2° (10.4), experimental pre EROT= 102.6° (8.5), post=110.0° (7.2). Statistical significance lacked by group and measure when comparing the control pre/post IR avg. torque pre= 24.02(14.1), post=24.09(13.8), experimental group pre= 29.23(10.2), post= 30.5(10.2) and in ER avg. torque control group pre= 14.37(7.4), post=14.54(7.1), experimental pre=17.65(5.4), post=18.03(4.5).

Conclusion: External rotation ROM improved significantly (+7.4).

Clinical Relevance: Due to lack of statistical significance in all variables except EROT ROM, this study demonstrates little to no clinical relevance to the use of MFD for the purposes of increasing immediate shoulder ROM and strength.

Key Terms: Myofascial decompression (MFD), range of motion (ROM), strength

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CHAPTER I

INTRODUCTION

Muscular and anatomical adaptations or changes that occur with repetitive overhead movements that are commonly associated with different sport participation can lead to several pathologies that can cause an athlete to miss practice and competition time (Mulligan, Biddington, Barnhart, & Ellenbecker, 2004). These movements can include but are not limited to: throwing a baseball/softball, serving a volleyball, throwing a javelin, and the overhead strokes that are completed during swimming (Dwelly, Tripp, Tripp, Eberman, & Gorin, 2009). The repetitive motions that are involved with participation within certain sports can be more safely performed when the participant has the correct anatomical features and muscular strength ratios (Falla, Hess, & Richardson, 2003). Muscular imbalances of the rotator cuff may create limited range of motion(ROM) and increased strength of internal rotators with little to no strength gains of the external rotators, which may lead to shoulder injuries (Kim et al., 2014). The less time that an athlete misses due to injury, the more opportunities they have to learn and grow in their chosen sport, as missed time can cause the athlete's improvement to be slowed and can be detrimental to the athlete's competitive future.

When discussing the effect of internal and external rotating muscles (rotator cuff) and the changes that occur to that muscle group due to overhead repetitive movements, many studies have looked at the different adaptations that occur. External rotator muscles were found to be significantly weaker on the dominant side when compared to internal rotation strength in athletes when compared to non-athletes (Borsa et al., 2005). There have been different theories of what causes this in the overhead population but the most widely accepted is when a high eccentric load is placed on the external rotators during the deceleration phase of an overhead movement can lead to intramuscular connective tissue tearing, chronic inflammation and muscle weakness (Kim et al., 2014).

As clinicians have sought to determine interventions to improve range of motion and strength, treatments outside of the traditional strengthening have been investigated. One such treatment is Myofascial Decompression Therapy (MFD), also known as cupping Therapy. MFD is a key part of traditional Chinese medicine that has its roots dating back over 2,000 years ago (Shannon, 2004). MFD is a treatment method that uses the application of a vacuum effect to a localized area of the skin to produce a therapeutic effect (Granter, 2011). The earliest history of MFD is in the ancient book Bo Shu that was written on silk and discovered in the ancient tomb of the Han dynasty (Shannon, 2004). Its beginnings come from the need to drain toxins from snakebitesand skin lesions. As a part of traditional Chinese medicine it was theorized that diseases are caused by stagnant or blocked Qi, the vital energy or life. MFD was used to unblock and correct imbalances that were found in the flow of Qi. Through unblocking and correcting any imbalances that existed health could be restored.(Cao et al., 2010) Later it was often used during surgeries to draw blood away from the surgery site. Although MFD's history is rooted in China, the Egyptians and early Greeks often used MFD for many different therapeutic effects such as pain, inflammation, and viral illnesses (Cao et al., 2010). Cupping sets were offered from medical-supply companies in the United States of America as early as the 1940's (Granter, 2011).

A study in 2005 looked at the Biomechanical perspective of MFD (Tham, Lee & Lu, 2006). The results showed multiple findings. The tissue enclosed by the cup and around the periphery of the edge is under tension, while the soft tissue directly under the rim is compressed. When looking at the pressure of the cup in a sagittal plane view it would look bulb-shaped under the center of the cup. The force is strongest in the area of the skin next to and just inside the edge of the cup. The results of the study also showed that MFD was only effective for the tissues directly under the cup (Tham, Lee, & Lu, 2006).

The use and interest in MFD continues into today's healthcare. Modern MFD activists state that through the suction and negative pressure achieved by the cups it releases rigid soft tissue; flushes excess fluids and toxins; loosens adhesions and lifts connective tissue; and promotes blood flow to inactive skin and muscles (J.-I. Kim, Lee, Lee, Boddy, & Ernst, 2011). Today MFD therapy is often used in the massage therapy and chiropractic setting and its use in sports medicine is growing due to the simplicity of treatments and its instantaneous symptom relieve (Cao et al., 2012). Previous studies tend to look at pain levels including an upper extremity study that looked at MFD's effect on carpal tunnel therapy that showed to be effective (Huisstede et al., 2010).

Purpose of the Study

The purpose of this study was to determine the immediate effects of myofascial decompression therapy on range of motion (ROM) and the strength of internal (IROT) and external rotation (EROT) of the shoulder and the possible benefits to assist clinicians when making a choice for effective treatment for overhead athletes.

Hypotheses

The following are the null hypotheses which were examined in this study:

Ho1

There will be a significant difference in the subjects shoulder ROM and Strength post MFD

treatment.

Ho2

There will be a significant difference of Shoulder ROM and Strength in between the experimental and control groups.

CHAPTER II

REVIEW OF LITERTURE

Muscular and anatomical adaptations or changes that occur with repetitive overhead movements that are commonly associated with different sport participation can lead to several pathologies that can cause an athlete to miss practice and competition time. These movements can include but are not limited to: throwing a baseball/softball, serving a volleyball, throwing a javelin, and the overhead strokes that are completed during swimming. The less time that an athlete misses due to injury, the more opportunities they have to learn and grow in their chosen sport. The missed time can cause the athlete's improvement to be slowed and can be detrimental to the athlete's competitive future. The purpose of this study is to understand the immediate effects of myofascial decompression therapy has on Range of Motion and Strength of internal and external rotation of the shoulder and the possible benefits and choice for effective treatment for overhead athletes. For example, adaptations to internal and external rotator shoulder rotator cuff muscles that are involved in overhead throwing kinematics could lead to muscular strength imbalances which become an intrinsic risk factor for shoulder injury, as well as a change in shoulder range of motion(ROM) occurring. The chance of these pathologies (shoulder impingement, rotator cuff tendonitis or tendonosis, etc...) can be lowered with knowledge of what activities and training programs can cause these imbalances which lead to injury along with the knowledge of what treatments are effective in increasing strength and ROM of the rotator cuff muscles along with also having a possible effect on the strength. With most of these adaptations it is best to have early detection and prevention with rehabilitation exercise programs at an early age(Dupuis, Tourny-Chollet, & Beuret-Blanquart, 2003).

The repetitive motions that are involved with participation within certain sports can be more safely performed when the participant has the correct anatomical qualities (IR/ER ROM) and muscular strength ratios. These changes have been found in a variety of sports including baseball/softball, swimming, rugby, javelin, and volleyball along with others. With proper knowledge of common imbalances and anatomical changes that can occur with these repetitive activities coaches, athletic trainers, and other professionals can decrease the number of these pathologies diagnosed within their population.

A comprehensive literature review was conducted concerning different adaptive changes that occur to the rotator cuff muscles of the glenohumeral joint during selected sport participation, effects of therapeutic cupping therapy, and other ways that these imbalances have been treated. Studies concerning anatomical, strength, and muscle balance changes were accessed. Sources of information included, but was not limited to professional research journals, dissertations, and books. Once the information was gathered, the review was organized by subject matter and then presented in a compare and contrast format.

Although this is a literature review report it is important to discuss the usual way that rotator cuff strength ratio is tested during these scientific studies. Most often it is conducted through isokinetic testing using a dynamometer at varying speeds. The most common speeds that are used to test the rotator cuff muscles are 6o°, 120°, and 180° per second, although several studies used 240°(Dupuis et al., 2003). The mean and peak torque during each movement are normally the quantified statistics taken away from the test.

Many different studies have been conducted on the development of rotator cuff muscle imbalances in athletes from the high school, collegiate, and professional levels. Studies have been conducted with positive results of rotator cuff imbalances with athletes from baseball, javelin, volleyball, tennis, and many other sports that require repetitive overhead movement. These adaptations to the internal and external rotators of the shoulder are widely considered an intrinsic risk factor for shoulder injury, and could assist in the cause of modified shoulder ROM.

Sport Participation Studies

General hypothesis have estimated that the more forceful of the overhead movement the greater the muscle imbalance will become over time. An example is the sport of water polo where overhead throwing motion is created with passing, shooting, and swimming. McMaster, Long et al. studied the isokinetic torque imbalances of the rotator cuff in elite water polo athletes. The results of the studied showed two different imbalances in the athlete's dominant arm when compared to the non-athlete control group. First, was that the shoulder adductors had increased in strength creating a 2:1 strength ratio when compared to abductors at the glenohumeral joint. The second imbalance noted was that the internal rotators of the water polo athletes gained strength and created a 6:1 ratio when compared to the external rotators at the glenohumeral joint(McMaster, Long, & Caiozzo, 1992). The study showed that the increased force and varying angles of the overhead movement can cause multiple muscular imbalances.

A majority of the studies that have looked at rotator cuff muscle imbalances have been conducted with baseball players of all ages. In 2012, a study was conducted with junior high school aged baseball players looking at the morphology of the shoulder rotator cuff muscles compared to non-athletes and their non-dominant arm. The cross section and volume of each rotator cuff muscle was greater in the baseball athlete group when compared to those who did not participate in any athletics. Both groups showed significantly greater subscapularis on the throwing/dominant side. During the isokinetic testing the baseball players had greater peak torque than the non-athletes but there was no significant difference when it came to the muscle strength ratio in between the internal and external rotator cuff muscles. This study showed that by the time a baseball player is in junior high the chance of a muscular imbalance already occurring is decreased when compared to an active baseball player later in life(Nishiyama, Yanagisawa, &

Torii, 2012). This may due to several variables, one being that during younger years of baseball participation the athletes play more competitive games rather than practice so the repetitive overhead movement is not performed at the same volume as when the number of practices is increased. As baseball participation increases in years the ratio in between practice and games changes and the amount the throwing motion is completed increases.

Muscular imbalances have been discovered in baseballs as young as junior high school but are much more commonly seen to develop during an athlete's high school years once practice becomes such a regular part of an athlete's life. Baseball pitchers are the most common group of athlete's that have imbalances due to the volume of unnatural forceful overhead movements they perform. Mulligan, Biddington et al. looked at the isokinetic profile of shoulder internal and external rotators of high school age pitchers. One result of their study was that the non-dominant arm demonstrated significantly greater eccentric strength compared with the dominant arm during external rotation(Mulligan, Biddington, Barnhart, & Ellenbecker, 2004). This demonstrates the usually imbalance that is seen in overhead athlete's that was not seen often when compared to junior high aged athletes.

A common ideology among clinicians when it comes to rotator cuff muscle imbalances is that detection and prevention with corrective exercise programs during the earliest stage of onset is recommended. Another study that shows the importance of this was conducted with elite level junior tennis athletes. Saccol, Gracitelli et al. showed the muscle imbalances that develop in youth that play tennis at a high volume. This study showed that all variables related to internal rotation were significantly higher on the athlete's dominate shoulder when compared to their nondominate. Their study also showed that the eccentric strength of the external rotators were not greater than the concentric strength of the internal rotators of the glenohumeral joint(Saccol et al., 2010). The outcome of this study showed that junior tennis players with no current shoulder injury or limitations show to have muscular strength imbalances that alter their normal functional strength ratio and will likely cause the athlete to miss practice or competition time later during their career if not detected and corrected.

A common error of thought among clinicians and non-clinicians is that repetitive throwing is what strengthens the rotator cuff muscles. While it may play a slight role in the strength gains seen in throwing athletes most if not all of their shoulder strength increases seen come from the weight training programs that they participate in. In 2006, Nocera, Rubley et al. looked at the effects of repetitive throwing on shoulder proprioception along with internal and external rotation strength. The results of their study showed that the athletes that repetitively throw gained proprioception while not increasing internal and external rotation isokinetic strength (Nocera, Rubley, Holcomb, & Guadagnoli, 2006).

Another repetitive overhead sport that muscular imbalances have been reported in is javelin throwing. In 2013, Edouard, Frize et al. looked at the static and dynamic shoulder stabilizer adaptations that occur in javelin throwers. Their main finding of this study was that static and dynamic shoulder stabilizer adaptations due occur in individuals that repetitive practice javelin throwing in two different ways. First, significantly lower internal rotation and significantly higher external rotation range of motion was found in javelin athletes when compared to the control group. Second, concentric and eccentric internal and external strength were significantly higher in dominant shoulder of a javelin thrower when compared to the control group and non-dominant shoulder (Pascal Edouard, Damotte, Lance, Degache, & Calmels, 2013). During this study results did not show a significant difference in external and internal rotator strength ratios. Another study performed by Forthomee, Crielaard et al. looked at javelin throwers looked at the involvement of the internal and external rotator cuff strength with performance. They discovered that higher peak torque did correlate with performance of the javelin throw. They noted that most of javelin training focuses on internal rotation of the shoulder, when it should incorporate more external rotational movements to increase performance and decrease chance of injury due to the imbalances that can occur due to the repetitive movement (Forthomme, Dvir, Crielaard, & Croisier, 2011).

One of the more interesting studies that have been done on rotator cuff imbalances was a study looking at the influence of rugby practice on the rotator cuff. Edouard, Frize et al. looked at the isokinetic strength of the internal and external rotators at 60° and 240° per second in both eccentric and eccentric direction. Their findings showed that rugby players had higher peak torque than non-athletes but rugby players generally do not create muscle imbalances of the rotator cuff muscles of the shoulder (P. Edouard et al., 2009).

In 2012 Nodehi-Moghadam, Khaki et al., generalized throwing athletes and non-throwing athletes into two different groups and looked at the 3 different areas: shoulder rotational strength, range of motion and proprioception. The study showed that external rotation was significantly more while there was no difference in internal rotation range of motion in throwing subjects when compared with the non-throwing. The throwing athletes also demonstrated a significantly higher isometric strength of shoulder internal and external rotation when compared to non-throwing athletes. Throwing athletes also showed a significant lower isokinetic strength of shoulder external rotation than internal rotation (Nodehi-Moghadam, Khaki, Kharazmi, & Eskandari, 2013). The end result of this study can lead to mobility, strength and neural adaptations.

One of the common findings in this study was that throwing athlete's shoulder rotator muscles were significantly stronger compared to non-athletes. These can be concluded to the athlete's participation in some form of strengthening exercises as a part of a training routine that non-athletes are not involved in. There is probably also some contribution by the repetitive forceful movements they perform during their sporting activities.

Another common finding was that external rotator muscles were significantly weaker on the dominant side when compared to internal rotation strength in athletes when compared to non-athletes. It has been proven that when a high eccentric load is placed on the external rotators during the deceleration phase of an overhead movement can lead to intramuscular connective tissue tearing, chronic inflammation and muscle weakness (H. M. Kim et al., 2014). To counter, during overhead motion the internal rotator muscles undertake a plyometric type of training (Whitley & Terrio, 1998). Plyometric training has been proven to enhance muscular power and proprioception (Swanik, Swanik, Lephart, & Huxel, 2002).

Stability of the glenohumeral joint is provided by the contraction of the rotator cuff muscles along with the long head of the biceps. We have already discussed the importance of the rotator cuff muscles when it comes mobility of the glenohumeral joint. The rotator cuff is important when it comes to stability and mobility of the shoulder girdle. An athlete having the proper balance of agonist and antagonist muscle group is essential for them to have normal shoulder function (Falla, Hess, & Richardson, 2003).

These studies showed an increase in strength of internal rotator muscles without comparable increase in external rotator muscles. Wilk et al believed that an athlete should have an external to internal rotator strength ratio of 66% to 75% to provide proper dynamic stabilization (Borsa et al., 2005). Like we discuss earlier it is know that the development of muscular imbalances of the rotator cuff muscles could predispose overhead athletes to injury.

The repetitive motions that are involved with participation within certain sports can be more safely performed when the participant has the correct anatomical features and muscular strength ratios. The major concerns with muscular imbalances of the rotator cuff are creating limited range of motion and increased strength of internal rotators with little to no strength gains of the external rotators. With the information brought together in this study coaches, athletic trainers, and other clinicians can evaluate and correct this imbalances to decrease the number of these pathologies diagnosed within their population.

Therapeutic Cupping

Therapeutic cupping is a key part of traditional Chinese medicine that has its roots dating back over 2,000 years ago (Shannon, 2004). Cupping therapy is a treatment method that uses the application of a vacuum effect (cup) to a localized area of the skin to produce a therapeutic effect. The earliest history of cupping is in the ancient book Bo Shu that was written on silk and discovered in the ancient tomb of the Han dynasty. Its beginnings come from the need to drain toxins from snakebites and skin lesions. As a part of traditional Chinese medicine it was theorized that diseases are caused by stagnant or blocked Qi (vital energy or life force in TCM). Cupping was used to unblock and correct imbalances that were found in the flow of Qi. Through unblocking and correcting any imbalances that existed health could be restored. Later it was used often during surgeries to draw blood away from the surgery site. Although its beginning is rooted in China the Egyptians and early Greeks often used cupping therapy for many different therapeutic effects(Cao et al., 2010). Eventually the technique slowly made it ways throughout all of Europe and the Americas. Cupping sets were still often offered from medical-supply companies during the 1940's(Granter, 2011).

There are different forms of cupping therapy that include: retained cupping, flash cupping, moving cupping, wet cupping, medicinal cupping, and needling cupping. The three main forms are retained, wet, and moving. Cups are made of multiple types of material including plastic, glass, and bamboo(Granter, 2011). Today, cupping is most commonly performed using a multiple sized round cups made of thick glass or heavy duty plastic with a rolled rim to guarantee a total air-tight contact with the skin of the patient in order to preserve the vacuum effect. Cupping is traditionally used with thick glass cups that have negative pressure created by warming the air inside the cup and then allowing it to cool while in contact with the skin. The air is heated either by swabbing the inside of the cup with alcohol and then applying a flame, or by lighting an alcohol-soaked flammable material held in the interior of the cup. The cup is then placed on the desired point right before the flame is out. The heat causes the suctioning effect and draws the skin upward inside of the cup(Cao et al., 2010). Currently, there is a move to using heavy plastic cups with a hand operated pump to create the vacuum effect. It is an easier and safer way to achieve the desired effect.

The main theory used for the benefits of cupping is that the use of the negative pressure caused by the cupping when used of acupoints creates hyperemia or hemostasis, which causes the desired therapeutic effect. Research has conducted on such pathologies as various pain conditions, herpes zoster, cough, dyspnea, stroke rehabilitation and hypertension with all results pointing to a benefit. In 2011, Lee et al. produced an overview of five reviews of the effects of cupping therapy and concluded that cupping is only effective as a treatment for pain. Pain is the number one reason individuals seek out alternative medicine, such as cupping therapy. Other alternative medicine that people seek are acupuncture, massage and mind-body therapies(J.-I. Kim, Lee, Lee, Boddy, & Ernst, 2011).

The most common areas of the body that cupping therapy is applied is back, chest, buttock, and abdomen. This areas are chosen because they have abundant muscle and surface area. Generally cups are left on the site for anywhere from 5-15 minutes depending on the desired result(Tham, Lee, & Lu, 2006). The most common side effect of cupping is large circular ecchymoses that may be alerting to some. These can take days to weeks to settle down depending on the patient.

Here is a quick review of the different types of cupping. Retained cupping is when suction (negative pressure) inside of the cup is applied to the desired part of the body. One ideal suction is achieved there is no movement of the cup. Retained cupping is most individual's introduction to cupping therapy. Wet cupping is a two step process. First, the practitioners make several small incisions at the acupoint to cause light bleeding. Second, retained cupping is applied over the small incisions. Another common form of cupping is moving cupping. This is achieved when a controlled suction is applied to the subject while the cup is moved in one desired direction. This action is repeated as necessary for a desired result. Needling cupping is when acupuncture is applied first and then the cups are placed over the needle. Other types of cupping therapy include empty cupping and medicinal cupping(Cao, Li, & Liu, 2012).

Modern cupping activist state that through the suction and negative pressure achieved by the cups it releases rigid soft tissue; flushes excess fluids and toxins; loosens adhesions and lifts connective tissue; and promotes blood flow to inactive skin and muscles. Today cupping therapy is often used in the massage therapy and chiropractic setting. Its use in sports medicine is growing. Therapeutic cupping is growing in popularity because of is simplicity in giving treatments and its instantaneous symptom relieve(Cao et al., 2012).

One of the major concerns with cupping therapy is how do you control the amount of pressure and what is the optimal suction amount. It is important to always make sure that the patient is comfortable with the amount of suction. Treatment should always begin with light to medium suction and build up with the subject's tolerance of the sensation(J.-I. Kim et al., 2011). You can also watch the circulatory reaction to see if there is any changes that need to be made to the amount of pressure.

In 2012, Cao et al. produced an updated systematic literature review of clinical studies on cupping therapy. They included 135 trails that were published from 1992-2010, with more than half of those being from 2008-2010. In these trails 58% used wet cupping, 17% used retained cupping, and 9 % used moving cupping. Three pain related conditions where look at in this review. These were: herpes zoster, inflammatory pain of the nerve; lumbar disc herniation, and cervical spondylosis, pain caused by nerve compression. This were the only conditions that the results of the trails was pain decrease. Retained and wet cupping were used during these tests. Although most of the trails that the author included in his review did not reach their criteria their conclusion was that the review suggested that cupping therapy appears to be effective for various conditioning including the above mentioned. In conclusion they state that more quality designed studies on the effect of cupping therapy need to be performed so a better review can be performed(Cao et al., 2012).

In 2014 a pilot study on the effects of cupping on patients with subacute low back pain(LBP) when looking at relieving pain, improving Rom, and function. In this pilot study there were 21 patients who had the qualification of LBP in the previous 8 weeks. Cupping therapy simply consisted of 4 glass cups being applied over the lower erector spinae muscles. Results showed significant improvements in pain scale, straight leg raise, and lumbar flexion ROM. The authors concluded that cupping is a low-risk treatment for LBP that can decrease symptoms quickly and also improve the subject's functional movements(Cao et al., 2010).

One of the more interesting studies on cupping was performed in 2005 by Tham et al. It was entitled Cupping from a biomechanical perspective. In this study they looked at vacuum pressure, loading rate, friction coefficient at the cup-skin interface, and size and shape of the cup effects. The model showed that stresss on the soft tissue was increased for increased applied vacuum pressures. It also showed that the effects of cupping were mostly limited to the area enclosed by the cup. The most significantly result of the simulation was that there is no correlation in-between the size of cup used and the depth of the disorder the treatment is being used for(Tham et al., 2006).

Another systematic review of the use of cupping for treating pain was performed in 2011. Kim et al. wanted to assess the evidence for or against the effectiveness of cupping as a treatment option for pain. A total of seven randomized clinical trials (RCTs) were accepted by this study. All seven showed positive results for the treatment of pain associated with low back pain, cancer, trigeminal neuralgia, brachialgia, and herpes zoster. The conclusion of the study even though all seven studies showed positive results is that due to the lack of high quality trails no determination can be made(J.-I. Kim et al., 2011).

Other Avenues of Treatment

Many different treatments have been looked at and studied in the area of increasing IR and ER ROM and strength of the glenohumeral joint. Three of the most often looked at treatments to increase ROM and assisted those that have deficits in this area is a stretching protocol, joint mobilizations and instrument assisted soft tissue mobilization. There are countless stretching protocols that have been created for overhead athletes. In 2012 Aldridge et al. looked at a daily stretching protocol of passive stretches during a 12 week protocol in Division 1 baseball players. They monitored not only IR and ER ROM increases but any shoulder injuries and training/competition lost due to shoulder injuries during the 12 week intervention time. Each athlete completed a set of 6 passive stretches focusing on IR for 5 days a week for 12 weeks. Each stretch was performed 3-5 repetitions which were held for 30 seconds each. The results of the study was the average Shoulder IR ROM of the athlete's throwing shoulder was 48.89 degrees which increased to 54.07 degrees. Although that number is no statistically significant there was an improvement. There was also a gain of 1.82 degrees of ER. Due to the extreme forces of torque and velocity that is placed on the shoulder during the throwing motion the balance of ROM and stability is very important(Aldridge, Stephen Guffey, Whitehead, & Head, 2012). The soft tissue changes that can result from repeated overhead motion can be addressed by consistent participation in a stretching program focused on IR and ER. Although, it is not proven that participation in such protocol will prevent injury.

In 2013 Harshbarger et al. performed a review of literature that included shoulder stretching and join mobilization as a treatment for posterior shoulder tightness. All 3 studies that fit their qualifications stated significant improvements to IR of the glenohumeral joint when participants were treated with combined joint mobilization and stitching protocols. Studies that included a control group of individuals that only completed the stretching protocol showed that while the control group had increases in GH ROM when the stretching protocol was combined with grade 4 posterior glenohumeral joint mobilizations the best results were found(Harshbarger, Eppelheimer, Valovich McLeod, & Welch McCarty, 2013).

Another treatment that has been heavily looked at for shoulder ROM is instrument assisted soft tissue mobilization. A study conducted in 2014 looked at the acute effects of IASTM on improving posterior shoulder ROM in collegiate baseball players. The study took 17 subjects that received IASTM treatment and 18 that were in the control group. Significant increases in horizontal adduction and internal rotation ROM were found in the group that had IASTM treatment performed acutely. Subjects that received IASTM gained an average of 4.8 degrees of IR while the control group had a result of -0.14 degrees(Laudner, Compton, McLoda, & Walters, 2014). The results of this study show that the treatment of IASTM is effective when trying to acutely increase shoulder horizontal adduction and IR.

As we have learned muscular and anatomical adaptations or changes that occur with repetitive overhead movements that are commonly associated with different sport participation can lead to different pathologies that can cause an athlete to miss time. The less time that an athlete misses due to injury, the more opportunities they have to learn and grow in their chosen sport. The purpose of the correlating research study is to understand the immediate effects of myofascial decompression therapy has on Range of Motion and Strength of internal and external rotation of the shoulder and the possible benefits and choice for effective treatment for overhead athletes. The purpose of this literature review was to understand what previous research has to say about different anatomical adaptations of the shoulder girdle that result from repetitive shoulder motion, the benefits of general myofascial decompression(cupping therapy), and what are some of the other forms of treatment used and their effectiveness The chance of these pathologies (shoulder impingement, rotator cuff tendonitis or tendonosis, etc...) can be lowered with knowledge of what activities and training programs can cause these imbalances which lead to injury along with the knowledge of what treatments are effective in increasing strength and ROM of the rotator cuff muscles along with also having a possible effect on the strength.

CHAPTER III

METHODOLOGY

Subjects reported to a controlled research laboratory for a 20-30 minute testing session. A convenience sample of 30 individuals aged of 18-28 with no previous shoulder surgery in their life and any shoulder pain or injuries within the last 6 months. Subjects read and signed the informed consent document approved by the University Institutional Review board and completed the health history questionnaire. Upon determination of inclusion based on the health questionnaire, participants were randomly assigned to the control or experimental treatment group.

Range of motion was assessed using a standard size goniometer with the subject in a supine position on a treatment table while in 90° of shoulder abduction and 90° of elbow flexion (Forthomme, Dvir, Crielaard, & Croisier, 2011). External and internal ROMs were assessed three times each. The mean of the three measurements was calculated and recorded. Shoulder strength measurements were assessed using a Biodex System 3 isokinetic dynamometer. Seat straps were applied diagonally across the chest and shoulders from both sides as well as across the pelvis in order to prevent any accessory motions during strength testing. Subjects performed 10 reps of maximal effort in internal and external rotation as fast as they can at 180° per second starting at 0° of shoulder internal/external rotation. Torque values were recorded and the average torque of both internal and external rotation of the ten repetitions was calculated (Forthomme et al., 2011). Subjects assigned to the experimental treatment group received a single MFD treatment between pre and post measurements. All treatments were performed by the same clinician to ensure consistency. Treatments were consistent in length and parameter (10-15 minutes), allowing only a small variability based upon the size of the shoulder anatomy. Treatment began with a light scanning of the area using an Instrument Assisted Soft Tissue Mobilization (IASTM) soft tissue massage tool to increase blood flow and screen for soft tissue adhesions. IASTM was used to scan for any adhesion in the musculature of the shoulder. Light to moderate pressure was used to go over each muscle slowly 3 times each (Granter, 2011). The MFD cups were then be placed in an anatomically inspired pattern, and left for 5 minutes while the subject was instructed to relax. The pattern was for two standard size cups (2 inches in diameter) to be placed medial of the scapula with one at the inferior angle of the scapula and the other at superior angle. One large size cup (3 cups in diameter) was placed inferior of the spine of the scapula over the infraspinatus. One standard size curved cup (1 ½ inch diameter) was placed over the medial supraspinatus with a small curved cup over the lateral aspect of the muscle. The anatomical placement of cups can be seen in Figure 1. Cups utilized were plastic with a beveled edge that used suction from a suction gun to draw skin into cup. Each cup was pumped 3 times or till pressure was complete with suction tool. After the 5 minutes of MFD, cups were removed from the skin and a flush was complete on the areas that the cups were in contact with the skin. A flush utilizes an IASTM tool with moderate pressure to direct inflammation from MFD towards the heart (Shannon, 2004).

Upon the completion of five minutes of cupping, the subject performed a series of active movement patterns of 10 repetitions of shoulder flexion, shoulder abduction, internal and external rotation through total arc of motion with the cups in place and attached to the skin surface (Kim et al., 2011), Upon completion of the active range of motion movements, the cups were removed. Scanning the area with IASTM tool was then completed pushing the inflammation back towards the heart.

Subjects in the control group were directed to lie down and relax for seven minutes, the same amount of time of a MFD treatment group performed. Measurement for the experimental and control groups were then repeated after the intervention or seven minutes of relaxation. Data was analyzed using SPSS software (Version 22). Descriptive statistics were calculated and repeated measures ANOVA and a standard T-Test was used for comparing pre and post values for ROM and strength.

CHAPTER IV

FINDINGS

Thirty subjects, 15 females and 15 males participated in this study split into a control group (n=15) and experimental group (n=15). The mean descriptive statistics of the group are as follows; height= 68.9 inches (SD=4.63), weight= 167.3 pounds (SD=36.59), and age= 22.5 years (SD=2.21). Pre and post range of motion strength measurements can be found in Table 1. T-Tests were performed to determine if differences occurred between pre and post measurements within the overall population, the control group, and experimental group. Six measurements were determined to have statistical differences between pre and post. Table 2 demonstrates the T-test results.

ANOVA results only demonstrated on statistically significant difference when comparing the results of the control and experimental groups, with external ROM improving more in the experimental group (F(1,28)=, P=0.02). All ANOVA results can be found in Table 3. Although, this study only proved to show clinical significance with only ER ROM post a signal MFD treatment there may be more clinical significance that can be applied from the results of this study. With a gain of almost 9° of IR post MFD treatment post single treatment MFD could prove to be effect if you need to gain ROM maybe before a throwing or rehabilitation program.

CHAPTER V

CONCULSION

DISCUSSION

Multiple studies have been conducted on the development of rotator cuff muscle imbalances in athletes from the high school, collegiate, and professional levels. Studies have been conducted with positive results of rotator cuff imbalances with athletes from baseball, javelin, volleyball, tennis, and many other sports that require repetitive overhead movement (Dwelly et al., 2009). These adaptations to the internal and external rotators of the shoulder are widely considered an intrinsic risk factor for shoulder injury, and could assist in the cause of modified shoulder ROM (Manske & Ellenbecker, 2013b). Clinicians need to know the most effective ways that this specific signs and symptoms can be treated. With each different intrinsic risk factor and from athlete to athlete the best treatment may vary.(Manske & Ellenbecker, 2013a)

With the results of this study being that the only test having statistical significance of the benefit of immediate gains of external rotation with MFD therapy clinical application could include internal rotation because of the increased ROM found in the study, although it is not statistical significant. Thus signify that maybe for immediate results a treatment including IASTM or joint mobilization would yield better results. The effect on ER ROM most likely has to do with increasing blood flow and also lengthening the ER muscles of the shoulder those agonist muscles of external rotation (Tham et al., 2006). While there was a gain in IR the lack of statistical significance may be due to the lack of ability to cup anterior muscles of the shoulder. While the study did not yield significant results on all tested areas, this study may begin a discussion about the effect of MFD therapy on the upper extremity, especially the shoulder, as there is limited literature about the effectiveness of MFD on this area of the body. MFD's effect on pain has been studied more frequently than any other effect, even though it hasn't even been deeply studied. With MFD activists stating a wide range of positive effects including ROM and strength those factors need to be more deeply researched (Cao et al., 2012). Similar studies utilizing alternative forms of treatment to influence ROM have yielded yield similar results. One study sought to identify the effect of IASTM on glenohumeral IR and found a gain of an average 4.8° with a onetime IASTM treatment (Laudner, Compton, McLoda, & Walters, 2014). In a study looking at 6 week self passive stretching routines there were gains of an average of 17.8° of IR gained and 11.3° of ER (Harshbarger, Eppelheimer, Valovich McLeod, & Welch McCarty, 2013). In a study looking at overhead athletes participating in a 12 week program of self assisted passive glenohumeral strengthening results demonstrated gains of 6° IR and 2° ER (Aldridge, Stephen Guffey, Whitehead, & Head, 2012).

Limitations and Future Research:

This research study had limitations that could benefit from further research that could give us a better idea of the effective of MFD. Further research could investigate MFD therapy and its effects on ROM, strength, and pain therapy of all major muscle groups and joints of the body. Areas that could strengthen this study world have been to have a subject pool of overhead athletes that are actively performing overhead movements within participation within their sport, and possibly use the athletes with known ROM and strength deficits. This study identified the immediate results therefore a further studies could look at the results of a MFD treatment longitudinally over a 48-72 hour time period to determine the long term effects of a single MFD session on ROM and strength or the impact of multiple sessions. With the current subject population of only healthy individuals that have never had shoulder surgery and no shoulder pain for the previous 6 months, a study on an unhealthy population may yield different results.

Conclusion

In conclusion, due to lack of significance found in this study, MFD therapy lacks an immediate effect on IROT range of motion and IR/ER strength. However, it has a positive and significant effect on EROT range of motion when comparing MFD to a control group. However, pre and post differences were identified with MFC in internal and external rotation as well as internal rotation torque. These pre and post differences demonstrate that MFD does have a clinical impact on range of motion and internal rotation torque. Clinicians may use these findings to justify the use of MFD to improve shoulder range of motion.

REFERENCES

Aldridge, R., Stephen Guffey, J., Whitehead, M. T., & Head, P. (2012). The Effects of a Daily Stregthening Protocol on Passive Glenohumeral Internal Rotation in Overhead Throwing Collegiate Athletes. International Journal of Sports Physical Therapy, 7(4), 365-371.

Borsa, P. A., Wilk, K. E., Jacobson, J. A., Scibek, J. S., Dover, G. C., Reinold, M. M., & Andrews, J. R. (2005). Correlation of Range of Motion and Glenohumeral Translation in Professional Baseball Pitchers. American Journal of Sports Medicine, 33(9), 1392-1399.

Cao, H., Han, M., Li, X., Dong, S., Shang, Y., Wang, Q., Liu, J. (2010). Clinical research evidence of cupping therapy in China: a systematic literature review. BMC Complementary and Alternative Medicine, 10, 70-70. doi: 10.1186/1472-6882-10-70

Cao, H., Li, X., & Liu, J. (2012). An updated review of the efficacy of cupping therapy. Plos One, 7(2), e31793-e31793. doi: 10.1371/journal.pone.0031793

Dupuis, C., Tourny-Chollet, C., & Beuret-Blanquart, F. (2003). Isokinetic analysis of the volleyball player at the end range of motion. Isokinetics & Exercise Science, 11(1), 67.

Dwelly, P. M., Tripp, B. L., Tripp, P. A., Eberman, L. E., & Gorin, S. (2009). Glenohumeral Rotational Range of Motion in Collegiate Overhead-Throwing Athletes during an Athletic Season. Journal of Athletic Training (National Athletic Trainers' Association), 44(6), 611-616.

Edouard, P., Damotte, A., Lance, G., Degache, F., & Calmels, P. (2013). Static and dynamic shoulder stabilizer adaptations in javelin throwers: A preliminary study. Isokinetics & Exercise Science, 21(1), 47-55.

Edouard, P., Frize, N., CaImeIs, P., Samozino, P., Garet, M., & Degache, F. (2009). Influence of Rugby Practice on Shoulder Internal and External Rotators Strength. International Journal of Sports Medicine, 30(12), 863-867.

Falla, D. L., Hess, S., & Richardson, C. (2003). Evaluation of shoulder internal rotator muscle strength in baseball players with physical signs of glenohumeral joint instability. British Journal of Sports Medicine, 37(5), 430.

Forthomme, B., Dvir, Z., Crielaard, J. M., & Croisier, J. L. (2011). Isokinetic assessment of the shoulder rotators: a study of optimal test position. Clinical Physiology & Functional Imaging, 31(3), 227-232.

Granter, R. (2011). An Introduction to Vacuum Cupping. SportEX Dynamics (30), 15-18.

Harshbarger, N. D., Eppelheimer, B. L., Valovich McLeod, T. C., & Welch McCarty, C. (2013). The Effectiveness of Shoulder Stretching and Joint Mobilizations on Posterior Shoulder Tightness. Journal of Sport Rehabilitation, 22(4), 313-319.

Huisstede, B. M., Hoogvliet, P., Randsdorp, M. S., Glerum, S., van Middelkoop, M., & Koes, B. W. (2010). Carpal Tunnel Syndrome. Part I: Effectiveness of Nonsurgical Treatments-A Systematic Review. Archives of Physical Medicine & Rehabilitation, 91(7), 981-1004.

Kim, H. M., Caldwell, J.-M. E., Buza, J. A., Fink, L. A., Ahmad, C. S., Bigliani, L. U., & Levine,

W. N. (2014). Factors Affecting Satisfaction and Shoulder Function in Patients with a Recurrent Rotator Cuff Tear. Journal of Bone & Joint Surgery, American Volume, 96(2), 106-112.

Kim, J.-I., Lee, M. S., Lee, D.-H., Boddy, K., & Ernst, E. (2011). Cupping for treating pain: a systematic review. Evidence-Based Complementary and Alternative Medicine: Ecam, 2011, 467014-467014. doi: 10.1093/ecam/nep035

Laudner, K., Compton, B. D., McLoda, T. A., & Walters, C. M. (2014). Acute Efeects of Intrument Assisted Soft Tissue Mobilization for Improving Posterior Shoulder Range of Motion in Collgieat Baseball Players International Journal of Sports Physical Therapy, 9(1), 1-7.

Manske, R., & Ellenbecker, T. (2013a). Current concepts in shoulder examination of the overhead athlete. International Journal of Sports Physical Therapy, 8(5), 554-578.

Manske, R., & Ellenbecker, T. (2013b). Invited Clinical Commetnary Current Concepts in Shoulder Examination of the Overhead Athlete. International Journal of Sports Physical Therapy, 8(5), 553-577.

McMaster, W. C., Long, S. C., & Caiozzo, V. J. (1992). Shoulder torque changes in the swimming athlete. American Journal of Sports Medicine, 20(3), 323-327.

Mulligan, I. J., Biddington, W. B., Barnhart, B. D., & Ellenbecker, T. S. (2004). Isokinteic Profile of Shoulder Internal and External Rotators of High School Aged Baseball Pitchers. Journal of Strength & Conditioning Research (Allen Press Publishing Services Inc.), 18(4), 861-866.

Nishiyama, K., Yanagisawa, O., & Torii, S. (2012). The morphology of shoulder rotator cuff muscles and shoulder strength in junior high school baseball players. Japanese Journal of Clinical Sports Medicine, 20(1), 138-144.

Nocera, J., Rubley, M., Holcomb, W., & Guadagnoli, M. (2006). The Effects of Repetitive Throwing on Shoulder Proprioception and Internal and External Rotation Strength. Journal of Sport Rehabilitation, 15(4), 351-362.

Nodehi-Moghadam, A., Khaki, N., Kharazmi, A., & Eskandari, Z. (2013). A Comparative Study on Shoulder Rotational Strength, Range of Motion and Proprioception between the Throwing Athletes and Non-athletic Persons. Asian Journal of Sports Medicine, 4(1), 34- 40.

Saccol, M. F., Gracitelli, G. C., da Silva, R. T., Laurino, C. F. d. S., Fleury, A. M., Andrade, M. d. S., & da Silva, A. C. (2010). Shoulder functional ratio in elite junior tennis players. Physical Therapy in Sport, 11(1), 8-11.

Shannon, A. J. (2004). The Art of Massage Cupping Therapy. Massage Magazine (110), 54-62.

Swanik, K. A., Swanik, C. B., Lephart, S. M., & Huxel, K. (2002). The Effect of Functional Training on the Incidence of Shoulder Pain and Strength in Intercollegiate Swimmers. Journal of Sport Rehabilitation, 11(2), 140-154.

Tham, L. M., Lee, H. P., & Lu, C. (2006). Cupping: From a biomechanical perspective. Journal of Biomechanics, 39(12), 2183-2193.

Whitley, J. D., & Terrio, T. (1998). Changes in peak torque arm-shoulder strength of high school baseball pitchers during the season. Perceptual & Motor Skills, 86(3), 1361

Figure 1. Picture of MFD with cup anatomical placement.

Table 1. Means and Standard Deviations (N=30)

Statistical look at difference in between pre & post tests for control group.					
Internal Rotation Range of Motion (degrees)					
	Control		Mean	Standard Deviation	P Value
		Pre	73.67	9.98	1.34
		Post	79.33	12.9	
	Experimental				
		Pre	72.33	13.75	2.08
		Post	83.13	13.98	
External Rotation Range of Motion (degrees)					

	Control				
		Pre	101.6	6.15	0.598
		Post	102.2	10.36	
	Experimental				
		Pre	102.6	8.5	0.092
		Post	110	7.21	
Internal Rotation Torque (ft-ibs)					
	Control				
		Pre	24.01	14.12	0.715
		Post	24.09	13.85	
	Experimental				
		Pre	29.23	10.2	0.024
		Post	30.51	10.24	
External Rotation Torque (ft-ibs)					
	Control				
		Pre	14.37	7.39	0.178
		Post	14.54	7.07	
	Experimental				
		Pre	17.65	5.41	0.119
		Post	18.03	4.53	

Table 2. T-Test results.

	T-Statistics		
	All Data	Control Group	Experimental Group
Pre IR ROM – Post IR ROM	-5.09**	-2.5*	-4.95**
Pre ER ROM – Post ER ROM	-3.08*	-0.31	-5.74**
Pre IROT – Post IROT Torque	-1.73	-0.14	-2.5*
Pre EROT – Post EROT Torque	-0.59	-0.27	-0.53

*p<0.05, **p=0.00

Table 3. ANOVA Results Compaing Myofascial Depcompression and the Control Group

	F Value	P Value
IR ROM	0.598	0.446
ER ROM	5.728	0.024
IROT Torque	2.08	0.16
EROT Torque	2.583	0.119

VITA

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