Clinical Case Report Competion

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The effects of joint mobilizations on treating chronic instability following an inversion sprain: A case study

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Abstract

Objective: To investigate the effects of treating a lateral inversion ankle sprain with joint mobilization techniques in combination with massage therapy to reduce pain, improve range of motion and restore balance.

Background: Subject is a 37 year old female presenting with a month old left ankle lateral ankle sprain that has resulted in chronic pain and limitations in gait due to reduced range of motion of the left ankle complex.

Methods: This case study consisted of ten 60 minute sessions completed twice weekly. Massage therapy techniques included general Swedish, neuromuscular therapy, and trigger point release to treat the gluteals, hamstrings, quads, tibialis anterior and peroneal group muscles. Joint mobilization techniques were applied to all three joints making up the ankle complex: the talocrural, sub talar and distal tibial fibular joints.

Results: Improvements were recorded in all areas of testing. Dorsiflexion increased from 10° to 20°. Balance was tested using the Balance Error Score System and the number of errors decreased from 27 to 12, thereby indicating improvement. Using the Foot and Ankle Ability Measure questionnaire, overall ankle ability was evaluated initially at 50% and the final result was 76%.

Conclusion: The results show an increase in range of motion in the ankle, improvements in gait and balance and reduction in pain. It was concluded that the treatment protocol is an effective combination to treat insufficiencies resulting from a lateral ankle sprain.

Key Words

Inversion sprain, Anterior Talofibular ligament, Talocrural joint, Joint Mobilizations

Introduction

Ankle inversion sprains are common orthopaedic injuries. It is estimated that 23,000 people sprain their ankle daily in the United States with up to 70% of those people experiencing residual symptoms for over two years. [1] The number of people who sustain this injury combined with the percentage of chronic symptoms highlight the need to identify treatments that can address the mechanical and functional impairments associated with inversion sprains. Inversion sprains can affect all age groups and significantly impact activities of daily living. This can lead to not only, loss of earnings but also impaired social interaction.[2]

The management of this relatively common injury tends to vary depending on where the patient is seen and by whom. This is reported by Eldon- Lee [3], after completing a study in an emergency department and found that treatment was not always evidence-based and tended to vary greatly.

Ankle Anatomy and Biomechanics

The ankle joint is where the foot and lower leg meet. It is formed by three separate joints, the talocrural joint, the subtalar joint and the distal tibiofibular sydesmosis . Fong et al [4] explain the talocrural joint is formed by the articulation of the dome of the talus, the medial and lateral malleolus and distal end of the tibia. The joint acts as a hinge, allowing dorsiflexion and plantar flexion. The lateral malleolus extends further than the medial, effectively creating a block. The feature allows for a larger range of inversion than eversion, thus, inversion sprains are more common than eversion.

The talocrural joint is supported by several ligaments divided into two groups. The deltoid ligament is comprised of three separate ligaments that connect the medial malleolus to the talus. The lateral collateral group, consists of the anterior talofibular, the calcaneofibular and the posterior talofibular. Due to the load and anatomical positions of origin and instertion, the anterior talofibular ligament is most commonly injured in a lateral ankle (inversion) sprain.

The subtalar joint is formed by articulation between the talus and calcaneus. This joint acts as a ball and socket joint and allows for inversion and eversion. The subtalar joint is supported by three groups of ligaments.

The distal tibiofibular joint is formed by the articulation between the distal tibia and fibula. The joint is stabilized by an interosseus membrane. This joint allows for limited translation and rotation during dorsiflexion and plantar flexion to accommodate the movement of the talus.

Inversion sprains occur when then ankle is forcefully inverted, damaging the lateral structurs of the ankle, most frequently the anterior talofibular ligament. This can lead to pain, altered gait, limitations in range of motion of the ankle and instability.

Rattray and Ludwig report that ligaments are moderately vascularized and may heal slowly. [5] Adhesions may form between the damaged ligament and nearby structures, painfully limiting range of motion. Especially in the ankle, adhesions can form within the joint itself. Green et al[6] state that this deficit could alter the axis of rotation, causing changes in alignment and disrupt proprioception resulting in future sprains.

Joint mobilization is a passive modality that moves a joint through its accessory movements, by a means others than under voluntary control.[7] Joint mobilization is indicated to restore pain free range of motions, resolve capsular fibrosis, decrease muscle guarding and improve joint health. Previous research demonstrated the effectiveness of joint mobilizations of the talocrural joint in increasing range of motion. Landrum et al completed a study that resulted in increased dorsiflexion in subjects with prolonged ankle immobilization after a single session of grade three joint mobilizations.[8]

Another study, performed by Reid et al [9], also demonstrated the effectiveness of joint mobilization increasing dorsiflexion in patients whom had experienced a lateral ankle sprain within two years of the study and whom had all completed a rehabilitation program but still had limited dorsiflexion on their affected ankle.

Along with research supporting the improvements in dorsiflexion with joint mobilizations, research has also been conducted regarding gait. Green et al [6] researched the effects of joint mobilization of the talus in increasing recovery time and restoring gait speed with patients with acute lateral ankle sprains. Outcomes in this study showed that the experimental group, those subjects that received joint mobilizations in combination with RICE, required fewer treatments than the control to achieve full pain free dorsiflexion and showed increases in gait speed.

These studies are parallel in the use of grade three posterior joint mobilizations to the talocrural joint for the treatment of inversion ankle sprains, but not examine the effectiveness of an anterior mobilization of the same joint or review the contribution of the subtalar joint in limitations in gait and balance. Two of the three studies were also examining data after a single

treatment session. All of the studies done were focused on joint mobilizations in isolation, without the combination of massage therapy.

An important goal of this study is to reduce pain for the subject. Rattray and Ludwig [5] write that "massage can break the pain cycle and eliminate the original source of the pain by increasing blood flow to the ischemic tissue". Also noted by Rattray and Ludwig, repetitive stroking is considered to be soothing and can decrease sympathetic nervous system firing and reducing pain perception.

This case study aims to investigate if repeated sessions of massage therapy combined with mobilizations of the talocrural, subtalar, proximal and distal tibiofibular joints, are an effective way to treat lateral ankle sprains leading to increase range of motion, balance and decrease painful gait.

Case Study Subject Information

Subject is a 37 year old female presenting with a six week old injury after a fall down flight of stairs on March 5th, 2014 and suffered a lateral ankle sprain of the left foot. Subject had x-rays confirming the absence of a fracture. She had pain at night described as "throbbing" and "aching". The subject reported the pain was repeatedly disrupting her sleep, and consequently proved challenging to maintain normal function throughout the workday. She felt "unsteady" and was using a crutch while walking.

Subject has had eight treatments with a Physical Therapist consisting of ultrasound therapy and stretching. Subject also had two appointments with a Registered Massage Therapist which did not include any joint mobilizations.

Subject works as a Program Coordinator, the majority of her day is seated at a desk. While subject is generally healthy, she has a sedentary lifestyle; her primary recreational activity is walking her dog. The instability and pain was affecting her life significantly, as well as the inconvenience of using the crutch on public transportation for her daily commute. Subject was diagnosed with Iron deficiency in Dec 2013, currently taking iron supplements and also has controlled hypothyroidism.

Observations at initial treatment; she was partially weight bearing on the left leg. She was walking very tentatively on the foot, indicating instability. There was slight swelling around the lateral malleoli, anterior talus and metatarsals of the right foot.

Examination revealed no deformity, heat or redness. There was noticeable pain around the lateral malleoli and anterior talus. There was moderate swelling at the lateral malleoli. Patient had tenderness travelling up the lower leg with hyper tender spots in tibialis anterior and around the medial femoral condyle. There was limited and painful active range of motion in dorsiflexion and reduced inversion and eversion. Patient had hypertonicity of the gluteals, soleus, tibialis anterior and peroneals. Also palpated was myofascial adhesion of the iliotibial band and vastus lateralis.

Methods

Treatment consisted of a six week, ten session protocol. Orthopaedic physical assessment tests included the Balance Error Scoring System developed by the National Strength and Conditioning association.[10] The Balance error scoring system (BESS) is a clinical field test that can be used for sideline evaluations of postural stability.. The BESS is scored by counting the errors the subject commits during the tests. The BESS is a valid and reliable method of measuring postural stability with good test-retest reliability (r= .673). [11] This was performed on the first, fifth and final treatment.

The Foot and Ankle Ability Measure (FAAM) questionnaire was completed at the same time as the BESS. The FAAM is a questionnaire developed to assess physical function for individuals with foot and ankle related impairments. Each item is scored from 'no difficulty at all' to 'unable to do'. Item score totals were transformed to percentage scores. Higher scores represent higher levels of function, with 100% representing no dysfunction. Esechaute et al [12]concluded that the FAAM is an appropriate, patient-assessed instrument to quantify functional disabilities in patients with chronic ankle instability.

Goniometer measurements were taken on the first, third, fifth, eighth and final treatments to following the protocols outlined by Norkin and White [13] to determine range of motion in dorsiflexion at the Talocrual joint and inversion of the subtalar joint.

Treatments took place twice weekly and were sixty minutes in duration. Each session began with full body compressions, sacral float and when required, diaphragmatic breathing. General Swedish techniques were applied to the gluteals in the form of knuckle kneading and ulnar border stripping. The hamstrings, triceps surae, quadriceps and lower leg received treatment such as palmer stroking, palmer kneading, picking up, wringing, and open c kneading. Neuromuscular techniques included golgi tendon release by bowing the Achilles tendon and frictions to the anterior tibotalar ligament were applied as well as stripping to the soleus, tibialis anterior and peroneals. Trigger point release was used when tolerated to anterior tibialis and peroneals. The plantar fascia and intrinsic muscle of the foot were addressed during the treatment. The compensatory leg was treated with general Swedish techniques. The massage was performed starting with the subject prone, and the posterior side was treated for twenty five minutes, after which the subject turned prone to access the anterior side for another twenty five minutes. Joint mobilizations were completed bilaterally after the above massage and the muscles were addressed. Joint mobilizations included anterior and posterior joint mobilizations of the talocrual joint, medial and lateral glide and gapping mobilizations to the subtalar joint, superior/inferior and anterior/posterior to the proximal and distal Tibial Fibular joint. Mobilizations were completed without pain for the subject and were grade two or three depending on the subject's tolerance following the procedures described in Edmonds [7]. Each joint mobilization was performed for one to two minutes using the remaining ten minutes of the session.

Results

There was a significant improvement with dorsiflexion. Initial measurement of dorsiflexion of the left foot was 10°. The largest single change in ROM was measured at the beginning of the fifth treatment. Dorsiflexion changed from 10° to 17°, a gain of 7° .Improvement continued at a gradual pace culminating with 19° at the tenth and last treatment, resulting in a total gain of 9°. Measurements of dorsiflexion of the right foot were included in the study as a base line. (Figure 1)

Inversion range of motion of the left foot was recorded at 20° at the initial treatment. Improvement was measured through the course of the study. The largest single gain in inversion was recorded at treatment 8, an increase of 3° resulting in a measurement of 25°. (Figure 2)

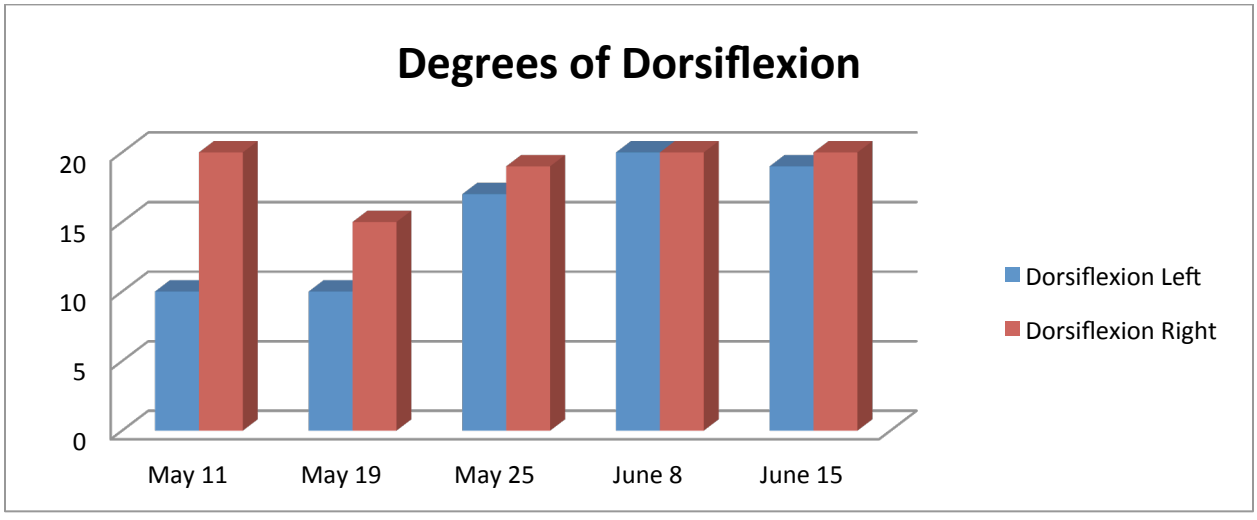

Figure 1: Degrees of Dorsiflexion of the left and right foot.

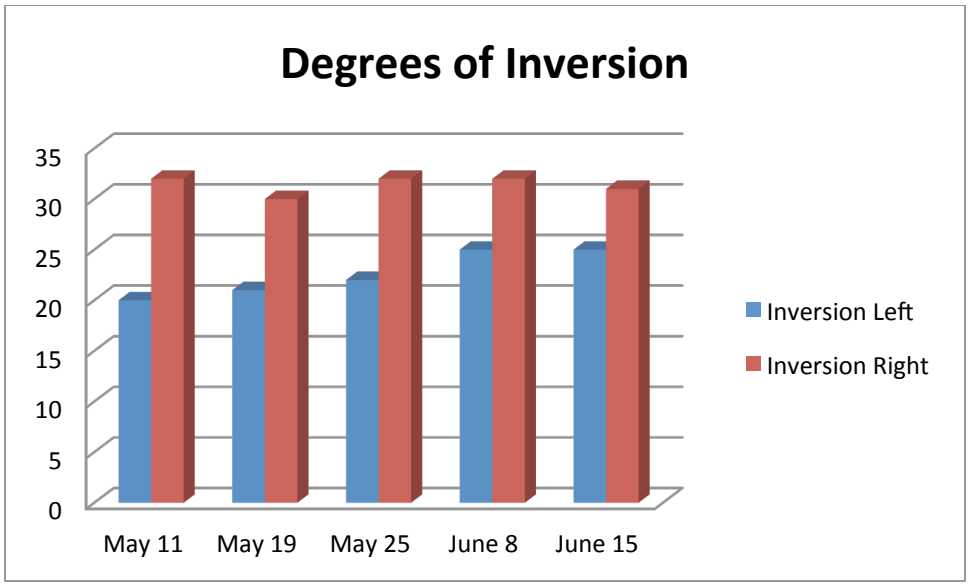

Figure 2: Degrees of Inversion of the left and right foot.

The subject completed the BESS three times during the course of the treatment. The number of errors decreased through the duration, demonstrating an improvement in balance and stability. Twenty seven (27) errors were recorded at the initial treatment, decreasing to eighteen at the fifth treatment and the subject had twelve (12) errors on the final treatment. (Figure 3)

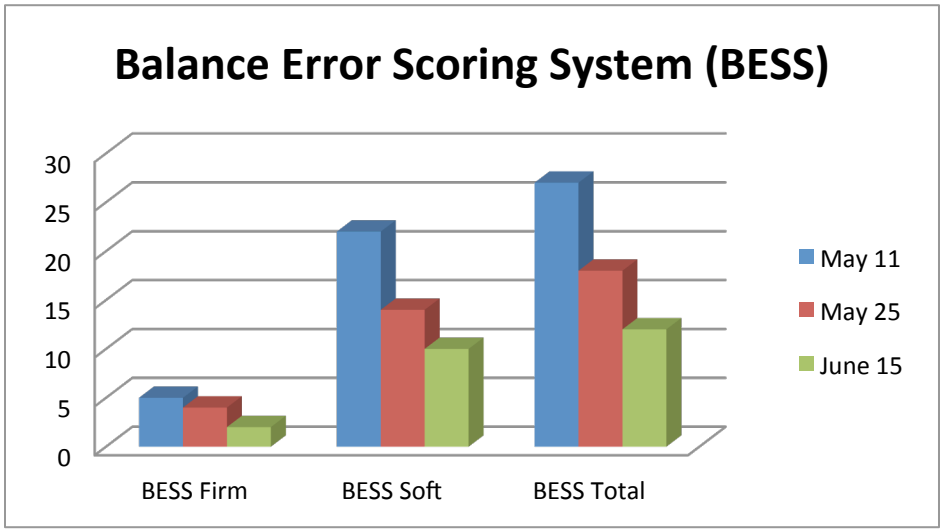

Figure 3: Results of the Balance Error scoring system (BESS)

Improvements were reported by subject through the completion of the self-reporting Foot and Ankle Ability Measure questionnaire. Initial data collected translated to 50% ability to complete daily activities of living (ADL's) and 12.5% ability to complete sports related movements. The final reporting was rated at 76 % of ability to complete ADL's, and increase of 26%. (Figure 4)

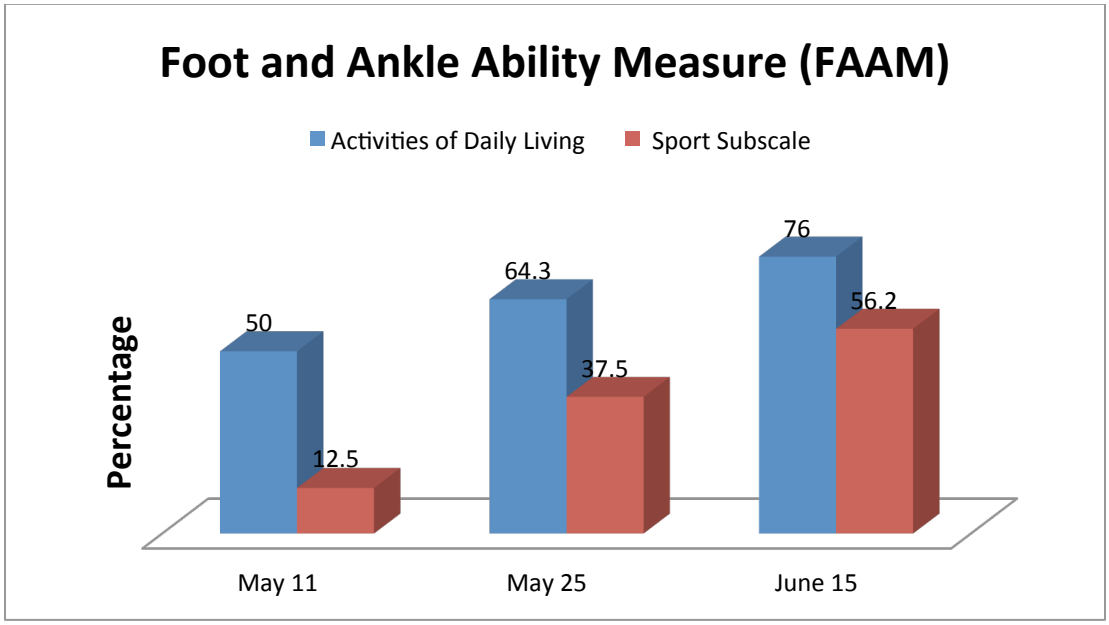

Figure 4: Foot and Ankle Ability Measure

Discussion

This study demonstrated effectiveness of using joint mobilization techniques in combination with massage to increase range of motion of the ankle joint. Final measurements of dorsiflexion of the left foot were 19°, resulting in improved gait. Increasing the range dorsiflexion improves gait and other functional activities because, at least, 10 degrees of dorsiflexion is required for walking, descending stairs or kneeling; running requires 20-30 degrees of dorsiflexion. This data is consistent with the outcomes of previous studies. Green et al [6] reported that anteroposterior mobilizations of the talus resulted in improvement in dorsiflexion ROM and return to normal gait speed. Likewise Landrum et al [8] demonstrated increased dorsiflexion following prolonged ankle immobilization after a single session of joint mobilizations.

The use of joint mobilization has shown to be a method of improving proprioception.[14] This can be seen in the data from the BESS system which showed an improvement and the subject was able to fully balance on the injured foot at the last treatment.

A important outcome of this study was the reduction in pain, using the principles repetitive stroking is considered a to be soothing and can decrease sympathetic nervous system firing and reducing pain perception. The self-reporting FAAM questionnaire includes a number of questions directly related to pain and its impact on daily living. The data collected show the subject rating her use of the ankle at 50% at the initial treatment with the lowest scores in questions relating to pain. Following the final session, this value was up to 75%, indicating how reduction in pain had improved her normal activities.

Considering the number of people affected by ankle injuries and the inconsistency in treatment recommendations, studies that provide evidence regarding treatment protocols and outcomes make this case study important to the health care industry as a whole. Doctors and nurses would be among the primary professions to benefit from having evidence that emphasises that targeted management of using joint mobilizations demonstrate improvement and could be a resolution for acute or chronic management of lateral ankle sprains.

This treatment protocol would appear to be effective method to be utilized by massage therapists for treatment of lateral ankle sprains. The techniques used were aimed at improving the strength, mobility, flexibility and elasticity of the muscles, tendons and ligaments that run between the knees and toes. All of these components help to stabilise and control dorsiflexion of the ankle and foot leg during the heel strike portion of the gait cycle.

The single case study design utilized in this study limits the generalization of its findings. A larger group of subjects with use of a control group would improve the statistical significance of the findings.

Future studies regarding range of motion of the ankle would benefit from more accurate measuring device rather than the goniometer. The goniometer is inexpensive and commonly used in clinical environments, but also requires the greatest degree of technical proficiency, due to the necessity of aligning the axis with the joint fulcrum and positioning the two arms with established reference points. Alternative methods to measure ankle ROM are digital inclinometer or a tape measure using the distance-to-wall technique which show methods result higher reliability

Conclusion

A treatment protocol of joint mobilization techniques in combination with massage therapy is an effective method to treat a lateral inversion ankle sprain. The goals were successfully achieved of reducing pain, improving range of motion and restoration of balance.

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