Massage Therapists' Association of British Columbia

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Clinical Case Report Competition

West Coast College of Massage Therapy, Victoria

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First Place Winner

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The effects of massage therapy on motion restriction and pain resulting from a chronic ankle injury involving an inversion sprain, fibular fracture and avulsion fracture: A case study

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Table Of contents:

Abstract

Objective: Is massage therapy an effective treatment for motion restriction and pain in the ankle of a patient with a chronic ankle injury including and inversion sprain and fibular fracture?

Clinical Features: Patient is a 27 year old athletic female. Her left ankle presents with decreased range of motion and significant pain in her lower left leg and ankle. Symptoms are the result of an injury obtained 11 months prior involving an oblique fracture of the fibular head, an avulsion fracture and a grade-3 inversion sprain. Patient complains that symptoms increase with activity and also notes observing mild to moderate instability in the affected ankle. Signs and symptoms have also caused a decreased state of athletic competence.

Methods: Patient received 9 treatments, 60 minutes each; over a period of 10 weeks, as well as a homecare plan. All treatments followed very similar protocol, each with minor modifications to suit the patient's rehabilitative progression. Techniques used included myofascial release, trigger point release, joint mobilization, stretching, attachment release and general Swedish massage. The homecare plan involved active ankle movement, stretching, strengthening and stabilizing exercises, as well as cold hydrotherapy applications after treatments and exercise.

Results: Pain at rest, during exercise, and post exercise all decreased steadily throughout the course of treatment. Active range of motion of the affected ankle increased significantly throughout the course of treatment. An increase in stability of the affected ankle was achieved and athletic competence regained.

Conclusion: In this case, massage therapy, combined with a homecare plan, proved to be effective in the treatment of pain and motion restriction in a chronic ankle injury involving an inversion sprain, fibular fracture and avulsion fracture.

Key words: massage therapy, inversion ankle sprain, fractured fibula, decreased range of motion

Introduction

Ankle injuries, specifically sprains and fractures, are among the most common orthopedic injuries, occurring in anyone from well-trained athletes to the sedentary and elderly. This is not surprising when you consider the fact that the ankles are often in a position of supporting a person's entire body weight. Sprains are the most common foot and ankle injury. They account for approximately 85% of all ankle injuries. Of the patients who suffer sprains, it is estimated that as many as 50% will have a recurrence. (1)

A sprain is caused by a trauma-related sudden twist or wrench of the joint beyond its normal range of motion. Contributing factors include congenital ligament laxity, previous sprains to the joint, altered biomechanics that place stress on the ligament and joint, and connective tissue pathologies such as rheumatoid arthritis. (2) When an ankle sprain happens and the ligament is stretched beyond its natural range, it may be either partially or completely torn. The severity of a sprain can be graded 1-3. Grade 1 is a minor stretch and tear to the ligament. Grade 2 involves significant tearing of the ligament fibers. Grade 3 is either a complete rupture of the ligament itself or an avulsion fracture in which the bony attachment of the ligament is torn off, while the ligament remains intact. (2) The most common type of ankle sprain is an inversion sprain. This occurs when the ankle is twisted or rolled inwards overstretching ligaments on the lateral side of the foot. The opposite can occur with an eversion sprain when the foot is twisted or rolled outwards and the medial ligament is overstretched. Due to the anatomical structure of the foot and ankle, eversion injuries are much less common and are often accompanied by fractures or other structural damage.

The diagnosis of an ankle sprain is considered when a patient gives a history of "turning" or "rolling" his or her ankle, accompanied by sudden pain and swelling. Physical exam will reveal bruising with point tenderness over the injured ligaments. Ligament testing may reveal abnormally increased motion with grade 2 or 3 sprains (3). Depending on the grade of sprain, the patient may or may not be able to continue activity. With a grade 2 or 3 sprain, a snapping noise may be heard at the time of injury.

Immediate care is paramount when it comes to treating a sprained ankle. Ice should be applied as soon as possible, accompanied by rest, elevation, compression, and protection from further injury by use of a splint, crutches, and/ or a compression wrap. Rehabilitation is very pivotal in correct healing and prevention of recurrent injury. Rehabilitation for an ankle sprain involves re-training the body's proprioception through progressive strength and stabilization exercises. In most cases, if treated and rehabilitated correctly, a sprained ankle can return to near full strength, stability, and range of motion without surgical intervention. However in some cases, surgery is necessary to re-attach ligaments and re-establish ankle stability.

An Ankle fracture, commonly referred to as broken ankle, is the second most common ankle injury. Any of the 3 bones that constitute the ankle may be involved. Fractures occur when excessive stress is placed on a bone. This may happen as the result of any number of causes, such as blunt force trauma directly over the bone, repetitive overuse injuries causing stress fractures, or severe sprains causing avulsion fractures. Fractures may also occur when the foot is firmly planted and the body gets twisted, or when a running or jumping athlete lands on an uneven surface. (4)

The diagnosis of an ankle fracture is considered when a patient gives a history of an event that may have placed excessive stress on a bone, accompanied by pain and swelling. The physical exam will reveal tenderness over the involved bones. Possible deformity and severe swelling of the ankle may be present. X-rays are needed to confirm the fracture and plan for treatment. Occasionally, a CT or MRI is ordered to evaluate the cartilage or tendons around the ankle. (4) Typical treatment for a broken ankle involves the patient's lower leg being casted for several weeks, after which physical therapy is necessary to regain lost muscle strength and complete the healing process. With more severe fractures, surgery involving the placement of screws and plates may be necessary. (4)

Some preventative measures used to help avoid ankle injuries include; building and maintaining strength of the muscles around the ankle joint, ankle taping, bracing or wearing splints, wearing high top shoes and performing proprioceptive exercises to heighten balance and stability. Long term residual effects of a sprained or fractured ankle may include; pain at rest or with activity, joint stiffness, decreased active and passive range of motion, decreased balance, stability and proprioception, and inability to fully return to activities. The goal of this case study is to determine whether massage therapy can serve as an effective treatment for motion restriction and pain in the ankle of a patient with a chronic ankle injury including and inversion sprain, fibular fracture and avulsion fracture.

Anatomy and Kinesiology

The ankle is the point of junction between the lower leg and the foot. The bones of the lower leg include the tibia, which is the larger more medial bone, and the fibula, which is the narrower more lateral bone. The bones of the foot include the seven tarsals, (calcaneus, talus, navicular, cuboid and 3 cuneiforms) which form the skeletal framework for the ankle, five metatarsals, and the phalanges, which are the bones of the toes. (5)

There are 3 main joints that contribute to the stability and mobility of the ankle: the inferior talofibular joint, the talocrural joint and the subtalar joint. The most significant of these 3 joints is the talocrural joint. It is the articulation between the distal tibia and fibula and the body of the talus. (6) Together, the distal ends of the tibia and fibula form the ankle mortise, which is a deep socket, shaped to accommodate the talus. The talus is a wedge shaped bone, wider anteriorly. Cartilage lines the almost continuous articulating bone surfaces in the mortise, as well as the articulating surface of the talus. The medial portion of the distal end of the tibia is known and the medial malleolus. It is the bulbous boney protuberance that can be easily seen and palpated on the medial ankle. The lateral distal end of the fibula, known as the lateral malleolus, is slightly more distal and can be easily seen and palpated on the lateral ankle.

A joint capsule and ligaments are in place to stabilize the talocrural joint. The fibrous capsule, which is lined with a synovial membrane, attaches at the margins of the articular surfaces of the talus, the tibia and the fibula. (7) The capsule is fairly thin and especially weak anteriorly and posteriorly. Therefore the stability of the ankle depends primarily on an intact ligamentous structure. (6)

There are two major ligaments that stabilize the talocrural joint. Medially is the medial collateral ligament (MCL), commonly referred to as the deltoid ligament, and laterally is the lateral collateral ligament (LCL). The deltoid ligament is large, strong and triangular in shape. Its apex is attached superiorly to the medial malleolus and its broad base attaches below to the navicular, the talus and the calcaneus. (5) It serves to prevent excessive ankle eversion and pronation. The lateral ligaments, unlike the medial side, are separate bands of fibers diverging from their proximal attachment at the distal end of the fibula. (7) These lateral ligaments include the anterior talofibular ligament, the calcaneofibular ligament and the posterior talofibular ligament. The anterior talofibular ligament, which runs from the lateral malleolus to the neck of the talus, is the most commonly injured ligament in the ankle. In the neutral position, the ligament checks posterior movement and external rotation of the leg on the tarsus. With the foot in plantar flexion, the ligament becomes more vertically oriented and is in a position to check inversion of the talus in the mortise. (7) An inversion stress can result in a partial or complete tear of the anterior talofibular ligament and often the calcaneofibular ligament, which runs from the lateral malleolus to the lateral calcaneus. The posterior talofibular ligament, the strongest of the lateral ligaments, runs from the lateral malleolus to the posterior aspect of the talus and is torn only with massive inversion stresses. (8) As a whole, the LCL serves to prevent excessive inversion and supination.

The talocrural joint is classified as a hinge joint. Its motions are dorsiflexion and plantarflexion. Dorsiflexion is movement of the dorsal surface of the foot up towards the anterior surface of the leg. (9) This motion is produced primarily by the tibialis anterior muscle. Plantarflexion is movement of the plantar surface of the foot down towards the posterior surface of the leg (9). Primarily the soleus and gastrocnemius muscles produce this motion. The stable, close-packed position of the talocrural joint is dorsiflexion. The more vulnerable, loose-packed position is plantarflexion. Body weight is transmitted through the talocrural joint when weight bearing, about 90% of which is transmitted to the tibia, while the fibula holds only minimal weight bearing responsibility.

The distal tibiofibular joint is a syndesmosis, or fibrous union, between the concave facet of the tibia and the convex facet of the fibula. (7) The 2 bones are held together by inferior aspect of the interosseous membrane and by the anterior and posterior tibiofibular ligaments. Stability of the distal tibiofibular joint is important for stability of the mortise and, therefore, the stability of the ankle. (6) Although the joint is a fibrous union, it does allow very slight movement. The malleoli may separate up to 2mm to accommodate the wider anterior talus with dorsiflexion of the foot. (7)

The subtalar joint is the articulation of the inferior surface of the talus with the calcaneus. The MCL and LCL, as well as a number of other small ligaments, stabilize this joint. It is here that the motions of inversion, the twisting of the foot inward, and eversion, the twisting of the foot outward, occur. During active movement, inversion naturally occurs with plantarflexion and adduction.

Combined, these 3 movements produce supination. Eversion, during active movement, naturally occurs in combination with dorsiflexion and abduction, producing the movement knows as pronation. The peroneal muscles are the main muscles that produce pronation while the tibialis anterior produces supination.

For visual display and normal ranges of motion, see Appendix A and B.

Clinical Features

The subject in this case study is a 27-year-old female. She is a full time student who plays competitive soccer and frequently participates in yoga classes. She presented for treatment of her left ankle 11 months after injuring it during a soccer game. At the time of injury, the patient was weight bearing on her right leg with her left leg flexed at the hip, extended at the knee and plantar flexed at the ankle. The patient was in the process of kicking the ball with her left foot when the defending goal-keeper attempted to claim the ball by diving and landing with her full body weight on the patient's outstretched left leg. The patient's left ankle was forced far beyond normal range into extreme inversion. Previous to this incident the patient had no history of ankle injury.

The patient described feeling immediate "lightning like pain" followed by numbness in her left leg, ankle and foot. She did not hear any snapping or cracking noise at the time of injury, possibly due to the high volume of surrounding players and bystanders. The patient was carried off the field and unable to return to play. Immediate swelling was present and ice was applied, along with elevation, as soon as the patient was off the field. After the game, the patient was carried to her car and she drover herself home despite being unable to move her left ankle. She continued to ice and elevate her ankle that night, and the next day she attended a walk–in-clinic where she saw a doctor who assessed her ankle, sent her for x-rays, and diagnosed her as having obtained a grade 3 inversion sprain. X-rays later revealed an avulsion of the posterior talofibular ligament with a fracture at the site of avulsion.

The patient began using crutches the day after the injury. She continued to ice her ankle every day as well as using tape to compress and stabilize her ankle for the first 2.5 weeks post injury. At no point was her ankle casted or any sort of hard splint or brace used. The patient began physiotherapy one week after the injury. She attended physiotherapy sessions 3 times per week for approximately 6 weeks, and then continued with one physiotherapy session per week for approximately 10 weeks. Three months after the injury, the patient also began seeking treatment through massage therapy. She attended appointments with a Registered Massage Therapist, receiving 60-minute treatments, once a week, for 3 months. Three months post injury the patient was complaining of persistent pain and her signs and symptoms were not subsiding. The physiotherapist recognized that the recovery process was not progressing at the expected rate and the patient was sent for a second set of x-rays and a CT scan. These tests revealed an oblique fracture at the distal end of the fibula that had not been discovered with the initial x-rays. (See attached CT images)

At eleven months post injury, the patient had just recently returned to playing soccer. She reported slight pain at rest, just inferior to her lateral malleolus, as well as experiencing constant nagging pain in her lower leg and ankle. Aggravating activities included playing soccer, doing yoga, and allowing her ankle to hang. She was experiencing frequent severe calf cramps and reported finding it hard to walk after soccer. The pain was so severe that the patient was unable to put her ski boots on, an activity that previous to the accident would not have produced any pain. The patient was not taking any medications. Temporary moderate relief was being achieved through the use of stretches, self-massage and myofascial work, as well as applying Traumeel- a topical homeopathic anti-inflammatory cream.

The patient reported that the ankle had not locked or given out since the injury, but she described it as feeling weak, unstable and very stiff with range of motion being limited. She also reported that after standing or running for more than 10 minutes swelling would appear under the left lateral malleolus. The patient rated the worst pain, which occurred after playing soccer, as being a 6/10 on the pain scale (see Appendix C). Pain during soccer was rated a 5/10 on the pain scale. Varying degrees of pain at rest were reported with very little time spent in a pain-free state. As an athletic and competitive individual, the patient expressed an eager desire to regain range of motion and stability and to decrease pain in order to reclaim her athletic competence.

Assessment

Initial assessment included postural observation, active range of motion testing, palpation, stability testing, muscle strength testing, and inquiry about any neurological abnormalities. Postural observation revealed that when weight bearing, the patient stood with the left foot slightly pronated. The calf muscles of the left leg were slightly smaller than the right. There was also slight swelling visible on the lateral left ankle. Other postural features included a possibly anteriorly rotated pelvis, a lowered left shoulder and a left side tilted head.

The patient's left ankle had reduced active ranges of motion in all directions, (see appendix E). With muscle testing, all right leg muscles scored a 5, while the left soleus, gastrocnemius and tibialis anterior scored 4.5 and the left peroneals scored 4 (see Appendix D). Pain was produced with left peroneal and gastrocnemius muscles tests. The patient described feeling deep pain in the posterior leg when pushing the active limits of dorsiflexion. She also described experiencing deep pain along the lateral tibia when pushing the limits of active plantarflexion. Both painful motions were rated a 3/10 on the pain scale. Points of tenderness were identified on the dorsal surface of the left ankle, as well as on the lateral ankle just inferior to the malleolus and on the medial ankle. The patient was able to hop 5 times on her left foot as well as do a 1-legged squat with her eyes closed. Both actions were pain free, but slight instability was noted on the left side. No neurological referral or abnormalities were noted. X-rays and CT images were presented for therapist review, with the oblique fracture of the fibular head visibly apparent. (See attached CT images)

All tests performed in initial assessment were also performed at the end of the final treatment. Shorter assessment was performed at the beginnings of treatments 2-8. The same 3 areas of point tenderness were assessed and rated on the pain scale, and active ranges of motion were charted at the beginning of every treatment except the second. Also, measurements of pain at rest were taken at the beginning and end of each treatment.

It was determined during initial assessment that the patient's goals for treatment were to increase joint motion and mobility, specifically plantarflexion and dorsiflexion, to decrease pain, and to increase stability and regain athletic competence.

Methods

The patient attended nine 60-minute appointments over a 10-week span. The first appointment was 328 days after the injury occurred. It consisted of 40 minutes of interview and assessment, followed by 20 minutes of treatment. The subsequent 8 treatments included an average of 10 minutes of assessment and 50 minutes of treatment. All treatments were focused primarily on the left lower leg, ankle and foot. Treatment of other areas was kept minimal with only 1 quick set of compressions to the right leg and left upper leg at the beginning of each treatment. This was done in order to open circulation and to encourage patient relaxation and a decrease in muscle guarding.

The first treatment was fairly short and gentle. It included myofascial release techniques (MFR), passive range of motion (PROM) and grade 2 distractions of the talocrural and subtalar joint. This treatment served largely as a trial run to observe how the patient responded to manual therapy.

Treatments 2-9 were longer and more aggressive and all followed a very similar protocol. These treatments began with approximately 10 minutes of MFR techniques including cross-hands, shearing and skin rolling. These were done in order to release fascial adhesions and restrictions. The next area of focus was on relieving tension and releasing trigger points in the soleus, gastrocnemius, tibialis anterior and peroneal muscles. Approximately 30 minutes was spent using muscle stripping to beak up adhesions and align muscle fibers, as well as ischemic compression to release trigger points as they were located. General Swedish massage (GSM) was performed intermittently with these more aggressive techniques in order to flush out the area and to sooth pain as necessary. Approximately 5 minutes was spent performing joint mobilizations on the talocrural joint each treatment. Anterior glide was applied with grade 1 distraction in order to increase plantarflexion. Posterior glide was applied with grade 1 distraction in order to increase dorsiflexion. Grade 2 and 3 distractions were used to decrease pain and to maintain and increase capsular mobility. At the end of each treatment, approximately 5 minutes was spent performing stretches to lengthen muscles and thereby increase range of motion. Agonist contraction of the gastrocnemius and soleus muscles was performed to increase dorsiflexion. Contract/ relax stretches were performed on the tibialis anterior and peroneal muscles to increase plantarflexion, eversion and inversion. However, these contract/ relax stretches were done gently due to patient apprehension. During treatments 6-9, a couple of minutes were also spent performing frictions and attachment release at the insertions of the tibialis anterior and peroneal muscles. These techniques were performed in order to break up adhesions and increase muscle length, thereby increasing available range of motion.

In order to maximize results of treatment and further increase speed and quality of rehabilitation, a homecare plan was provided for the patient at the first appointment. It was suggested that, in order to increase range of motion, she perform active range of motion exercises with her left ankle at least 2 times per day. She was instructed to go to the end range of free active motion and attempt to actively move a bit further than was naturally comfortable, not however pushing so hard as to induce pain. The patient was advised to strengthen her peroneal muscles with theraband exercises, doing 2 sets of 15 repetitions daily. A progressive stabilizing exercise was recommended in which the patient spent 5 minutes per day standing on the injured foot with her eyes closed. If this became too easy, moving onto a softer surface, such as a pillow or a wobble board, was advised to increases intensity. It was also suggested that, in order to decrease swelling and inflammation, the patient apply cold hydrotherapy for 10 minutes after treatments and after playing soccer or participating in any strenuous physical activity. The patient was encouraged to continue with this homecare throughout the entirety of treatment. She was also encouraged to continue playing soccer and doing yoga as a means to stretch, strengthen and stabilize her injured ankle.

For the most part, the patient was quite diligent with her homecare. She reported performing her active range of motion exercises daily, continuing with her soccer and yoga activities, doing the one-foot stabilizing exercise most days, and also consistently icing her ankle post treatment and after strenuous activity.

Results

Positive results were evident nearly immediately. After just two treatments, active dorsiflexion and pronation had doubled, plantarflexion had increased by 10 degrees and supination had increased by 5 degrees. Active dorsiflexion and plantarflexion continued to increase as treatments progressed. Supination and pronation however did not increase beyond the ranges achieved at the third appointment.

Pain at the three monitored points of tenderness decreased during the course of treatment. Tenderness on the medial ankle decreased from 1.5 to zero. Pain on the dorsal surface of the ankle decreased from 2 to zero, and pain on the lateral ankle decreased from 5 to 1 but then rose back up to 2.5. Pain at rest varied at each pre and post treatment assessment, but showed an overall decrease with time. At the final appointment the patient reported playing a whole game of soccer without noticing any pain in her ankle, and subsequently experienced no pain after the soccer game. This was a great improvement from the high levels of pain with activity that were reported during initial assessment. The patient also reported a cessation of calf cramps, which were frequent and intense at the beginning of treatment. All four muscles that scored less than 5 with initial manual muscle tests, showed increased strength and, scored 5 with manual muscle testing in final assessment. Pain with soleus muscle testing decreased to 0.5 while all other muscle tests were performed pain free during final assessment. Comparison of stability testing at the initial and final assessments showed an increase in proprioception and stability, and the patient reported increased confidence and athletic competence. Goals of increasing range of motion, especially plantarflexion and dorsiflexion, decreasing pain, increasing stability and regaining athletic competence, were all achieved.

Discussion

In this case, one of the most detrimental factors to the patient's recovery is the fact that the oblique fracture was not discovered until 3 months post injury. Because the leg was never casted, as such an injury should be, the patient was weight bearing on the injured ankle much earlier than she should have been. The forces placed on the injured structures, by contracting musculature while weight bearing, quite likely slowed the healing process and caused and increased amount of scar tissue. With increased scar tissue, more time and work is required to regain tissue quality, return to pre-injury state and reclaim lost range of motion. Therefore, it was to be expected that, in the case of this patient, recovery time and rehabilitation processes might be more complex and lengthily than an average, properly treated ankle injury.

When considering ranges of motion that were increased with treatment, it is important to consider the goals and precautions around increasing joint mobility. After an inversion ankle sprain, the LCL is compromised and does not regain full strength and stability. Therefore, it is not fully competent and may not provide enough stability to prevent excessive movement. Regaining full range of ankle supination is not a goal or a desired result.

In the case of this patient, manual therapy in areas other than the lower left leg, ankle and foot may have been beneficial in the healing process. As an active athletic individual, tension and soreness were noted in areas proximal to the areas treated. In initial assessment it was observed that the patients hips were possibly in need of adjustment. Also, one week into treatment, the patient complained of a strained left quad. These areas were left untreated in order to preserve the methodical treatment protocol followed during the case study treatments. However, such issues and injuries may aggravate existing issues, create further imbalances, and possibly slow or prevent recovery of the area being treated. Compensating or other problematic areas should be treated in order to maximize the effects of massage therapy on an injury such as the one treated in this case.

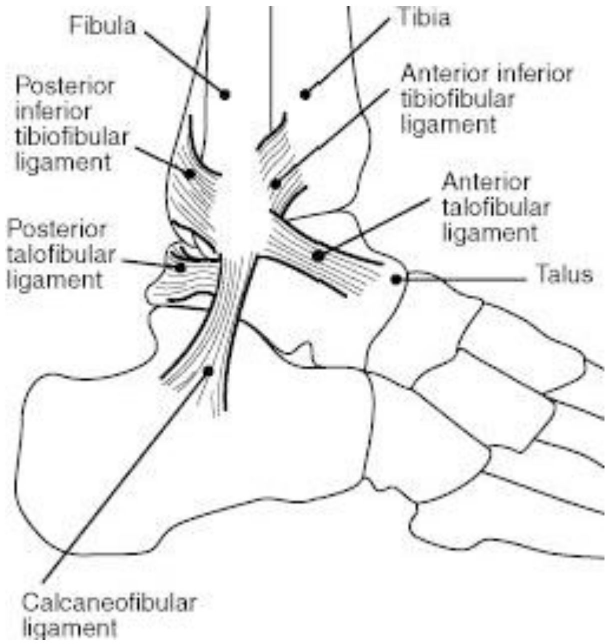
Conclusion

The objective of this case study was to observe whether or not massage therapy can be used as an effective treatment for motion restriction and pain in the ankle of a patient with a chronic ankle injury including and inversion sprain, fibular fracture and avulsion fracture. The goals of treatment were to increase joint motion and mobility, specifically plantarflexion and dorsiflexion, to decrease pain, and to increase stability and regain athletic competence. Throughout the course of treatment, all of the goals were accomplished to some degree. Range of motion was significantly increased, pain was significantly decreased, stability was increased and the patient was able to regain her athletic competence. Therefore, it can be concluded that, in this case, massage therapy combined with a homecare plan was an effective treatment for this patient's chronic ankle injury.

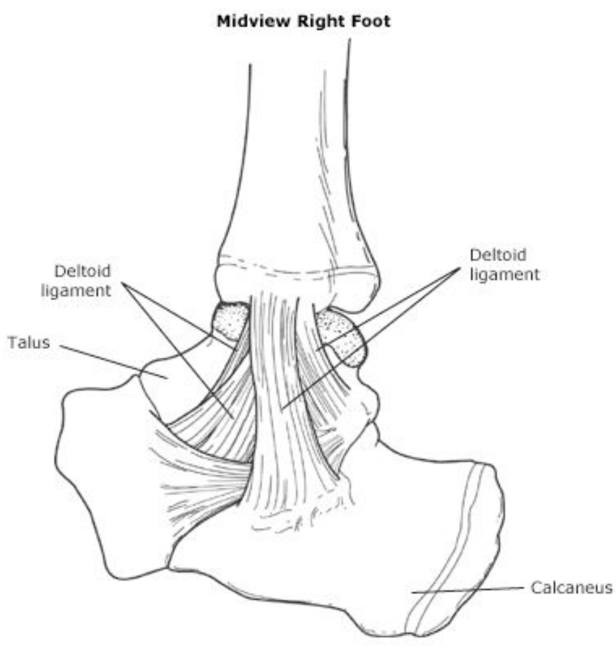
This individual study does not provide enough evidence to state that massage therapy is an effective treatment for ankle injuries. Nor does its claim to have the most effective protocol for treating such an injury. Further research and studies are necessary to validate the effectiveness of massage therapy in treating chronic ankle injuries.

Appendix A

A.1 Anatomy Of The Ankle- Lateral Ligaments (10)



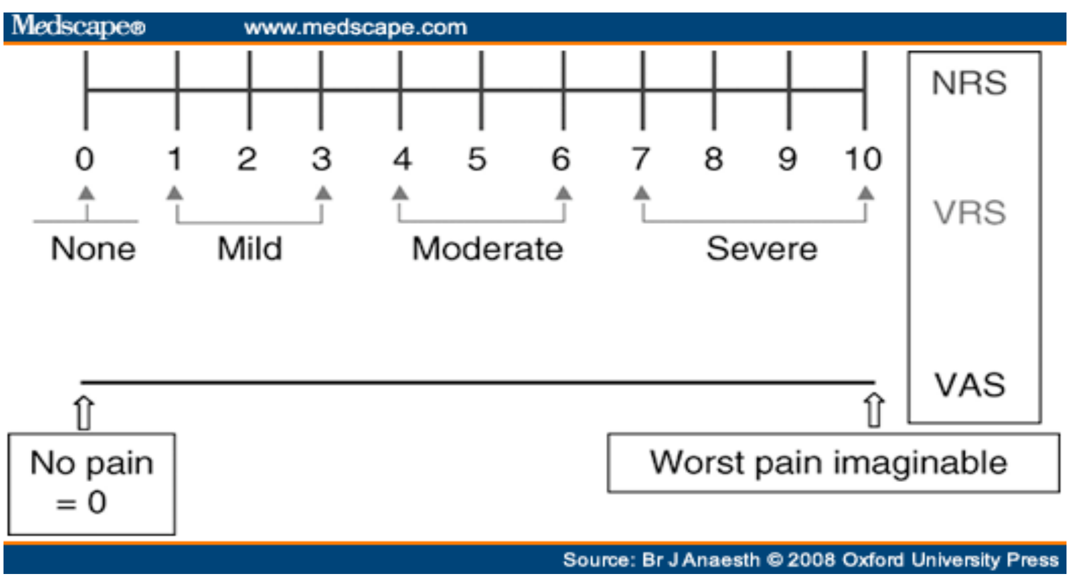
A.2 Anatomy Of The Ankle- Medial Ligaments (10)



Appendix B:
Normal Ranges Of Motion Of the Ankle (11)

Motion	Degrees of Movement
Dorsiflexion	20
Plantarflexion	50
Supination	45-60
Pronation	15-30

Appendix C
Pain Scale: Number Rating System 0-10 (10)



Appendix D

Manual Muscle Test Scale 0-5 (10)

Medscape® www.medscape.com

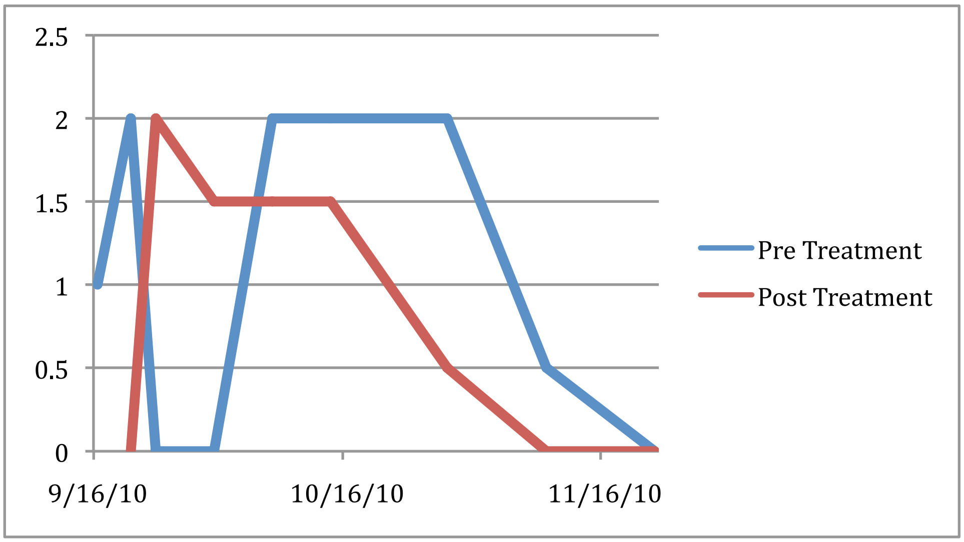
Modified MRC Grade	Degree of Strength
5	Normal power
5 –	Equivocal, barely detectable weakness
4 +	Definite but slight weakness
4	Able to move the joint against combination of gravity and some resistance
4 –	Capable of minimal resistance
3 +	Capable of transient resistance but collapses abruptly
3	Active movement against gravity
3 –	Able to move against gravity but not through full range
2	Able to move with gravity eliminated
1	Trace contraction
0	No contraction

*Medical Research Council of Great Britain.

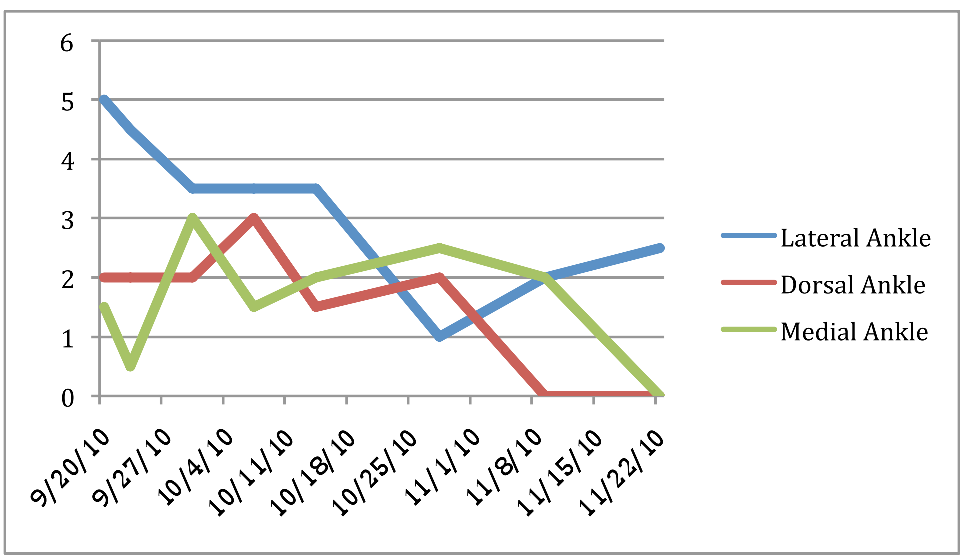
Source: Semin Neurol © 2008 Thieme Medical Publishers

Appendix E:

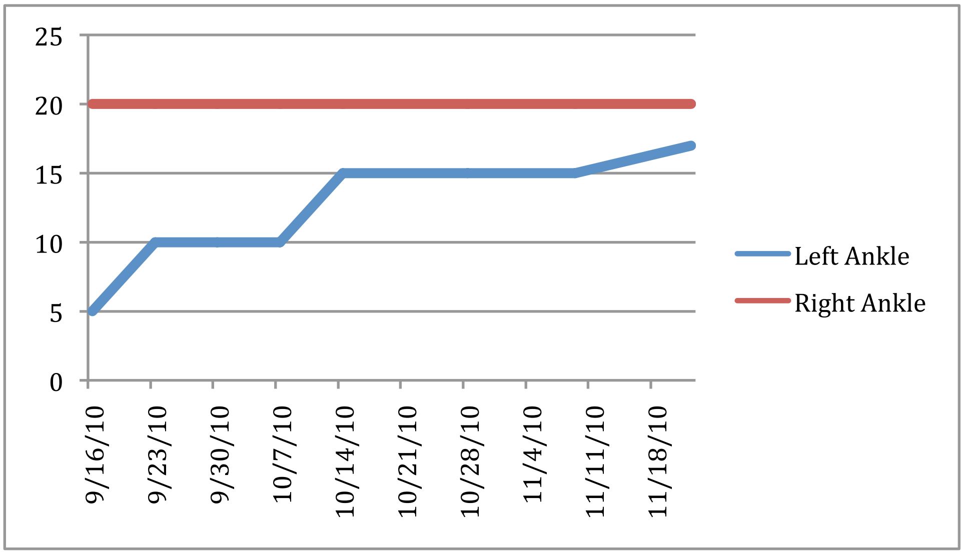
E.1 Ankle Pain At Rest- Using Pain Scale of 0-10



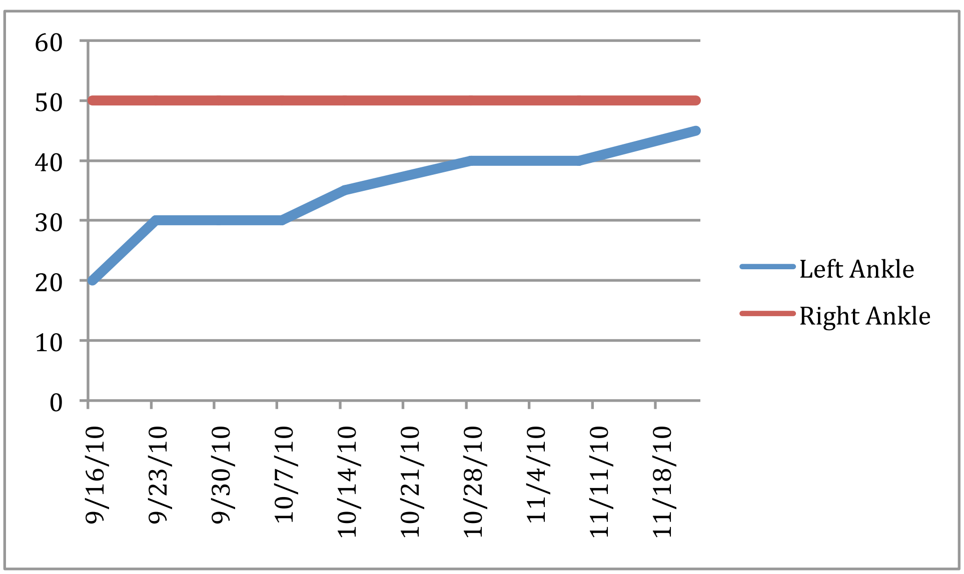
E.2 Tenderness On Palpation: Pre Treatment- Using Pain Scale of 0-10



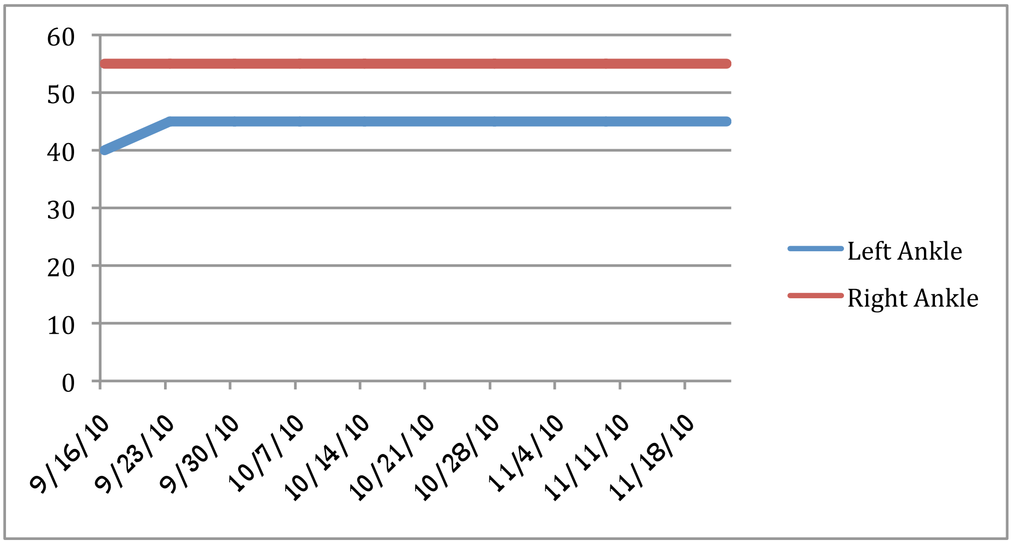
E.3 Degrees Of Active Dorsiflexion Pre Treatment



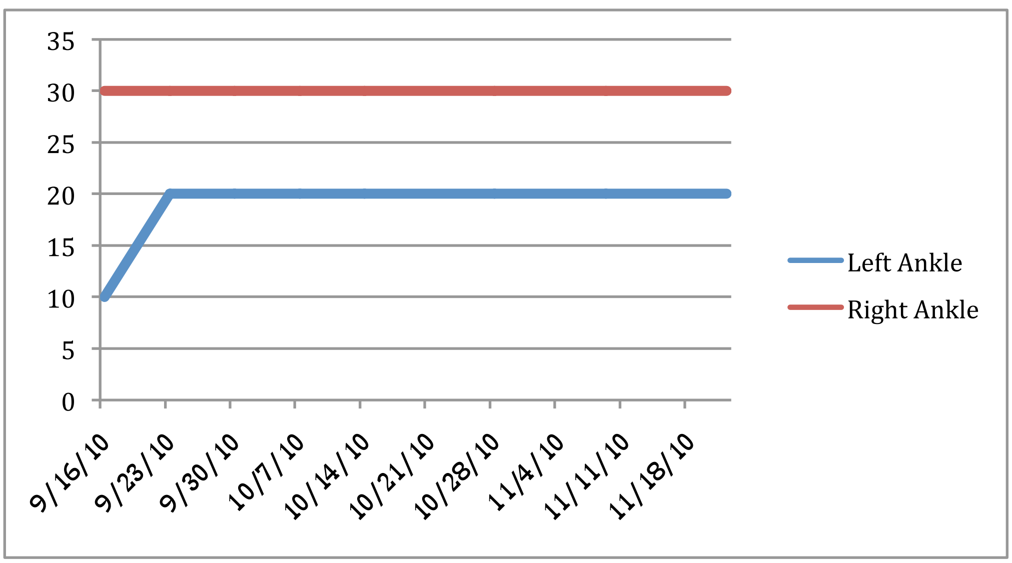
E.4 Degrees Of Active Plantarflexion Pre Treatment



E.5 Degrees Of Active Supination Pre Treatment



E.6 Degrees Of Active Pronation Pre Treatment



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