TREATMENT OUTCOMES OF MYOFASCIAL DECOMPRESSION ON HAMSTRING PATHOLOGY

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Abstract: INTRODUCTION: This study examined the effectiveness of two different hamstring soft tissue treatments; myofascial decompression (MFD) and a moist heat pack with self-myofascial release using a foam roller (SMR). Myofascial decompression, or cupping therapy, is a traditional Chinese therapy that has been adapted to the field of sports medicine. METHODS: This treatment served as the intervention group, a foam roll treatment and heat pack served as the control. Participants consisted of 17 division I student athletes from Oklahoma State University of both male and female genders (4 females and 13 males). All subjects signed an IRB approved consent form prior to any participation. Range of motion measures and a Perceived Functional Ability Questionnaire (PFAQ) scale, to assess patient perception, were used before and after each treatment. The Global Rating Of Change (GROC) scale was completed by all subjects after each treatment to reflect each subject's perception of treatment effect. Subjects were randomly assigned to either the control group (SMR) or the intervention group (MFD). A paired samples T-test was used to determine differences in pre and post measures and a one-way ANOVA was used to compared differences between the two treatment groups. RESULTS: Statistically significant differences were found for range of motions measures regardless of the treatment subjects received. The same was found comparing overall flexibility and comparing the flexibility of the hamstrings on the PFAQ scale. A statistically significant difference was found in favor of the intervention group for the GROC values. CONCLUSION: The results of this study suggest that either treatment may be beneficial for range of motion increases in patients with hamstring injuries. It also provides a foundation for future researchers inquiring about the clinical effects of myofascial decompression as it pertains to sports medicine. Future research should include a larger patient population and possibly different patient populations. Adding more functional and objective measures may also prove beneficial in future studies to better document treatment outcomes.

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CHAPTER I

INTRODUCTION

The purpose of the study is to examine the timely effects of myofascial decompression soft tissue mobilization techniques as it effects fascial restrictions on hamstring muscle tightness and pain. Myofascial decompression is a term therapists are now starting to use that's replacing the traditional term of cupping therapy. Cupping therapy was traditional used by the Chinese as an alternate therapy to acupuncture with goals of pain relief and healing common medical conditions.[1] Historically in cultures around the world cupping has been used to treat musculoskeletal pathologies of the back and extremities, gynecological issues, pharyngitis, ear ailments, lung diseases, and a long list of other medical ailments.[2-4] As healthcare professionals use evidence-based practice and gain credibility for new techniques, adopting a more appropriate scientific term such as myofascial decompression was necessary. Using a collaboration of research surrounding soft tissue and the effects of different therapies on the human body, specific techniques have developed for cupping therapy to aid in healing of musculoskeletal pathologies. Movement patterns and functional exercise with the cups attached to specific sites are becoming a growing trend in sports medicine practice.

When trauma or strain occurs to soft tissue the first step in healing is the inflammatory response phase. Enriched blood is sent to the affected area to begin phagocytic activity and dispose of damaged tissue. As the body starts to produce new tissue it lays down in a randomized, intersected pattern and can cause adhesions within the fascia and the muscle tissue.[5]

Myofascial decompression offers another way to breakdown adhesions and mobilize the repairing soft tissue, allowing it to be correctly realigned through therapeutic exercise.

There is evidence that placing the cups on the body increases blood flow to the area and draws toxins from the deeper tissue, allowing for the body to heal more efficiently.[1] The cups actually have the ability to grab and lift the fascia to allow for lymphatic drainage of toxins, as well as stretching the fascial tissue.[1] The superficial fascia that lies between the dermis and the deep fascia acts as a lubricating agent to allow for free movement of the deep fascia and muscle tissue without resistance from the skin.[6] It is suggested that by using the appropriate cup size for the anatomical area being treated, there can be some relief of a deep fascial adhesion and allow for the muscle alone to move free of restriction.[1] The skin and fascia are highly responsive structures which allow them to play a major role in maintaining normal body function.[7] By restoring the tissue back to its most efficient state we can eliminate pain and mechanical deficiencies caused by tension within the soft tissue.[8]

Hamstring injuries are described as the third most common orthopedic problem after knee and ankle injuries, and often have a long recovery time.[9] Some of the pain perceived by individuals who suffer hamstring injuries can actual come from muscle stiffness, and maintaining flexibility of the muscle tissue can help eliminate that pain.[8] There are many different soft tissue approaches that therapists utilize throughout the rehabilitation process to combat this, such as the Graston Technique (Instrument Assisted Soft Tissue Mobilization), Active Release Technique (ART), self-myofascial release, and massage. The common theme with these therapies is they all place a compressive force on the tissue, Myofascial decompression offers a different approach to mobilizing soft tissue, eliminating pain, and range of motion restrictions because of its decompression of the structure rather than compression.

The goal of this study is to consider how mobilization of soft tissue and increased blood flow due to the myofascial decompression technique can have a positive effect on hamstring healing through patient perception and increases in range of motion when compared to a traditional technique of a heat pack and self-myofascial release.

PURPOSE

The purpose of the study is to examine the effects of myofascial decompression soft tissue mobilization techniques compared to self-mobilization on hamstring muscle tightness and subjective perception of pain as determined by a passive straight leg test, and subjective perception of pain measurements in Division I collegiate athletes between the ages of 18-28.

RESEARCH QUESTIONS

- Does myofascial decompression (MFD) have an effect on range of motion and pain perception in an athletic population?
- Is MFD as effective as a heat pack and foam rolling (SMR) in increasing flexibility and decreasing pain?
- Will the patient population feel MFD had an overall positive effect on their health?

HYPOTHESIS

H0: There will be no significant decrease in hamstring pain and tightness after a single myofascial decompression technique compared to a self-mobilization technique.

H1: There will be a significant decrease in hamstring pain and tightness after a single myofascial decompression technique treatment compared to a self-mobilization technique.

DEFINITION OF TERMS

Active Release Technique- A soft tissue mobilization technique that involves static pressure of by a therapist to a point on a shortened muscle while the patient actively lengthens the muscle.[10]

Autonomic Nervous System- a part of the vertebrate nervous system that innervates smooth and cardiac muscle and glandular tissues and governs involuntary actions[11]

Blank Myogeloses- A condition in which there are hardened areas or nodules within muscles[4]

Bloodletting- The therapeutic removal of blood[11]

Carpal Tunnel Syndrome- a condition caused by compression of the median nerve in the carpal tunnel and characterized especially by weakness, pain, and disturbances of sensation in the hand and fingers[11]

Dry Cupping- An ancient therapy that uses a mechanical hand pump and plastic cups or glass cups and fire to create a negative pressure underneath the cup that draws the skin, fascia, and some superficial muscle tissue into the cup[2]

Dynamic Stretching- A type of stretching that utilizes functional movements to elongate and increase blood flow to peripheral muscle tissue[10]

Fascia- a sheet of connective tissue (as an aponeurosis) covering or binding together body structures[11]

Golgi Tendon Organ- a spindle-shaped sensory end organ within a tendon that provides information about muscle tension[11]

Graston Technique- A patented form of instrument-assisted soft tissue mobilization that enables clinicians to effectively break down scar tissue and fascial restrictions[11]

Interstitial Muscle Receptors- situated within but not restricted to or characteristic of a particular organ or tissue, used especially of fibrous tissue[11]

Lymphatic Drainage- A return process similar to that of the venous network, but specializing in the removal of interstitial fluids.[12]

Microvacuolar System- An area that sits below the skin and above the deep fascia that allows for smooth muscular function[6]

Muscle Pump- Skeletal muscle contractions that encourage venous return of blood the heart through the compression of veins as they contract.[12]

Myofascial Decompression- A decompressive soft tissue mobilization technique where skin and fascia are sucked into a glass or plastic cup. Also known as "Cupping"

NSAIDs- a nonsteroidal anti-inflammatory drug[11]

Neuron- one of the cells that constitute nervous tissue, that have the property of transmitting and receiving nervous impulses[11]

Pacini- A mechanoreceptor described as egg shaped that respond to rapid changes in pressure[13]

PNF Stretching- a method of stretching muscles to maximize their flexibility that is often performed with a partner or trainer and that involves a series of contractions and relaxations with enforced stretching during the relaxation phase[11]

Ruffini- any of numerous oval sensory end organs occurring in the subcutaneous tissue[11]

Scarification- The act of making shallow cuts in the skin[11]

Stinger- A popular term in sports medicine for an injury to the brachial plexus due to abnormal stretching[11]

Visual Analog Scale- A graphic scale that helps a patient to quantify pain, depression, and other subjective and otherwise unmeasurable states or conditions[11]

Wet Cupping- An ancient therapy similar to dry cupping except scarification of the skin takes place underneath the cups.[2]

ASSUMPTIONS

- All subjects will allow for maximal hamstring measures to be taken pre and post treatment
- The primary investigator will be performing all of the myofascial decompression treatments
- All subjects will display honesty in signing the consent form and will not have participated in any prior stretching or treatment the day of study participation.
- No subject will have participated in previous cupping therapy for the specific pathology being treated.
- Subjects will answer all questions honestly to the best of their ability.

DELIMITATIONS

- All subjects will be athletes from Oklahoma State University
- Subjects will be between ages 18-28 of an athletic population

- No history of hip, knee, ankle, or foot surgery in the previous 6 months
- Subjects will not perform any type of strength measures
- A digital goniometer will provide the only objective measure in the study
- Subjects will only receive their treatment on one occasion

LIMITATIONS

- Allotted time frame for data collection may limit the number of subjects
- No device was used to ensure perfect range of motion measures each time
- Subjects recruited for the study did not have healthy hamstring tissue
- Control Participants will receive a moist heat pack because there is no possible sham myofascial decompression therapy.

CHAPTER II

REVIEW OF LITERATURE

The purpose of the study is to examine the timely effects of myofascial decompression soft tissue mobilization techniques as it effects fascial restrictions on hamstring muscle tightness and pain. This literature review will focus on what fascia is, the receptors that respond to pressure and tightness, how tissue heels in regards to hamstring injuries, and finally the effect that myofascial decompression has on this process.

The role of fascia in our bodies is something that has long been overlooked and potentially misunderstood. As we take a closer look at the human body through articles and research we see that is can be a major player in normal body functions, as well as playing a role in recovering from musculoskeletal pathologies.[7] This study will take a look first, at the properties of fascia, how it relates to musculoskeletal pathologies, specifically how hamstring pathologies are treated, and finally how myofascial decompression can aid in that recovery.

Anatomy Review

Fascia

The word fascia means “band or bandage”, which makes sense as the fasciae are a large number of small bands of connective tissue that engulf our muscles, bones, and organs. It protects, promotes lymphatic drainage, and creates compartments for muscles and promotes their synergistic movements.[7] Fascia can be either dense or very thin depending on the location throughout the body, and most contain innervation and vascular supply. Superficial fascia promotes movement between the skin and underlying structures, while deep fascia is made up of very dense fibrous tissues providing more structural support and synergistic muscle movements.[6,7] The fascia in the limbs and the back are dense and very responsive to stress and mechanical loads being placed on the body.[7] It also appears to be more superficial and dense in the lower limbs, which is thought to be due to the role it plays in muscle pump for venous return. Fascia is a major contributor in muscle pump contractions, not only does it act as a compressive aid, but it also encourages synergistic muscle movements and firing patterns in the lower leg.[7] The connection of the fascia to the bones and soft tissue links the innervation, and is responsible for the muscles to fire together.[7] By gaining knowledge on the properties and locations of fascia, relationships between it and musculoskeletal pathologies become much clearer. As a practitioner understanding the fundamentals of tissue and how to stimulate the receptors that guide its function is the key to effective treatment.

Flexibility and Range of Motion

The Golgi Reflex Arc

Research has shown that simply stretching the myofascial tissue doesn't stimulate the Golgi tendon organ.[13] This article suggests that due to the arrangement of the GTO receptors with the muscle fibers that the muscle must actively contract to stimulate the feedback loop. To support that, only 10% of the GTO receptors are found in the myotendinous junction, with the other 90% being split up between the muscle's belly, aponeuroses, and in capsules and ligaments.[13] Myofascial decompression utilizes movement patterns while cups are attached to the skin's surface to aid in activation of these receptors.

Ruffini and Pacini Corpuscles

Three major mechanoreceptors in the fascia are the large pacini corpuscles, the smaller paciniform corpuscles, and the ruffini organs. The pacini are described as egg shaped and respond to rapid changes in pressure, such as vibrations or high velocity manual therapy techniques.[13] The slightly smaller paciniform corpuscles respond to similar stimulations as the pacini. The ruffini are more longitudinal in shape and respond to pressure held over a longer period of time. The two types are found in all of the body's connective tissue, including fascia. The pacini corpuscles are found mostly in the myotendinous junction and in deeper segments of joint capsules, lateral thigh, the plantar surface of the feet, palmar surface of the hand, and in deep sine ligaments.[13] The ruffini are more common in the outer layer of joint capsules, deep dorsal fascia of the hand, dura mater, and anterior and posterior ligaments of the knee, they tend to respond more to lateral stretch and deep, slow tissue therapy.[13]

Research suggests that a practitioner could stimulate ruffini endings in fascial tissue that trigger the central nervous system to then change the tension in the attached muscle. When a practitioner manipulates tissue the mechanoreceptors within that tissue are stimulated and they send the corresponding signal to the brain, depending on which receptors are stimulated. The central nervous receives that signal and produces a return signal that causes a tonus change in the involved skeletal muscle tissue motor units.[13]

Interstitial Muscle Receptors

The third and most abundant group of interfascial mechanoreceptors, are the interstitial muscle receptors. Muscle tissue and its related fascia is the largest sensory organ the body has. They contain three times more sensory nerves than motor fibers. Of the sensory nerve fibers, about 20% belong to the previous mentioned ruffini, pacinicorpuscle, and golgi organs that originate in the muscle spindle and are commonly known as type I and II nerves.[13] More recently

Interstitial receptors, or type III and IV sensory nerves, have become more recognized and are found almost four times more frequently than type I and II. These neurons are much smaller than type I and II and are found abundantly in the fascial tissue. Most of them originate in free nerve endings and are unmyelinated.[13] Type III fibers are described as myelinated and make up a very small portion, leaving the type IV unmyelinated to comprise about 90% of the fibers.[13] Research does show these fibers to have functions of mechanoreceptors, as well as playing a role in pain perception. Interstitial receptors are broken down further into two equal subgroups; low-threshold pressure units and high-threshold pressure units.[13] The low-threshold pressure units are stimulated by extremely light touch. The high-threshold pressure units are thought to be more involved as pain receptors.[13]

A study performed in Japan in 1974 looked at the natural role of interstitial receptors in the body. It was discovered that the majority of these mechanoreceptors have autonomic functions involving heart rate regulation, blood pressure, respiration, and tissue metabolism and fluid dynamics.[13] It is thought that the major function of interstitial receptors is regulating blood flow. It has been proven that deep and slow sustained pressure to the abdominals and pelvis will increase vagal activity. This then triggers changes in the autonomic nervous system that changes local tissue fluid dynamic, as well as a whole body muscle relaxation. This is believed to be the responsibility of the interstitial and ruffini receptors.[13]

The Dermis

The fascia sits just below our skin and more specifically the dermis. The dermis is considered to be the principle structure contributing to the mechanical properties of the skin.[14] The skin, similar to fascia, is made of up small fibers interwoven and randomly oriented. Mostly consisting of collagen fibers, the dermis is a protein dense tissue that responds to mechanical stress.[15] When the skin is stressed or stretched the collagen fibers align along the same line as the stress being placed upon it. The collagen in the skin resists linear loading or stress, and changes the elasticity of the skin, making it stiffer.[14] The elastin fibers of the dermis respond to heat and store the energy of smaller stresses at a molecular level.[14,15]

"Microvacuolar System"

Synonymous with superficial fascia is what researchers have named the "microvacuolar system".[6] This is the area that sits below the skin and above the deep fascia, and is vascularized allowing for smooth muscular function unaffected by the skin. The space is filled with a filmy vascularized collagenous network that behaves like a gel due to its chemical make-up, and allows for the efficient movement exchanges between layers. The layer absorbs shear stresses and contains blood vessels, lymphatics, nerves, and water.[6] The role in the exchange of fluids within the collagen that this system has, makes it an important contributor in the tissue repair process.[10]

Soft Tissue Injuries

Tissue Healing

In athletics, soft tissue injuries make up 90% of all sustained injuries.[16] This statistic alone is enough to emphasize the importance of understanding the healing process of tissue. A muscle strain is a very common injury among athletes and occurs when an excessive force is placed upon the fibers of the muscle, typically near the muscle-tendon junction.[16] As soon as an injury occurs to the muscle, a repair process will begin that has an end goal of producing a scar where the original tissue was.[16] There are three described phases to the repair process; the inflammatory response phase, the fibroblastic-repair phase, and the maturation-remodeling phase.[10]

The inflammatory response phase happens immediately after an injury occurs to the effect cells of the area and lasts 2-4 days. As an injury occurs to a muscle the myofibrils, or muscle tissue, rupture causing a response from the body that floods the area with leukocytes. As the cells begin necrosis, the leukocytes are beginning a process called phagocytosis. This process is an essential part of the healing process and needs to be regulated. The primary purpose of phagocytosis is to remove debris and waste from the area and prepare it for new tissue to form.[10] An important note during this phase that the individual should not be completely immobilized after the first couple days. Scientific evidence has shown that a stronger scar formation takes place if there is some mobilization in the early phases.[16]

The second phase, the fibroblastic repair phase, can last from 4-6 weeks and is the period of time that scar tissue starts to form. The body sends oxygen and nutrient rich blood to the area for tissue regeneration. Fibroblasts then begin to breakdown the fibrin clot that has formed in the area where the tissue has been damaged. This process begins to formulate collagen and elastin substances that will produce the collagen fibers that will lie down as scar tissue.[10] As collagen forms in the area it will lay down in a randomized fashion. This increases the tensile strength of the wound, and as the strength increases the fibroblasts start leaving the area, letting the body know it can begin the maturation-remodeling phase.[10]

The final phase of healing can last anywhere from a few weeks to several years depending on the individual or the injury sustained. The maturation-remodeling phase highlights the realignment of the collagen fibers.[10] These fibers need to be able to withstand the tensile forces that will be placed upon them and order for this to happen the body has to place stress on the collagen fibers so they lay down in a linear pattern, and function in the most efficient way.[10] This is an important principle to understand during the rehabilitation process because this the primary healing phase that is effected through corrective exercises. However, the entire tissue healing process should be well understood in order to be the most effective in the treatment and rehabilitation of skeletal muscle injuries.

Hamstring Injuries and Recovery

Hamstring rehabilitation can present a challenge when returning an athlete to sport and there are many different approaches practitioners take. Hamstring injuries are described as the third most common orthopedic problem after knee and ankle injuries, and often have a long recovery time.[9] The mechanism of injury for hamstring injuries is an overload of tensile force that causes the muscle fibers to stretch beyond their normal limits causing them to tear, this is very common in sprinting.[9,17] When returning to activity, there is a significant amount of time that the patient is more susceptible to re-injury. Due to the origin of the hamstrings at the pelvis it has been suggested that neuromuscular control of the pelvic region is needed for proper hamstring function.[9] There is one clinical research study on the comparison of different rehab protocols for acute hamstring injuries; however there has been research that shows positive effects of trunk stabilization exercises and return to play in athletes with hip adductor pathologies.[9]

One study looked to compare two different hamstring protocols side by side based on time needed for return to play, and the reinjury rates of each protocol. Twenty four subjects took part in the comparative study, while participating in sports activities during the study. The most common mechanism of injury for the subject group was sprinting, which supports previous research on hamstring strains. The subjects were randomly assigned to one of two groups, one a progressive agility and trunk stabilization group (PATS), and the other a hamstring stretching and strengthening group (STST). All the subjects agreed not to take any nonsteroidal anti-inflammatory medicine or receive any other treatment for their injuries.[9] The STST group focused on static stretching and progressive resistance training for the hamstrings, and then moved into dynamic stretching with concentric and eccentric strengthening of only the hamstrings. The PATS group focused their athletes' attention on learning and maintaining a pelvic neutral position for stabilization while performing functional movements in the frontal and transverse planes and also received ice on their hamstrings.[9] Reinjury rate was looked at within the first year of return to sport, with the exception of the first two weeks back to the subject's respected sport. Between the two groups the PATS group had a quicker return to play rate and also had a much lower reinjury rate at an 7:1 ratio.[9] Unfortunately none of the comparing data were statistically significant, however all the data favored the PATS group.

The research performed in this comparative study is a great indicator of the direction hamstring research should be going in.[16] Although the data comparison between the two groups was not statistically significant it still suggests that using trunk stabilization exercises and neuromuscular reeducation exercises for hamstring rehabilitation can be more beneficial in the rate of return to play than hamstring exercises alone. A major limitation of this particular study was inability to provide direct evidence that it was the actual pelvic exercises that had the positive effect.[9] The trunk stabilization study controls early range of motion and eliminates atrophy in the early stages of rehabilitation. More research comparing hamstring protocols is needed, but the data from the current research suggests that neuromuscular reeducation is the most beneficial way to rehabilitate hamstring injuries in regards to rate of reinjury and expedited return to sport.

Another important aspect of recovering from hamstring injuries is maintaining and even improving to the patient's range of motion. If the practitioner can accomplish this they potentially avoid imbalances in mechanics by keeping body movements efficient and symmetrical. Some of the pain perceived by individuals who suffer hamstring injuries can actual come from muscle stiffness, maintaining flexibility of the muscle tissue can help eliminate this pain.[8]

One study looked at the impact of stretching on injured hamstring tissue in an athletic population. A subject pool of 80 athletes was collected for a study comparing stretching versus not stretching in a hamstring rehab protocol. Both groups performed the same rehabilitation exercises, the only difference being the amount of times stretching took place. One group performed static stretching of the hamstring four times for 30 seconds once per day in adjunct to their exercises, while the other group performed the static stretching 4 times daily throughout the duration of their rehab.[8] Statistical significance was found with an advantage for the group that stretched more frequently was noticed for both the time it took for return to sport and the time it took to regain normal values of range of motion.[8] In athletics an expedited return to play is often considered very important and necessary. The role of static stretching has a positive influence on the overall effectiveness and return to play rate when dealing with hamstring injuries.[8] Literature suggests that proprioceptive neuromuscular facilitation (PNF) stretching and dynamic stretching are even more effective than static stretching alone and can also be incorporated in rehabilitation during the later stages.[8] During PNF stretching the patient will contract the muscle being stretched against some form of resistance, the contraction recruits more motor units containing stimulated golgi tendon organs creating a decrease in muscle tension.[18] Dynamic stretching utilizes functional movements to elongate fibers and increase blood flow in peripheral muscle tissue, and because contractions are taking place with these two types of stretching, caution in early rehab should be respected.[10]

As discussed earlier, during the fibroblastic repair phase of tissue healing it is important to place an appropriate stress on the healing tissue so collagen lays down in a linear fashion along those stress lines.[8] If collagen is allowed to form in a randomized pattern it will lead to long term functional strength deficits, range of motion deficits, and an extended period of chronic hamstring pain.[8] Malliaropoulos suggests that injured hamstring tissue may require more stretching than healthy tissue. Repeated elongation of muscle tissue over time, will decrease tension in the muscle tissue.[8]

Cupping Therapy or "Myofascial Decompression"

Cupping is a non-traditional method of treatment popular in traditional Chinese medicine that involves placing vacuum suctioned cups over localized areas of the skin; usually trigger points.[1] Originally based on Qi, the vital energy and balance of life, it was said to unblock and correct imbalances in the flow of Qi.[1] There is also documentation that suggests other cultures used some form of cupping therapy, tracing it back to ancient Macedonia around 3300 BC.[2] This documentation, along with evidence from other cultures makes this type of therapy one of the oldest medical treatments recorded.[2] Historically in cultures around the world cupping has been used to treat musculoskeletal pathologies of the back and extremities, gynecological issues, pharyngitis, ear ailments, lung diseases, and a list of other medical ailments.[2-4] One particular study investigated the effects of stimulating acupuncture points for pain relief. By placing the cups on the surface of the skin, stimulation of small diameter nerves in the muscle occurs and sends impulses to the brain that trigger endorphin release.[1] Cupping therapy has since expanded to treating musculoskeletal pathologies. Tham et al. also noted the effects of cupping for the increase of circulation around the area being treated, drawing toxins from the muscles and out to superficial veins allowing for them to be removed from the body.[1] Without adequate blood flow toxins and metabolic waste become stagnant in local tissue.[19] One aspect of the cupping treatment of soft tissue involves sliding the cups along the skin. Studies have suggested an increase in muscle blood volume and fluid exchange with stimulation of the skin through massage, encourages the elimination of metabolic waste.[19] For the purpose is this study the literary focus will surround cupping benefits for the treatment of musculoskeletal dysfunctions.

There are two types of cup therapy used in today's practice, wet cupping and dry cupping. Wet cupping utilizes a mechanical hand pump and plastic cups or glass cups and fire to create a negative pressure underneath the cup that draws the skin, fascia, and some superficial muscle tissue into the cup. Once the initial cup is placed it is then removed, the skin is lightly punctured and the cup is replaced to allow for bloodletting. Typically the cup is allowed to fill completely with blood before it is removed again and the area is dressed.[2] Dry cup is the same exact treatment with the exception of the scarification and bloodletting.[2] This therapy is not very common in the United States or often practiced in western medicine.[2] The research that has been performed has shown positive effects for both types of cupping.[1,2,3,4,20]

Wet Cupping

Recent research performed in Europe looked at the efficacy of wet cupping for the treatment carpal tunnel syndrome as a low-cost effective way of treating the issue. A short term randomized study was performed to compare wet cupping treatments and a standard heating pad to the shoulder triangle for the relief of their carpal tunnel symptoms.[20] Subjects were to either have one wet cupping session or one session with the heating pad. The symptoms were graded using two upper extremity scales, a visual analog scale, and a medical questionnaire that measure the patient's overall quality of life prior to their treatment, and 7 days post treatment.[20] A statistically significant difference was noted in favor of the wet cupping treatment for all symptoms.[20] Patients in the wet cupping groups stated the procedure was not painful, suggesting it to be a safe and tolerable treatment.[20]

Another clinical study performed in Iran used the same wet cupping to treat migraine and tension headaches.[3] They based their study off previous research of wet cupping for migraine headaches where patients reported positive effects at an average of roughly 90% of the population.[2] Notable differences in study design between the headache model and the carpal tunnel model were study duration and lack of a control group. The study performed on headaches gave their subjects the treatment in three stages, at two week intervals. They used three measures for the study that were taken at baseline and again at a 3-month post treatment follow-up.[2] Subjects were measured with a 6-point Likert scale for the severity of their headache, they recorded the number of days with a headache, and their medication was logged using a medication quantification scale (MQS).[2] Of the total number of patients that completed the full study 95% reported an improvement of their symptoms, which would support previous research of cupping therapy.[2] One limitation pointed out by the investigators that performed the study is a future need of comparison against other supported treatments for migraine or tension headaches.

Iran was also the sight for a study involving wet-cupping and non-specific low back pain that compared against a control group of common treatment techniques for low back pain. Low back pain is one of the most common and expensive issues that health care providers face.[3] Traditional methods of treating low back pain include non-steroidal anti-inflammatory (NSAIDs), conservative rehabilitation exercises and alterations in daily activity, rest, and ultimately surgery.[3] This study was a randomized control study that used medication and exercises recommended by a physician as a control against the wet-cupping treatment. Each group was measured on pain intensity, medication used, and functional disabilities related to pain.[3] They hypothesized the wet cupping group would have a greater decrease on all three measures.

The control group was treated with a combination of traditional techniques including; bed rest, medication, spinal manipulations, and therapeutic exercise.[3] The wet cupping group received a series of three treatments over six days. On the first day the area between the scapulas was treated using traditional wet cupping techniques. On day 3 the sacral area was treated, and day 6 the corresponding calf was treated.[3] The wet cupping group and the control group were vastly different in their post-treatment measures. The control group showed no changes in pain intensity or functional disability due to pain, and only a small change in the decrease of their medication use.[3] The wet cupping group showed significant improvements in all three categories, also coinciding with previous research in support of wet cupping.[3]

Dry Cupping

Previous studies have also found success with the dry cupping technique, where the skin is not punctured for bloodletting. One of these studies examined the dry cupping technique on patients with osteoarthritis of the knee.[4] The main difference between this study and the technique being used in sports medicine is the type of cup being used. Typically the cups that are used in sports medicine settings are made of a hard plastic with a valve on the top that allows for connection to the hand pump. The arthritis study used a larger silicone cup so it fit over the entire anterior aspect of the knee joint.[4]

This particular study is the first one to look at the cupping therapy and osteoarthritis of the knee. Researchers measured the patients overall quality of life, and the ability of the cupping therapy to eliminate overall pain and stiffness against a group with no intervention.[4] The treatment group received dry cupping twice a week for four weeks, as well as two traditional plastic cups to their sacroiliac region based on traditional expert suggestion for the same duration of four weeks. The non-treatment group received nothing for the duration of the study.[4] At the end of the study only small differences were noted. While the quality of life score was higher in the cupping group and the stiffness score was lower in the cupping group, neither were significantly different. However at the four week follow up the pain intensity visual analog scale showed significantly lower numbers in the cupping group. Roughly half of the treatment group also rated their clinical effect as "improved" at the duration of the study.[4] The results of this study, while not significant, offer encouragement in support of the use of dry cupping to treat arthritis of the knee joint. The lack of research providing evidence of dry cupping demonstrates the need for future research to document such findings.[4]

The cervical region has also been addressed in dry cupping research, and is an important component of successfully treating athletes. The cervical spine and the soft tissue structures that support it are very susceptible to injury throughout the duration of one's athletic career. Causes of neck pain can range from something traumatic such as a "stinger" in football, or even linger from something as small as sleeping wrong. Conventional ways of treating cervical pain or dysfunction include; manipulation, stretching, NSAIDs, and physical therapy.[4]

A fifty patient, double blinded study was performed on individuals who complained of cervical region tightness and presented with blank myogeloses, or palpable "knots". Subjects were randomly assigned to either the "treatment" group, or the "wait list" group, that would receive no treatment.[4] The dry cupping in this study differs slightly from the previous ones discussed as it utilized glass cups and a flame to create the suction effect. Physicians identified the myogeloses, most commonly in the trapezius, and placed the cup over the tender nodule for 10-15 minutes looking for a dark pink to rose color.[4] The post measures showed a significant difference between the cupping group and the wait list group in favor of the cupping group for pain at rest and pain with movement.[4] Patients in the cupping group also verbally stated they had less pain and felt better overall. Even though each of the studies done on wet cupping and dry cupping may have differed slightly in the types of cups and suction technique used, they stayed consistent in the decompressive treatment of soft tissue. They all presented positive results in favor of myofascial decompression and implications for further research.

When muscle injuries, such as a strain occur, the fascia surrounding the muscle lays down in a randomized patter similar to muscle tissue.[5] When the cups are placed on the skin not only are the increasing blood flow, but if a larger cup is used it can also grab onto the connective tissue and stretch it.[1] When an injury occurs the fascia at that site is damaged, but the fascia in distant areas being tight may be the cause of the problem and also will need to be addressed.[10] By mobilizing the fascia and increasing blood flow, therapists can then go back and use neuromuscular exercises to realign the fibers in the correct manner and preventing restrictions in range of motion. Mobilization of deep and superficial fascia lead to more efficient movement patterns, which lead to a lower risk of injury.[10]

There have not been a large amount of studies performed to look at the effectiveness of cupping therapy, but the current literature suggests it has indications for eliminating "tightness". One conclusion of that research is the need for control groups to include appropriate treatment options in future studies. All of the research thus far had positive effects on relieving tension in soft tissue in a short period of time; the next step for future research is an analysis of its effects on the athletic population. With hamstring injuries being one of the most common and long lasting injuries in athletics, clinicians need to utilize techniques that will reduce the time lost from such injuries. Myofascial decompression can have an effect on the athlete's perception of pain by eliminating some of the tightness they are experience, as well as bring a healthy exchange of nutrient rich blood. Outside of case studies, cupping therapy lacks research in a sports medicine and rehabilitation setting; thus supporting the need for this research.

CHAPTER III

METHODOLOGY

Myofascial decompression soft tissue mobilization techniques (MFD), or cupping therapy, was compared to a moist heat pack and foam rolling treatment (self-myofascial release - SMR) for hamstring muscle tightness and perceived pain as determined by digital goniometry measurements of a passive straight leg raise, a PFAQ (Perceived Functional Ability Scale) survey, and a GROC (Global Rating Of Change) scale in Division I collegiate athletes between the ages of 18-28.

It was hypothesized that using myofascial decompression to treat the soft tissue of these athletic related injuries would decrease pain, increase range of motion (ROM) and have a positive influence on patient attitude. This study will be used as a foundation for further research on the effectiveness of myofascial decompression in an athletic population.

Subjects

Seventeen division I college athletes ages 18-22, 13 males and 4 females, from Oklahoma State University were recruited to participate in this study. Subjects were randomly assigned to each group by use of a coin flip. Eight athletes served as the control group of a moist heat pack and foam rolling treatment (SMR), and nine participated in the experimental group of the myofascial decompression technique (MFD). Ten athletes presented with right hamstring pathologies and seven presented with left hamstring pathologies. An institutional review board approved this study and subjects were asked to sign a consent form as well as a sworn statement they suffered their specific injury participating in team related activities before participating in the experiment. All subjects had undergone a pre-participation examination signed off on by Oklahoma State's Head Team physician and were cleared for the physical activity level of division I competition. Subjects were selected on the criteria suggesting symptoms of a hamstring strain as reported by their athletic trainer. Symptoms ranged from acute to chronic, but none of the subjects presented anything greater than a grade I hamstring injury and were all participating in some form of activity. Subjects complained of symptoms such as; tightness, pain, decreased strength, and decreased flexibility. None of the subjects in the study had received cupping therapy prior to this study for this specific injury. Prior to data collection the participants were informed to tell the investigator if the treatment becomes too painful or uncomfortable, at which point to treatment would stop. All of the subjects in the study were able to complete the full intervention in both the intervention group and the control group.

Materials

A large crescent IASTM soft tissue instrument was utilized for the pre-treatment regional scan. The cupping set used was a Steady Ease standard kit of 24 plastic valve cups that use a hand pump to control suction levels. The medium between the cups and the skin to allow for sliding was a Graston Technique soft tissue emollient (Graston Technique, Indianapolis, Indiana). For the control group a standard MEDCO heat pack (Patterson Medical, Warrenville, Illinois) and Premium EVA foam roller (SPRI Products, Libertyville, Illinois) were used for treatment. The range of motion measurements were taken with a Mitutoyo Pro 360 digital protractor (Mitutoyo American Corporation, Aurora, Illinois).

Figure 1: Large Crescent IASTM Tool

Procedure

Before any measures were recorded each subject signed a consent form. All subjects completed a single pre and post range of motion measure that was assessed using a Mitutoyo Pro 360 digital protractor and a passive straight leg raise. The subjects involved leg was passively raised by the investigator until the subject verbally indicated they reached their limit or until the subject began to compensate at the hip joint or knee joint. The knee was maintained in full extension by applied pressure to the front of the knee by the investigator's hand. The measure was only taken once each time so the repeated movement didn't affect the tissue length. Subjects also completed the Perceived Functional Ability Questionnaire (PFAQ) survey prior to and after treatment to assess the patient's perception of the treatment.[21] Subjects were instructed to answer the questions based on how they were feeling at that particular moment. The PFAQ is an eight question scale that assesses the patients' perceived ability in six domains of functional ability; health, flexibility, muscular strength, pain, restriction of sport, and skill performance. (Apendix A)   Subjects assigned to the control group received a moist heat pack for 10 minutes and then were instructed to place the area they felt the most tightness on the foam roller for 90 seconds and then rolled out the rest of the hamstring muscles for 1 minute. Immediately after the interventions range of motion was measured, followed by a second subjective measure using the

PFAQ. After intervention treatment subjects also completed the Global Rating of Change Scale (GROC). Subjects were asked to select a phrase on the GROC that best described how they were feeling after their treatment. The scale was designed to quantify a patient's improvement or deterioration over the given time to determine the effectiveness of the treatment based on the perception of the subject.[22] The scale has 15 possible answers ranging from +7 ("a very great deal better") to -7 ("a very great deal worse"), with an option of 0 ("about the same").[22] Jaeschke noted the clinical relevance of the scale, its adequate reproducibility, and sensitivity to change.[22] The open nature of the questions make it easy for both the patient and the clinician to understand.[22] Given the population and nature of this study, the GROC was the most appropriate scale to use. The GROC scale can be found in Appendix A. A moist heat pack and foam rolling was chosen because of its common use as a treatment for hamstring injuries in athletic populations.

Subjects randomly assigned to the experiment group completed a single myofascial decompression treatment with the same pre and post measures recorded. The study used one trained clinician with three years of experience for all cupping treatments performed in the study to ensure treatment consistency. Treatments were all consistent in length and parameter, allowing only a small variability due to the different individual pathologies. Those small differences were only a matter of seconds utilized to attach a higher number of cups to the skin. Treatment began with a light scraping of the area using an IASTM soft tissue instrument to increase blood flow and screen for soft tissue adhesions. The cups (YCY Better Health Centre, Vancouver B.C., Canada) were then placed in an anatomically inspired pattern, and left for three minutes while the athlete was instructed to relax. (Figure 2) Following the three minutes the athlete performed a series of active movement patterns, ten hamstring curls, and ten prone straight leg raises with the cups in place. (Figure 3) The clinician then passively took the athlete's leg through passive range of motion with the cups still in place. The final step of the treatment was a sliding of the cups along the treatment area following a distal to proximal pattern. As soon as the cups were removed post measures for range of motion were taken immediately, then the post measure PFAQ and GROC were also completed.

Figure 2: Subject lying relaxed with the cups attached

All data was uploaded into SPSS. Descriptives for all variables were calculated. A paired samples T-test and a one way ANOVA were performed to assess data. The paired samples T-test was utilized to identify the range of motion differences for both treatment types, while the ANOVA compared the differences between the two treatment types.

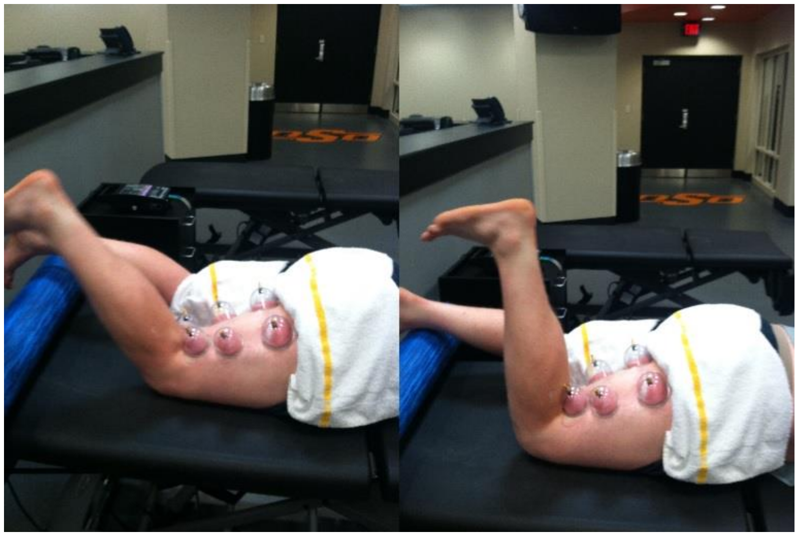

Figure 3: Hamstring curl progression performed by the subject with the cups attached

CHAPTER IV

FINDINGS

Data was collected from a total of 17 student athletes, [13 males (20.6+/- years, 184.9+/-cm, 90.8+/-kg) and 4 females (20.5+/-years, 167.1+/-cm, 62.7+/-kg)]. Ages of participants ranged from 18-22 years old. Subjects were student athletes from football, baseball, softball, and track and field. Ten of the subjects presented injuries to their right leg and 7 presented with injuries to the left leg. A total of 9 subjects received the myofascial decompression (MFD) intervention (8 males, 1 female) and a total of 8 subjects were randomly selected to the control (SMR) group (5 males, 3 females).

A paired samples T-test was used to compared pre and post measurements for range of motion and each of the PFAQ questions for all participants. This t-test did not take into consideration the type of treatment, instead was investigating the influence of an intervention. A summary of the results can be found in table 1. A statistically significant difference was found for an overall improvement in post treatment range of motion measures ($t=-3.10, p=0.01$), indicating that both treatment groups improved range of motion. The ANOVA showed a statistically significant difference for the range of motion measure in favor of the intervention group. (See Table 2) Three of the eight PFAQ questions were also found to be statistically significant in both groups, with another trending toward significance. The first question on the PFAQ was trending toward significance asked subjects, “At this moment how would you rate your overall physical health?”. Results of the PFAQ showed that subjects found an overall improvement in muscular flexibility (p=0.03), muscular flexibility of the affected body part (p=0.00), and an overall improvement in muscular strength of the hamstrings (p=0.03) regardless of which treatment they received.

Variable	Measure	Mean	SD	t	sig
ROM	Pre	74.69	15.96		
	Post	78.76	17.64	-3.10	0.01*
Overall physical health	Pre	5.47	1.88		
	Post	6.00	1.50	-2.05	0.06
Overall muscular flexibility	Pre	4.65	1.97		
	Post	5.06	1.89	-2.38	0.03*
Flexibility of hamstring	Pre	3.00	1.06		
	Post	4.00	1.28	-5.83	0.00*
Overall muscular strength	Pre	5.88	1.41		
	Post	6.18	1.24	-1.77	0.10
Strength of hamstrings	Pre	4.18	1.38		
	Post	4.71	1.45	-2.31	0.03
Pain in hamstrings	Pre	4.41	1.84		
	Post	3.94	1.89	1.58	0.13
Effect on sport performance	Pre	5.41	1.66		
	Post	5.29	1.86	0.52	0.61
Effect of activities of daily living	Pre	2.65	2.21		
	Post	2.53	2.27	1.46	0.16

Table 1: Paired Samples T-Test Overall Model N=17. * indicates significance at p= <.05.

A one-way ANOVA was also used to compare the difference calculated between pre and post measures of the two individual groups, the intervention group and control group. Results can be found in Table 2. When looking at the differences in range of motion between the two groups, there were no statistical differences. When comparing MFD and the SMR groups, statistically significant differences were found in only one measure. Subjects receiving MFD had better perceived hamstring flexibility compared to those who received the moist heat pack and foam roll mobilization ($F_{(1,15)}$=5.43,p=.034).

The GROC scale was utilized in attempt to gain an observable difference between how subjects felt after their treatment in the control group and in the intervention group. Subjects were asked to select a single phrase following their treatment, each of which carried a numeric value. Statistically significant differences ($F_{(1,15)}$=11.68,p=0.00) were found in the GROC, with patients who received myofascial decompression having higher scores. On average, subjects rated their overall condition as “moderately better” after receiving MFD whereas subjects receiving SMR indicated their overall condition ranged from “a tiny bit better” to “a little bit better”.

Variable	Treatment	Mean	SD	95% Confidence Interval	$F_{(1,15)}$	Sig
ROM	MFD	3.68	7.22	-2.36, 9.71		
	SMR	4.42	3.55	1.69, 7.15		
	Total	4.07	5.41	1.29, 6.85	0.08	0.79
Overall physical health	MFD	0.13	0.35	-.17, .42		
	SMR	0.89	1.36	-.16, 1.94		
	Total	0.53	1.07	-.02, 1.08	2.35	0.15
Overall muscular flexibility	MFD	0.13	0.35	-.17, .42		
	SMR	0.67	0.87	.00, 1.33		
	Total	0.41	0.71	.05, .78	2.71	0.12
Flexibility of hamstring	MFD	0.63	0.52	.19, 1.06		
	SMR	1.33	0.71	.79, 1.88		
	Total	1.00	0.71	.64, 1.36	5.43	0.034*
Overall muscular strength	MFD	0.00	0.00	0.00, 0.00		
	SMR	0.56	0.88	-.12, 1.23		
	Total	0.29	0.69	-.06, .65	3.15	0.096
Strength of hamstrings	MFD	0.13	0.64	-.41, .66		
	SMR	0.89	1.05	.08, 1.70		
	Total	0.53	0.94	.04, 1.01	3.15	0.096
Pain in hamstrings	MFD	-0.25	0.89	-.99, .50		
	SMR	-0.67	1.50	-1.82, .49		
	Total	-0.47	1.23	-1.10, .16	0.47	0.50
Effect on sport performance	MFD	-0.13	0.35	-.42, .17		
	SMR	-0.11	1.27	-1.09, .86		
	Total	-0.12	0.93	-.59, .36	0.001	0.98
Effect of activities of daily living	MFD	0.00	0.00	0.00, 0.00		
	SMR	-0.22	0.44	-.56, .12		
	Total	-0.12	0.33	-.29, .05	2.02	0.18
GROC	MFD	4.00	1.32			
	SMR	1.50	1.69			
	Total				11.68	0.00

Table 2: One-Way ANOVA Results Comparing Efficacy of Myofascial Decompression and Moist Heat Packs (N=17, SMR=, MFD=) * indicates significance at p= <.05 level.

CHAPTER V

DISCUSSION

The results of this study indicate both interventions could produce positive outcomes if applied in a clinical setting, especially as it pertains to range of motion gains. Regardless of treatment group, subjects experiencing pain and tightness in the hamstring demonstrated greater hamstring flexibility using either MFD or moist heat pack and self myofascial stretching. Patient perception was also significantly effected in the myofascial decompression treatment group. However, there are some limitations that will need to be addressed.

This study is unique in its design and intervention choice. This is the first study that evaluates myofascial decompression outside the case study format, using an experimental design. It also compares its results against another common treatment intervention for the given population. The goal was to establish a foundation that clinicians and researchers can build from for negative pressure soft tissue mobilization. Numerous studies have been conducted on the Graston Technique, ART, and self-myofascial release, and other compression therapies for the indication of soft tissue mobilization. These studies have produced evidence-based data that clinicians can interject into their practice. This study will be the first to produce similar data for myofascial decompression therapy in a sports medicine setting. The specifics of this intervention differ from that of traditional cupping therapy due to the movement component that is involved. The implications for this treatment in the field of sports medicine also differ from traditional methods in regards to an expectation that speeds injury recovery.

As hypothesized the myofascial decompression treatment had a positive effect on hamstring range of motion and the subject's perception of overall health. However, from our statistical analysis we found that no matter which treatment group the subject was randomly assigned to they both had gains when looking at range of motion measures. Previous studies performed on moist heat packs and the physiology of cupping therapy can offer strong suggestions for why this occurred. The application of heat to an area of the body is generally thought to increase muscle elasticity through localized blood flow, however studies on heat have seemed to be inconclusive.[21-23] One study however compared moist heat application, cold pack application, and stretching, and found it didn't matter what intervention was chosen they all increased range of motion.[23] In adjunct with the heat pack treatment subjects were also instructed to rest the area the felt the greatest amount of tension on the foam roller and rest it for 90 seconds, then proceed to slide back and forth over the roller. The body possesses a mechanoreceptor found in fascia called the ruffini. They are mostly found in capsular tissue and respond to a slow, deep pressure stimulus that transmits a message to the central nervous system causing the brain to allow that tissue to relax.[13] Muscle and fascia are the largest sensory organ in the body containing roughly three times more sensory nerves than motor, and 20% of those are the ruffini.[13] When the subjects placed their legs over the foam roller for the given time frame the stimulation of these receptors, could explain the increases subjects experienced in range of motion.

The patients that received the myofascial decompression treatment received no outside source of heat; however patients felt significantly better after this treatment as compared to the control group. The GROC scale subjects completed after each treatment was the biggest indicator of difference between the two treatment types. The scale asked subjects selected a phrase (each carried a number weight) that best described their overall attitude toward how their hamstring felt immediately after the treatment. The mean value for patients in the myofascial decompression group was 4, as compared to the control value of 1.5. Previous research and knowledge of anatomy can help us understand why this occurred. When the cups are initially placed on the patient's leg they are left for 2-3 minutes. During this time the cups have pulled the skin and some of the fascial tissue away from the body and applied a prolonged stretch. This action stimulates the previously mentioned ruffini receptors. It has also been shown that the interstitial space contains receptors that respond to high and low threshold stimulation that have an effect on pain, as well as autonomic functions such tissue metabolism, fluid dynamics, and whole body relaxation.[13] These mechanisms further suggest a physiological reason to why subjects had an increase in range of motion, felt more flexible, and recorded GROC scores that indicate they felt better overall post treatment.

Implications

Based on the findings from this study and previous research relating to soft tissue interventions it is reasonable to suggest that myofascial decompression is an adequate intervention for soft tissue injuries. It was found to be just as effective as a moist heat pack and foam rolling for achieving gains in range of motion. When PFAQ and GROC measures were taken into consideration patients perceived less pain and more function after the myofascial decompression treatment. In rehabilitation settings myofascial decompression can be used to mobilize myofascial adhesions, increase localized blood flow, and increase lymphatic drainage before any corrective exercises take place. Athletic trainers and physical therapists could potentially start seeing better results with corrective exercise efforts if this type of treatment was added to a protocol. If we follow the CES (Corrective Exercise Specialist) model, mobility has to take place prior to strengthening.[26] Myofascial decompression has the ability to increase joint range of motion and decrease pain. If a clinician is trying to utilize corrective exercise with a patient that can't move their hip, knee, or ankle through its full range, the success rate will be much lower. Mobilizing soft tissue prior to starting exercise allows this movement to occur and provides the best situation to be successful.

Another important factor this study revealed was subjects indicated they felt better after the MFD treatment. How a patient feels about their own body or injury is an important aspect of recovery. The GROC scale allows the subject to consider what they feel is important; the subjective measure displays what is important to the subject.[22] Following an injury athletes consciously assign value to the stressors in their life.[27] The way a patient cognitively assess their injury can have an effect on their attitude toward rehabilitation of that injury and the rate of healing.[27] Wiese-Bjornstal et al (2010) identified that a patients perception of pain can affect wound healing. Clinicians can use MFD at the start of a rehabilitation session to decrease a patient's perception of pain and increase their attitude toward the rehabilitation of that injury.

Another indication for clinical use revolves around its negative pressure principle. Often therapists attempt to move trapped fluid or swelling away from the body through massage techniques or other compressive soft tissue techniques.[19] Without blood flow toxins and metabolic waste can become stagnant in local tissue.[19] Myofascial decompression has the ability to draw fluid and waste into the interstitial space to allow for natural removal.[13] Several wet cupping studies have shown significant improvements for the relief of tension caused by stagnant local waste.[2, 3, 4, 20] Through adequate hydration and stimulation of the lymphatic system myofascial decompression can appreciate the same positive effects.

It is important to point out that healthcare professionals should seek out adequate training for myofascial decompression techniques used in sports medicine prior to treating patients. This is necessary to understand safe and proper techniques to treating musculoskeletal injuries with the use of the technique. Training is available to achieve competent skill levels regarding all aspects of the technique from application to documentation.

Limitations

The biggest limitation to this study was the ability to recruit enough subjects experiencing this particular pathology. Due to the fact that it is impossible to control the amount of hamstring injuries that occurred within our athletic program during the time period for data collection, consequently resulting in only 17 subjects with hamstring pathology. Future study designs could do several things to increase subject enrollment. Increasing the time allowed for data collection, implementing a multi-sized data collection model, and not limiting the subject population to only NCAA Division I athletes are suggestions for increasing subject population. Other research investigating the treatment outcomes of manual therapy have been published utilizing low subject numbers. Baker et al (2013) studied the treatment outcomes of positional release therapy in four subjects with acute torticollis.[28] One of the limitations of this case series study is that it lacked a control or comparison group. Our study utilized an experimental case series, randomized clinical trial design that demonstrated positive outcomes as a result of the MFD treatment (overall better feeling after the treatment, improved flexibility of the hamstring, and perceived improvement in flexibility of the hamstrings). Large scale randomized clinical trial research is needed to further investigate the evidence of MFD in the treatment of musculoskeletal pathologies.

Another limitation of this study is the control group intervention. There is currently no sham intervention for cupping therapy so we had to select another common soft tissue treatment for hamstring injuries. Future studies might change the control group or compare myofascial decompression against other popular forms of soft tissue therapy in sports medicine such as Graston Technique, Active Release Technique (ART), or even dry needling.

Further limitations could have occurred with the measures selected. Subjects did not perform multiple treatments or any follow up measures due to the goals of the study. Intentions were to illustrate an accurate perception of how the intervention changed the way subjects felt in the immediate timeframe. The range of motion measure used a digital goniometer for the most accurate numbers, however a device could have been constructed to stabilize the hip joint and allow only the knee to flex and extend.

Future Research

Myofascial decompression is a technique that can be beneficial in the field of healthcare. This study has the potential to be the foundation for future study designs and research on soft tissue mobilization. Comparisons to ART, Graston Technique Instrument Assisted Soft Tissue Mobilization, fascial stretching techniques, massage, and dry needling would be beneficial for numerous reasons. Patient comfort, return from injury, and effectiveness of intervention can be measured and compared across the board. There is a need for further research on myofascial decompression and how it affects other segments of the body, how it effects different populations, and how multiple treatments can be objectively measured.

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APPENDICES

APPENDIX A

IRB Approval Letter

Oklahoma State University Institutional Review Board

Date: Thursday, October 17, 2013

IRB Application No ED13158

Proposal Title: Myofascial Decompression and Hamstring Strain Recovery in Sports Medicine

Reviewed and Processed as: Expedited

Status Recommended by Reviewer(s): Approved Protocol Expires: 10/16/2014

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Stillwater, OK 74078

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

☒ The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval. Protocol modifications requiring approval may include changes to the title, PI, advisor, funding status or sponsor, subject population composition or size, recruitment, inclusion/exclusion criteria, research site, research procedures and consent/assent process or forms.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact Dawnett Watkins 219 Cordell North (phone: 405-744-5700, dawnett.watkins@okstate.edu).

Sincerely,

Shelia M. Kennison

Shelia Kennison, Chair
Institutional Review Board

Consent Form

MYOFASCIAL DECOMPRESSION AND HAMSTRING STRAIN RECOVERY IN SPORTS MEDICINE

Principal Investigator: Zach LaCross, ATC, LAT
Graduate Assistant Football Athletic Trainer
Oklahoma State University
Co-Principal Investigator: Aric Warren, EdD, ATC, LAT, CSCS, CES
Associate Professor
Applied Health and Education Psychology
Oklahoma State University

PURPOSE OF THE STUDY

The purpose of the study is to see if Myofascial Decompression, or Cupping Therapy, when applied to hamstring muscle tightness and pain will have a positive effect. The tools used to measure this effect will be; a digital goniometer measurement of a Passive Straight Leg Raise, a Perceived Functional Ability Questionnaire, and a Patient Global Rating Scale. The population for the study will be Division I collegiate athletes between the ages of 18-28, both male and female.

PROCEDURES

All subjects will complete a single pre and post ROM of motion measure that will be assessed using a digital goniometer and a passive straight leg raise. This means the investigator will lay you prone on the table, lift your leg straight up and take a reading off an instrument. All subjects will complete the Perceived Functional Ability Questionnaire (PFAQ) survey, and Global Rating Scale (GROC) to assess the patient's perception of the treatment. The survey is attached. Subjects assigned to the control group will receive a moist heat pack for 15 and then foam roll for 1 minute after the heat pack. A moist heat pack and foam rolling was chosen because of its common use a treatment for hamstring injuries in athletics. The investigator will demonstrate how to do this for the subject. Subjects randomly assigned to the experiment group will complete a single Myofascial Decompression treatment with pre and post measures recorded. The study will use one trained clinician with three years of experience for all cupping treatments in the study to ensure the most consistency. Treatments will all be consistent in length and parameter (10-15 minutes). Before the treatment starts the subject will be asked to perform a feet together toe-touch to give them a subjective sense of hamstring tightness. Treatment will begin with a light scanning of the area using an IASTM soft tissue tool to increase blood flow and screen for soft tissue adhesions. This will not be uncomfortable. The Myofascial Decompression cups will then be attached to the subject's skin using a hand pumped to remove the air inside the cup, and then left for 3 minutes while the athlete is instructed to relax. They will be placed on the back of the subject's thigh along the line of the hamstring muscle the subject has injured. The PI will use enough cups to cover the area that the subject is complaining of. (see images below). Then the athlete will perform a series of active movement patterns, ten hamstring curls, and ten prone straight leg raises with the cups. A prone leg raise requires you to lie on your stomach and lift your leg straight back. The therapist will then passively stretch the athlete with the cups still in place. The final step of the treatment will be a sliding of the cups along the treatment area, following a distal to proximal pattern (feet to head direction). During this step approximately half of the air will be removed from the cup by pulling up on the valve that is on top of the cup, this allows the cup to slide across the skin. Once the cups are removed, again pulling up on the valve to release all of the air, post measures for ROM will be taken immediately. Then the athlete will be asked to get off the table and perform a feet together toe-touch before they fill out their post measure PFAQ Survey.

RISKS

There are no known risks associated with this project which are greater than those ordinarily encountered in daily life. The procedures being employed will not have a negative effect on the injury being treated. Some patients may experience a circular discoloration to the surface of the skin after the treatment. Typically this correlates with skin color, the lighter your skin, the better chance you have to notice the discoloration. The marks could last from 2-10 days. This discoloration is classified as a surface bruise of the skin, subjects should consult the back page of this consent form for an image of the treatment before signing this form.

BENEFITS

Benefits include using the treatment on the athlete to expedite their current rehabilitation process and relieve pain. Society will benefit from the first known study documenting quantitative values for the effectiveness of Myofascial Decompression in an athletic setting. This study may also introduce people to this treatment method.

PARTICIPANT CONFIDENTIALITY

Since subjects are all student athletes and current patients already, HIPAA is always recognized and no identifiable information is shared with anyone. The treatment will be performed in the West Endzone athletic training facility in the public treatment area for both male and female subjects. Individuals will be given a subject number. Any connection between subject number and individual's name will be kept in a separate hidden file on the investigator's password protected computer, in the investigator's locked office. Raw data will be kept in a separate hidden file on the principal investigator's locked computer. Paper recorded data will also be kept in the investigator's locked office in a locked file cabinet. Paper documentation will be destroyed once it is uploaded to the electronic file. No one other than the PI and advisor will have access to the file connecting subject number and name and raw data. Data will be kept as long as it is scientifically useful, up to a period of five years after publication.

PARTICIPANT RIGHTS

I understand that my participation is voluntary, that there is no penalty for refusal to participate, and that I am free to withdraw my consent and participation in this project at any time, without penalty. If you chose not to participate in this study, you will still be able to utilize the treatment as part of your rehabilitation, but your information will not be utilized in the data analysis.

CANCELLING THIS CONSENT AND AUTHORIZATION

You may withdraw your consent to participate in this study at any time. You also have the right to cancel your permission to use and disclose information collected about you, in writing, at any time, by sending your written request to: Zach LaCross at zach.lacross@okstate.edu. If you cancel permission to use your information, the researchers will stop collecting additional information about you. However, the research team may have used and disclosed information that was gathered before they received your cancellation, as described above.

QUESTIONS ABOUT PARTICIPATION

Questions about procedures should be directed to the researcher(s) listed at the end of this consent form. Subjects may also contact the IRB office with any questions regarding their rights on this consent form. The IRB can be contacted at (405) 744-3377 or email at irb@okstate.edu.

PARTICIPANT CERTIFICATION:

I have read this Consent Form. I have had the opportunity to ask, and I have received answers to, any questions I had regarding the study. I understand that if I have any additional questions about my rights as a research subject I need to contact the Investigator.

I agree to take part in this study as a research participant. By my signature I affirm that I am at least 18 years old and that I have received a copy of this Consent and Authorization form.

____________________________ ____________________
Type/Print Participant's Name Date

____
Participant's Signature

I certify that I have personally explained this document before requesting that the participant sign it.

____________________ ____________
Signature of Researcher Date

Researcher Contact Information

Zach LaCross, ATC, LAT

Aric Warren, EdD, ATC, LAT, CSCS, CES

PFAQ Scale

ID number

In the following questionnaire you will be asked to rate your overall physical health, muscular flexibility, and muscular strength. You will also be asked to rate these relative to a affected body part. You will also be asked to rate your pain and ability to perform sport specific activities or activities of daily living.

>>

Please indicate if this is the first or second time you have completed this survey

- First (Pre)
- Second (Post)

>>

Please rate the following by circling the most appropriate number

	Poor				Good				Excellent	
	0	1	2	3	4	5	6	7	8	10
At this moment how would you rate your overall physical health?										

Please rate the following by circling the most appropriate number

	Poor				Good				Excellent	
	0	1	2	3	4	5	6	7	8	10
How would you rate your overall muscular flexibility?										

Please rate the following by circling the most appropriate number

	Poor				Good				Excellent	
	0	1	2	3	4	5	6	7	8	10
How would you rate the muscular flexibility of the affected body part?										

Please rate the following by circling the most appropriate number

	Poor				Good				Excellent	
	0	1	2	3	4	5	6	7	8	10
How would you rate your overall muscular strength?										

Please rate the following by circling the most appropriate number

	Poor				Good				Excellent	
	0	1	2	3	4	5	6	7	8	10
How would you rate the muscular strength of the affected body part?										

	None								Debilitating
	0	1	2	3	4	5	6	7	8	10
How would you rate your pain in the affected body part?										

>>

Please rate the following (note the different scale form the one used previously) by circling the most appropriate number

	No effect							Not able to perform		
	0	1	2	3	4	5	6	7	8	10
How does the affected body part effect your sport/skill performance?										

Please rate the following (note the different scale form the one used previously) by circling the most appropriate number

	No effect							Not able to perform		
	0	1	2	3	4	5	6	7	8	10
How does the affected body part effect your activities of daily living?										

>>

GROC Scale

Subject #:____________________

PATIENT GLOBAL RATING

Date:________/________/________
mm dd yy

Please rate the overall condition of your shoulder ***from the time that you began treatment until now*** (check only one):

☐ A very great deal worse (-7)	☐ About the same (0)	☐ A very great deal better (+7)
☐ A great deal worse (-6)		☐ A great deal better (+6)
☐ Quite a bit worse (-5)		☐ Quite a bit better (+5)
☐ Moderately worse (-4)		☐ Moderately better (+4)
☐ Somewhat worse (-3)		☐ Somewhat better (+3)
☐ A little bit worse (-2)		☐ A little bit better (+2)
☐ A tiny bit worse (almost the same) (-1)		☐ A tiny bit better (almost the same) (+1)

Any rating of lower than somewhat worse requires a comment from the therapist (ie..speculate on the cause of status change).

VITA

Zach Thomas LaCross

Candidate for the Degree of

Master of Science

Thesis: TREATMENT OUTCOMES OF MYOFASCIAL DECOMPRESSION ON HAMSTRING PATHOLOGY

Major Field: HEATLH AND HUMAN PERFORMANCE - ATHLETIC TRAINING

Biographical:

Education:

Completed the requirements for the Master of Science in your major at Oklahoma State University, Stillwater, Oklahoma in May, 2014.

Completed the requirements for the Bachelor of Science in your major at Eastern Michigan University, Ypsilanti, Michigan in 2011.

Experience: University of California at Berkeley Intern Athletic Trainer, 2011
Northwestern University Athletic Training Intern, 2011-2012

Professional Memberships: National Athletic Trainer's Association