Manual therapy technique for treating an acute lateral ankle sprain in a female athlete

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MANUAL THERAPY TECHNIQUE FOR TREATING AN ACUTE LATERAL ANKLE SPRAIN IN A FEMALE ATHLETE

by

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Master of Science in Physical Therapy
Mayo School of Health Sciences 2002

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Submitted to the Graduate Faculty of the
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for the degree of
Doctor of Physical Therapy

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This Scholarly Project, submitted by Steven Wynia in partial fulfillment of the requirements for the Degree of Doctor of Physical Therapy from the University of North Dakota, has been read by the Advisor and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.

(Graduate School Advisor)

(Chairperson, Physical Therapy)
PERMISSION

Title Manual therapy technique for treating an acute lateral ankle sprain in a female athlete

Department Physical Therapy

Degree Doctor of Physical Therapy

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Date 11/27/07
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ABSTRACT

Background and Purpose: Lateral ankle sprains are a very prevalent sports injury resulting in missed practice and competition. Several studies have shown manual therapy techniques to be effective in restoring normal active range of motion (AROM) and expediting return to activity compared to more traditional treatment approaches such as protection, rest, ice, compression, and elevation (PRICE). This article describes a unique manual therapy approach to treating an acute ankle sprain in an athlete. Case Description: The patient is a 16 year-old female with an acute lateral ankle sprain. This article describes a physical therapy episode of care involving an aggressive manual therapy treatment applied to a 16 year-old female with an acute ankle sprain suffered while playing in a varsity basketball game. The patient was treated 3 times over the course of 5 days. During two of these visits the patient received manual therapy and 1 visit she was instructed in an exercise program. She has also been practicing PRICE principles. Outcome: At discharge the patient reported no pain in her ankle and had returned to full activity without limitations. The Foot and Ankle Ability Measure for sport was used to assess outcome. Discussion: Manual therapy techniques may be beneficial at restoring impaired motion, decreasing pain, and allowing athletes to return to sport following a lateral ankle sprain.
CHAPTER I
INTRODUCTION

Ankle Sprains are prevalent sports injury and account for an estimated 30-40% of all sports injuries.\(^1\) Approximately 85% of all ankle sprains involve inversion injuries to the lateral ligamentous structure.\(^2\) In rehabilitating these injuries, the main objective is returning the athlete to sport.

The mechanism for spraining the lateral ankle includes supination and inversion of the talocrural joint with an externally rotated tibia on a fixed foot.\(^3\) The anterior talofibular ligament (ATFL) is the most commonly injured ligament with this type of mechanism, followed by the calcaneal-fibular ligament (CFL), and the posterior talofibular ligament (PTFL). The ATFL is most commonly injured as it has the lowest maximal load to failure of the three ligaments and is also taut when the ankle is in end-range plantarflexion (PF).\(^4\) It is the main stabilizing ligament for the lateral ankle. The PTFL is rarely injured as it is taut only in the extreme ranges of ankle dorsiflexion (DF).

Although there is a high incidence of ankle sprains and the injury is quite common, examining and evaluating the injury can still pose a challenge to physical therapists because of the varying degrees of sprains. A grade I sprain is characterized by a few torn fibers with no laxity or residual instability.\(^5\) Grade II sprains involve partial tearing of the ligament with mild laxity or instability, and grade III sprains is a complete rupture of the ligament resulting in gross laxity and instability with potential for complete loss of function. Typical recovery for an injured athlete varies depending on the severity
of the sprain. Special orthopedic tests can be used to help assess the severity of the injury, and it may be necessary to rule out a fracture by the use of radiographs. The Ottawa Ankle Rules support the use of radiographs to rule out fracture if a patient is unable to bear weight immediately after the injury and at the physician’s office (if at the office less than 10 days post injury) and has tenderness in the lower 6 cm of the tibia, fibula, navicular, or 5th metatarsal head. If the patient is examined by medical personnel greater than 10 days post-injury and pain is progressing, radiographs are also indicated.

Traditional physical therapy intervention to treat acute ankle sprains has included applying the PRICE principles. This includes protection, rest, ice, compression, and elevation. This treatment protocol aims to reduce inflammation, edema, and joint effusion to help with the healing process. Beyond this treatment, modalities are often used including electrical stimulation of varying types and ultrasound, although there is only marginal evidence to support their use. Once outside the acute phase, physical therapy intervention typically includes a progression of exercises and functional tasks to prepare the patient/client to return to full activity.

In addition to the above mentioned interventions, several research articles have explored the efficacy of various manual therapy treatments in people with lateral ankle sprains. Eisenhart et al showed a one-time manipulation in an acutely sprained ankle to the talocrural joint resulted in improved DF over a control group, but no significant reduction in pain. Other studies have shown mobilization to the talocrural joint resulted in improved active range of motion (AROM) and earlier return to work in patients with subacute to chronic lateral ankle sprains. A recent systematic review reported that manual mobilization is effective at initially improving DF range of motion,
but that clinical relevance of this finding may be limited. Few articles have investigated the use of manual techniques in patients with acute sprains and their subsequent return to aggressive sport or activity. The purpose of this case report is to describe a unique intervention that may be effective at immediately improving range of motion and function for an athlete following a lateral ankle sprain.
CHAPTER II

CASE DESCRIPTION

Examination, Evaluation, and Diagnosis

The patient is a 16 year-old female who injured her right lateral ankle while playing in a varsity basketball game 8 days prior to being examined in our physical therapy clinic. She landed on another girl’s foot, suffering an inversion injury. She was unable to continue playing and was immediately evaluated at a local emergency room. She did not recall hearing a “pop.” Plain film radiographs were obtained and were negative for fracture. She was provided with crutches for ambulation at that time. Since the time of the injury the patient has been ambulating with bilateral axillary crutches, and therefore unable to participate in basketball. She was able to perform all tasks necessary for her high school studies. She had no other medical problems and was on no medication.

Upon initial examination, the patient was ambulating with bilateral axillary crutches, non-weight bearing on the right lower extremity, using a swing-through gait pattern. There was minimal palpable edema surrounding the right lateral malleolus, and figure-eight circumferential measurements were equal bilaterally. She complained of point tenderness with palpation over the ATFL as well as the CFL. There was no tenderness over the posterior ligament structures. There was also point tenderness noted in the peroneal musculature and peroneal ligaments. Range of motion measurements were obtained by goniometry (Table 1).
Active and passive motion was guarded with protective muscle contractions evident. Pain complaints with end-range passive movements were reported in the peroneal tendons and musculature. All other AROM of the bilateral lower extremities was within normal limits. Within the patient’s available, limited AROM she was able to hold against strong resistance when testing dorsiflexion, eversion, and inversion. There was no obvious weakness when compared to the uninvolved side. The patient was unable to perform single-leg standing into PF secondary to increased pain with weight bearing, but was able to hold against strong resistance when testing plantarflexors in supine. Inability to bear weight in single-leg stance produced assumption of decreased proprioception on the involved extremity versus the uninvolved extremity. Sensation to light touch and pinprick was intact throughout the bilateral lower extremities. Passive mobility of the talocrural joint was restricted in all planes.

Anterior drawer of the right ankle, as described by Magee, was inconclusive secondary to increased muscle guarding. Talar tilt test, also described by Magee, was negative on the right as she demonstrated symmetric talar tilt. Squeeze test was also negative.

The patient did attempt ambulation on a treadmill, walking at 3 miles per hour. At this speed she demonstrated an antalgic gait on the right. She also rated pain intensity 6/10 (from 0=no pain to 10=worst pain imaginable) on an 11-point numerical rating scale (NRS). She was unable to continue ambulation to higher speeds.
The patient also completed the Foot and Ankle Ability Measure\textsuperscript{18} index for sport (FAAM for sport) and scored 1/32 for 3\%. On this specific outcome measure, she reported her current level of function as severely abnormal.

The patient was demonstrating impaired joint range of motion, joint mobility, and muscle performance secondary to a grade I-II lateral ankle sprain.\textsuperscript{5} This best fit practice pattern 4E in the Guide to Physical Therapist Practice.\textsuperscript{19} The patient did not hear a “pop” and plain-film radiographs had been obtained at the emergency room and were negative for fracture.

Prognosis and Plan of care

She did appear to have a high amount of muscle guarding which appeared to be most responsible for the decrease in AROM of the involved ankle, as swelling and edema were minimal. It was hypothesized that eliminating the surrounding muscle guarding would result in improved ankle range of motion and joint mobility. Also, reduced muscle guarding would allow for more accurate testing and assessment of the integrity of the lateral ankle ligaments. Intervention was planned to restore normal motion and mechanics through manual therapy. It was planned to use a unique manual approach that is outcome based. That is, the treatment would be performed until no further evidence of muscle guarding was noticed. Instructing the patient in a home exercise program consisting of strengthening, stretching, and proprioceptive exercises was also planned. Goals for this patient included independence in a home exercise program and full return to basketball. An additional goal included the patient scoring greater than 10/32 on FAAM for sport (minimal clinically important difference of 9).\textsuperscript{18} Goals were to be met within 2-4 visits over 1-2 weeks.
Intervention

Intervention was started immediately after examination. Manual therapy intervention was performed in a warm water pool (96 degrees Fahrenheit). The intervention has been developed by physical therapists employed at Therapywerks, PA in Faribault, MN. An inner tube was placed under the patient’s arms and she was placed in a prone position. There is a bar attached to the top side of the pool and the plantar surface of her right foot was placed under this bar with her knee in a flexed position. The therapist was seated alongside the patient and positioned his knee under the patient’s and provided and upwards, loading force of the talocrural joint in order to produce a DF moment of the right ankle (Fig 1). This force was strong enough to push the ankle into DF which elicited a contraction of the anterior tibialis muscle. Contraction of the anterior tibialis muscle was palpable over the tendon on the dorsum of the foot. The amount of force used did cause some reported discomfort in the heel cord, but no reproduction of lateral ankle pain. This position was held for about 45 minutes until there was fatigue of the anterior tibialis muscle as evidenced by inability to palpate the tendon. Following this, the DF force was continued and the ankle was mobilized into inversion (Fig.2) and eversion. Each position was held for prolonged periods of time (15-25 minutes). Initially, passive inversion and eversion under the loading force was minimal, but as time progressed the motion increased and evidence of muscle guarding decreased. The treatment was stopped when the therapist was able to move the ankle passively in all planes (inversion, eversion, DF, and PF) under a load without eliciting co-contraction or guarding of the surrounding musculature. Achieving passive motion under loading force
without eliciting co-contraction or guarding happened approximately 90 minutes into the treatment.

The patient’s gait was assessed immediately after she changed into gym clothes following the treatment. She was able to ambulate at 3 mph with a normal gait cycle and reported pain intensity 0/10 on the NRS. She was able to run at 6 mph using a normal gait cycle and reported pain 2-3/10 on the NRS. She was instructed to attempt running at basketball practice the next day. She was provided with a BioSkin TriLoc® ankle brace and instructed to tape her ankle as well as wear the brace, and to stop if pain persisted. She left the clinic ambulating with no assistive device using a normal gait cycle.

The patient returned the following day. She reported she was able to walk and perform straight line running with a pain rating of 0/10 on the NRS while she was taped and braced. She participated in practice. She demonstrated mild tenderness to palpation...
over the ATFL and CFL as well as the peroneals. AROM measurements were obtained (Table 2).

<table>
<thead>
<tr>
<th>Motion</th>
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<tbody>
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<tr>
<td>Plantarflexion</td>
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</tr>
<tr>
<td>Inversion</td>
<td>20°</td>
</tr>
<tr>
<td>Eversion</td>
<td>10°</td>
</tr>
</tbody>
</table>

Table 2
Right ankle active range of motion following one treatment

The patient was instructed in a home exercise program consisting of ankle group strengthening including active resisted eversion, inversion, and dorsiflexion with resistance band; single-leg heel raises; standing gastroc and soleus stretches; and single-leg balance/proprioceptive training. She was instructed to perform 15-20 repetitions, 2 sets, daily of strengthening exercises, and perform proprioceptive training minimum 5-10 minutes daily. Stretching instructions included a 30-second hold, to repeat twice, and to perform as often as possible throughout the day. She was provided with written instructions and demonstrated independence with this program following instruction. Since AROM measurements were still below normal limits another manual therapy session was planned.

Outcomes at Discharge

The patient was able to run at seven mph with a pain rating of 0/10 on the NRS following last treatment. End-range inversion of the right ankle was non-provocative. There was no palpable edema at the ankle and no pain with palpation over all ankle structures and musculature. Resisted testing of the right ankle was painless and showed normal strength compared to the left ankle. Active measurements were taken once again (Table 3).
Telephone follow-up was made three days later and the FAAM18 for sport was administered. At this time the patient reported her current level of function at nearly normal and scored 29/32 on the FAAM18 for 91%. She reported slight difficulty with jumping, lateral movements, and ability to perform activity with normal technique. She played in the basketball game the night before with a pain rating of "maybe a 1/10" on the NRS when cutting and jumping. She returned to competition seven days following onset of physical therapy and 15 days following injury. She had returned to practice and resumed training one day following onset of physical therapy. She was discharged from her treatment plan at this time.

<table>
<thead>
<tr>
<th>Motion</th>
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<th>Left</th>
<th>Normal</th>
</tr>
</thead>
<tbody>
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<td>20°</td>
<td>0-20°</td>
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<td>Plantarflexion</td>
<td>65°</td>
<td>65°</td>
<td>0-50°</td>
</tr>
<tr>
<td>Inversion</td>
<td>23°</td>
<td>25°</td>
<td>0-35°</td>
</tr>
<tr>
<td>Eversion</td>
<td>14°</td>
<td>15°</td>
<td>0-15°</td>
</tr>
</tbody>
</table>

Table 3
Final ankle active range of motion
CHAPTER III
DISCUSSION/REFLECTION

The patient met all functional goals that were set at the time of the initial examination. This treatment was difficult for the patient to tolerate at times, but resulted in restoration of normal right ankle active range of motion and mobility, and allowed her to return to basketball without limitations. Having a dramatic outcome such as this may suggest that pain arising from the injured ligament in lateral ankle sprain is minimal. The treatment focused on normalizing muscle and joint mechanics, but ligament healing is an innate property and was most likely not influenced by this treatment approach, other than possibly increasing blood flow and reducing edema. It is possible and likely that a significant amount of pain is due to muscle guarding and splinting and that this impaired muscle performance was responsible for impaired range of motion. The motion and muscle performance impairments in turn are responsible for the patient's disability.

The patient's signs and symptoms were similar to those described in randomized controlled trials.\textsuperscript{8-10} These studies\textsuperscript{8-10} focused on improving ankle DF and have shown improvements of ankle DF with manual approaches, but there was minimal reference to the change in other ankle motions (inversion and eversion). Most of the reviewed articles\textsuperscript{8-11} concentrated on restoring normal joint mechanics using arthrotherapy techniques, whereas the treatment described in this article focuses on normalizing muscle mechanics (myotherapy) in order to restore normal joint mechanics.

It is theorized that soft tissue injuries may involve distortion of connective tissue or tissue fibers, and not necessarily disruption of tissue fibers.\textsuperscript{21} With a lateral ankle sprain, it is assumed that the lateral ankle ligaments are disrupted, which may certainly be
the case. However, secondary (or possibly overlooked primary) responses may occur with an inversion ankle sprain. Other soft tissue responses may be in the form of a myofascial band, herniated trigger point, or enthesis disruption. If a distortion can be identified, it is possible that a properly executed manual therapy approach can correct this distortion, resulting in return of normal mechanics and function. Myofascial bands and herniated trigger points involve contraction of muscle fibers. Different techniques have been applied to resolve these soft tissue problems, including trigger point release as described by Travell, ischemic release, friction techniques, and other pressure techniques. The technique described in this paper is theorized to normalize muscle mechanics, possibly by fatiguing the muscle, which would most likely happen at the neuromuscular junction. It is theorized that pain is inhibited with this treatment approach by activating type I and II mechanoreceptors resulting in gating of pain.

Further research including a case series and/or randomized controlled trial would provide further evidence to whether this manual therapy approach is effective in treating acute lateral ankle sprains. One concern is that there is most likely some amount of ankle instability present. For this reason it is important the patient continue with her exercise program and continue to tape and/or brace the ankle while performing sports activities in order to prevent further injury.

Based on the results of this episode of care, if another patient presented identically in my clinic, I would carry out the same plan of care as I did with this patient. The patient had a remarkably fast return to function and activity with no adverse outcomes. The groundwork was also applied to help reduce the incidence of a future injury or ankle instability. However, in addition to the intervention performed with the patient described
in this case report, I would attempt to have the patient come in for one more visit. The purpose of this additional visit would be to review the home exercise program and progress the program as indicated. Additional objective measurements could also have been obtained if necessary.

Further evidence on grading potential ankle instability or decreased proprioception would be beneficial. I observed the patient attempting a single-leg stance on the involved and uninvolved limbs and made the assessment of decreased balance/proprioception on this observation. Having a quick, reliable method for testing proprioceptive activity of a selected joint would help clinical decision making. This would assist a clinician when determining if the patient is at a sufficiently decreased risk to return to sport or activity and would help determine need for further visits and/or intervention. Additional reliability and validity studies on the anterior drawer and talar tilt test may also be beneficial, although the manual interventions applied did not aim to directly affect the ligamentous tissue.

This patient did not require the assistance of other disciplines following physical therapy examination. However, if she had been examined prior to having radiographs and was positive on the Ottawa Rule, it would have been necessary to refer her to a physician to rule out fracture.

The patient was seen for a total of three visits over the course of five days. The first visit included a physical therapist examination followed by an interventional treatment. During this visit she incurred an evaluation charge as well as a unit charge for treatment. The other two visits included unit charges for intervention only. When
accounting for adjustments made by her specific third-party payer, the average cost per visit for this episode of care was $171.20.

The patient’s insurance was charged for the physical therapy care. She had a private insurance company. On her particular policy, she had a co-pay per visit and her total out-of-pocket expense was $45. In addition to services, she purchased an ankle brace that was also billed to her insurance company and reimbursed in full at the amount of $47.54.

Determining how this care will influence the patient’s future as a consumer is difficult. She did not incur any lost wages and she did not have an employer who lost out on productivity because of this injury. In reality, she probably would have returned to normal walking and eventually basketball within two to four weeks. However, caring for an acute sprained ankle and effectively rehabilitating it has been shown to help prevent functional instability in the ankle. This, in turn, helps prevent subsequent sprains. If we assume that the physical therapy intervention helped prevent just one future ankle sprain, the treatment becomes more justified. If that “future ankle sprain” would have entailed another trip to an emergency room, along with plain film radiographs, crutches, etc., the cost benefit becomes more favorable. If this sprain happened while the patient worked full-time and if the patient was unable to work for one to two weeks, this treatment and the cost of it becomes a bargain.
APPENDIX

Appendix A

Examination and Intervention Algorithm

Acute Ankle Injury

Pain at the posterior half of distal end of medial/lateral malleolus, inability to bear weight on involved extremity, or pain at the base of the 5th metatarsal or navicular?

Yes

X-rays ruled out fracture?

No

Sprain?

Grade I: ligamentous stretch
Grade II: Incomplete tear and functional instability
Grade III: Complete ligament

Yes

No

Mechanism of injury: inversion or eversion?

Refer for diagnostic imaging

Fracture?

No

Yes

Practice Pattern 4D in Guide to Physical Therapist Practice: Impaired joint mobility, motor function, joint range of motion, and muscle performance associated with connective tissue dysfunction

Differential diagnosis:
Syndesmotic sprain, Lis Franc injury, cuboid syndrome, dislocation of peroneal tendons, or subtalar/midfoot dislocation

Medically Stable?

Yes

No

Patient to follow-up with appropriate physician with physical therapy following as indicated

Instruct in HEP consisting of ankle PREs, stretching, proprioceptive exercises, PRICE principles, and brace as indicated. Progress as indicated.

Proceed with manual therapy intervention in warm water pool to normalize mechanics as described in case report

Patient reaches functional goals within expected timeframe and mechanics normal?

Yes

Discharge with continuation of home exercise program

No
## REFERENCES


