Mobilization with Movement to Improve Dorsiflexion of the Ankle after an Inversion Sprain: A Case Report

Erika Brand

A Case Report submitted to the Orthopaedic Manipulative Therapists’ Group of the South African Society of Physiotherapy, in partial fulfilment of the requirements for the Continuing Education course in Orthopaedic Manipulative /therapy (OMT course)

Windhoek / Namibia

September 2010

Copy 2
Index

Abstract ........................................................................................................................................... 1
Introduction ....................................................................................................................................... 2
Case Description .......................................................................................................................... 4
  Case History .................................................................................................................................... 4
Physical Examination ...................................................................................................................... 5
Management ..................................................................................................................................... 8
Outcome .......................................................................................................................................... 9
Discussion ....................................................................................................................................... 11
Conclusion ....................................................................................................................................... 14
References ....................................................................................................................................... 15
Appendices ....................................................................................................................................... 17
  Consent Form for Case Reports ...................................................................................................... 18
  Patient Assessment & Clinical Reasoning Form ............................................................................... 19
  Lower Extremity Functional Scale (LEFS) .................................................................................... 33
Abstract

Limited dorsiflexion range of motion is common after an inversion trauma of the ankle. In this study the effectiveness of Mobilizations with Movement (MWM) to improve dorsiflexion of the ankle was evaluated. A young female was referred for physiotherapy four weeks after sustaining an inversion sprain. MWM was used to restore normal joint range of motion. The MWM was progressed from a non-weight bearing position to a weight bearing position. Good results were achieved within four treatment sessions. Pain was reduced and functional ability improved. It has been argued that the reason for limited dorsiflexion can be the possibility of a positional fault or a limitation in the posterior glide of the talus. MWM is proposed to restore normal arthrokinematics.

Keywords: Inversion Sprain, Ankle injury, Mulligan Mobilization with Movement
Introduction

Lateral ankle sprains are amongst the most common musculoskeletal injuries that occur during sport and recreational activities. Limited joint range, especially in dorsiflexion, is a common phenomenon after a lateral ligament sprain (Collins et al, 2004) and it does not only limits functional ability (Reid et al, 2007), but it has been suggested that limited dorsiflexion can also be a risk factor for re-injury (Denegar et al, 2002). Furthermore proximal structures can be affected due to changes in postural sway and altered muscle strength of the hip abductors (Beckman and Buchanan, 1995)

The ankle joint is a complex joint involving three articulations namely the talocrural joint, the subtalar joint and the distal tibiofibular syndesmosis (Hertel, 2002). The talocrural joint acts as a hinge joint allowing dorsiflexion and plantarflexion. These movements take place around the transverse axis in the sagittal plane and automatically call into action the two tibiofibular joints which are mechanically linked to the ankle. The medial and lateral malleoli form the superior border of the talocrural joint and articulates with the dome of the talus. The width of the talus surface is smaller posteriorly than anteriorly; therefore to maintain good joint congruency during dorsiflexion as well as plantarflexion, the intermalleolar space must be able to vary within limits. The intermalleolar space is least during plantarflexion and greatest during dorsiflexion (Kapnaji, 2001). Ligaments provide passive stability to the talocrural joint. The Anterior TaloFibular Ligament (ATFL) runs form the lateral malleolus to the talus and prevent anterior displacement of the talus form the mortise. Denegar et al (2002) suggests that due to the fact that the talus has no muscular attachment; disruptions of the ligament may allow anterior subluxation of the talus, leaving it subluxated until
Mobilization with movement (MWM) to improve dorsiflexion after an inversion sprain

passively corrected. Furthermore, Hubbard (2008) found a significant anterior displacement of the inferior fibular head in subjects who sustained an inversion sprain. This suggests that a limitation in dorsiflexion, after an inversion sprain, can be due to altered arthrokinematics of the ankle joint.

Full physiological range of motion can not occur when accessory joint motions are restricted or limited. Limitation in the accessory posterior glide of the talus with respect to the ankle mortise will limit dorsiflexion (Reid et al. 2207) and needs to be addressed before full range of motion will be restored. MWM, as described by Mulligan (Mulligan, 1999) is an effective way to restore normal accessory glides and joint movement.

The objective of this case study was to test the effectiveness of the application of the MWM technique as described by Mulligan (Mulligan, 1999) to improve dorsiflexion in the talocrural joint in the sub acute stage after a lateral ankle sprain.
Case Description

CASE HISTORY

A 26 year old female, with no history of ankle injury or instability, was referred for physiotherapy four weeks after sustaining a traumatic inversion sprain to the right ankle. Immediately after the injury the RICE principle was followed. Swelling and a deep purple bruise appeared on the lateral side of the right ankle and foot. A non-steroidal anti-inflammatory drug was prescribed for the first three days and the patient rested the ankle for two days before returning to work. A soft ankle brace was worn during the day for the first week.

The main complaint involved superficial pain and stiffness on the lateral side of the right malleolus and over the dorsum of the right foot. Weight bearing activities, especially on uneven surfaces, aggravated the pain while rest and elevation relieved the symptoms. Pain increased towards the end of the day. The pain was described as a constant nagging pain aggravated by dorsiflexion. On the Numeric Pain Scale (NPS) a 4/10 was allocated to this area. Stiffness mainly limited dorsiflexion which improved during the course of the day. The lack of dorsiflexion was accommodated for by adapting a compromised gait pattern. Bruising, swelling and a raised temperature were still present on the lateral side of the ankle. Cold weather conditions increased the pain; however the patient was not dependent on medication and had no night pain. Three weeks after the injury the patient also developed pain over the anterio-lateral aspect of the right leg just below the knee. The pain was described as a constant nagging pain aggravated by active dorsiflexion. On the NPS a 4/10 was allocated to this area. Functionally the patient was limited in all sport and work related
activities. On evaluation the patient scored 41/80 (51, 2%) on the Lower Extremity Functional Scale (LEFS).

PHYSICAL EXAMINATION

The patient limped and preferred non-weight bearing positions. Gait in the forward and side ways direction (right) was limited and painful. Less time was spent on the right foot during the stance phase when walking forward and walking sideways towards right needed extra rotation in the right hip to be able to clear the ground. Gait in other directions was normal. Walking up stairs was problem free; when going down stairs the patient was unable to step-through. Inversion and eversion were not performed in weight bearing due to pain. The weight bearing lunge test (Figure 1) as described by Bennell et al (1998) measured 6cm on the right side in comparison to the 8,5cm of the left side. Plantar flexion showed no significant difference.

Figure 1: Illustration of the weight bearing lunge test. Distance (d) was taken as the measurement. (http://www.podiatry-arena.com)
The Lower Extremity Functional Scale (LEFS) was completed on the first day of evaluation and at the end within a week after the treatment was terminated (appendix 2). The patient scored 41 out of 80 (51, 25%) before treatment.

Primary and secondary painful areas were palpated. The lateral aspect of the malleolus, metatarsals and the lateral ligaments around the ankle were sensitive and painful. The figure-8 ankle measurement was used to determine swelling (Magee, 2002) and a difference of 1.5cm was documented. The peroneus longus and tibialis anterior muscle, as well as the superior tibio-fibular joint were palpated. The tibialis anterior muscle was painful at its origin and active dorsiflexion provoked pain at the antero-lateral area below the knee, rendering either the tibialis anterior muscle or the superior tibio-fibular joint as the possible source of pain just below the knee. No muscle strength deficit was documented upon isometric muscle contraction of the tibialis anterior and the peroneus longus muscle.

Range of Motion (ROM) was measured by means of the goniometer due to its good reliability (especially intratester reliability) and validity (Richard et al, 1978). The measurements are summarized in table 1.

An anterio-posterio (AP) glide on the superior tibio-fibular joint revealed no stiffness or pain. The AP glide on the inferior tibio-fibular joint showed limited movement with a stiff end feel. Pressure on the lateral malleolus was painful. No limitation in the accessory longitudinal movement in the superior tibio-fibular joint was noticed. The three lateral ligaments were assessed; only the anterior talo-fibular ligament had a stiff end feel and was painful.

Table 1: Range of Motion of the Ankle Joint
The patient successfully performed the one leg stand on the right side when allowed to stand on a flat foot; when the same test was performed standing on the ball of the foot the patient demonstrated decreased stability and poor motor control. Neurological conduction tests were negative and neurodynamics was unaffected.

<table>
<thead>
<tr>
<th>Movement</th>
<th>Initial Evaluation</th>
<th>Discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Active ROM</td>
<td>Passive ROM</td>
</tr>
<tr>
<td>Non Weight Bearing</td>
<td>(R)</td>
<td>(L)</td>
</tr>
<tr>
<td>Dorsal Flexion</td>
<td>-10°    *</td>
<td>92°</td>
</tr>
<tr>
<td>Inversion</td>
<td>30°      **</td>
<td>45°</td>
</tr>
<tr>
<td>Eversion</td>
<td>5°       **</td>
<td>15°</td>
</tr>
</tbody>
</table>

*indicates range of movement was limited by stiffness
** indicates range of movement was limited by pain

Figure 2: Body Chart indicating Painful areas

Area 1
- Lateral side of right lateral malleolus and dorsum of the foot
- Superficial pain
- 2/10 in the morning and 4/10 at the end of the day which involves a lot of walking and standing

Area 2
- Pain anterior-lateral to the right knee joint (not knee pain)
- Constant, deep pain
  4/10, pain is increased by dorsiflexion
MANAGEMENT

The patient was seen twice per week for a total of four 45 minute-sessions, excluding the first evaluation session. The main focus was to improve dorsiflexion. To evaluate effectiveness of treatment active and passive ROM was measured and documented before and after each treatment session. Measurements were taken by means of the goniometer and the weight bearing ankle lunge test.

Initially the mobilization with movement technique was performed in a non weight-bearing position for the first 3 sessions. During the last session the glides were performed in the weight bearing position as described by Mulligan (Mulligan, 1999). 3 Sets of 6 repetitions each were performed.

After treatment the patient had improved dorsiflexion (table 2) and a decrease in the pain at the anterior-lateral side of the knee. The patient maintained the increased ROM.

Literature showed the importance of stability training after an injury to the ankle ligaments to prevent chronic instability. During the last treatment session time was allocated to retraining stability and providing the patient with home exercises. The exercises included one leg stance on various surfaces, with eyes open and eyes closed.
Outcome

The MWM technique was effective. Improvement in passive and active ROM in dorsiflexion over the course of the 12 days (4 treatments) was noted (Table 2). The actual change was between the 2nd (day 5) and 3rd (day 8) treatment sessions. Functional activities improved and a reduction in pain was noted in the ankle as well as in the anterior-lateral area under the knee joint. The measurements for the weight bearing lunge test also showed improvement between the first and the last treatment session.

Table 2: Range of Motion Measurements on different treatment days

<table>
<thead>
<tr>
<th>Day</th>
<th>Treatment Session</th>
<th>Dorsiflexion after treatment</th>
<th>Active Lunge Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Active</td>
<td>Passive</td>
</tr>
<tr>
<td>Day 1</td>
<td>Evaluation</td>
<td>-10°</td>
<td>92°</td>
</tr>
<tr>
<td>Day 1</td>
<td>1st Treatment</td>
<td>-10°</td>
<td>92°</td>
</tr>
<tr>
<td>Day 5</td>
<td>2nd Treatment</td>
<td>-5°</td>
<td>95°</td>
</tr>
<tr>
<td>Day 8</td>
<td>3rd Treatment</td>
<td>92°</td>
<td>100°</td>
</tr>
<tr>
<td>Day 12</td>
<td>4th Treatment</td>
<td>92°</td>
<td>100°</td>
</tr>
</tbody>
</table>

To measure functional ability the LEF Scale was used. The questionnaire was completed after the first day of evaluation and again, within a week, after the last treatment session (appendix 2). The patient scored 41 (51.25%) and 72 (92.5%) respectively before and after treatment. A Minimal Detectable Change (MDC) and the Minimal Clinically Important Difference (MCID) is indicated by 9 scale points (Binkley et al, 1999). The patient indicated an improvement in functional ability of 31 (38.75 %) scale points and was able to participate in her usual hobbies again. Going up and down stairs as well as negotiating her way over
uneven surface showed marked improvement. Loading activities such as running on uneven surfaces as well as hopping showed marked improvement.

The secondary pain the patient developed over the anterio-lateral aspect of the right leg just below the knee improved by itself.
Discussion

Limitation in dorsiflexion range of motion is a common problem that develops after a lateral ligament sprain (Collins et al, 2004) and can result in significant gait dysfunction. It has been suggested that limitations in accessory joint motions will limit full physiological ROM which will affect proximal structures due to changes in postural sway and altered muscle strength of the hip abductors (Beckman and Buchanan, 1995).

It has been proposed that altered arthrokinematics could be the cause for limited dorsiflexion after an inversion trauma. Mulligan (1999) ascribes pain and swelling following an injury or a strain to a positional fault or slight dysfunctional joint alignment restricting normal movement. An anterior displacement of the talus has been suggested. The positional fault theory has been examined by means of magnetic resonance imaging and the study done by Merlin D. et al (2005) and the study strongly supports the positional fault hypothesis. Mulligan (1999) suggested that when a repositioning is performed and sustained; pain free function can be restored with lasting improvements after several repetitions of the restricted movement.

Anterior displacement of the talus is prevented by the ATFL which is a thin and weak ligament running from the lateral malleolus to the talus. During an inversion trauma the ATFL is the first ligament to be injured; thus increasing the propensity for anterior subluxation of the talus (Renstrom and Konradsen, 2010). Denegaar at al (2002) reported an increase in laxity of the ATFL together with restricted posterior talar glide in athletes who sustained an ankle sprain.
Mobilization with movement (MWM) to improve dorsiflexion after an inversion sprain

MWM combines antero-posterior glide of the talus on the tibia with active dorsiflexion movement. The clinical rationale is that the suggested anterior displacement and the restricted posterior glide of the talus can be corrected and sustained even after the release of the glide (Mulligan, 1999). The technique can be performed in a weight bearing as well as in a non-weight bearing position. Although the weight-bearing technique is superior to the non weight-bearing technique due to the functional aspect thereof; increased pain during weight-bearing activities clinically indicates non weight-bearing techniques at first (Collins et al, 2004). However the mechanism by which normal arthrokinematics can be restored in the presence of AFTL laxity calls for further investigation. However it should be noted that the joint is most congruent during weight bearing, causing it to be stable when loaded.

Another cause for limitation of accessory joint movements after an inversion sprain can be shortened ligament structures due to scar tissue formation. It can be argued that these structures will be stretched when the MWM technique is performed and that this could lead to the improved ROM in the joint. However this is unlikely to be the case. According to Threlkeld (1992) a certain amount of micro failure is desired during manual stretching techniques that are intended to provided elongation of connective tissue. It is unlikely that micro failure will be implicated by MWMs. Although Denegar et al (2002) showed that, even in the presence of restricted talar mobility, dorsiflexion range of motion could be restored to normal through excessive stretching or through excessive motion at surrounding joints; he suggests that restoration of normal arthrokinematics should be addressed during rehabilitation to prevent re-injury.
Mobilization with movement (MWM) to improve dorsiflexion after an inversion sprain

The pain over the anterio-lateral aspect of the right leg, just below the knee, disappeared by itself while treatment was focused on the ankle joint. It is suggested that improved arthrokinematics in the ankle joint offloaded the tibialis anterior muscle giving it time to heal.
Conclusion

Limited range of motion in dorsiflexion is common after an inversion trauma of the ankle and is seen as a possible predisposing risk factor for re-injury. An altered joint arthrokinematics or positional fault has been suggested as the main cause for limitation in accessory anterior-posterior glide which limits normal joint range of motion. This case showed that MWM is an effective way to correct joint arthrokinematics and restore normal joint function in a short period with a limited number of treatments. Although the exact mechanism of MWM is unclear and calls for further research, the technique can still be used to achieve results.
References

Mobilization with movement (MWM) to improve dorsiflexion after an inversion trauma


Appendices

Appendix 1: Clinical Reasoning Form

Appendix 2: Lower Extremity Functional Scale (LEFS)
physiotherapist's name: Date of assessment: 12/04/2010

THE INTERVIEW

Demographic Information:
Name: _____________________________ Age: 26
Address: P.O. Box 97155, Maerua Park, Windhoek, Namibia
Source of referral: Self
Medical diagnosis: Sprained lateral ligaments around the ankle, decreased dorsiflexion
WCA: no

Patient's Occupation: Physiotherapist
Hobbies, sport: Camping, outdoor activities, Gym, Swim, Cycle (not competitive)
Dominance (upper and/or lower limb): Right side, upper and lower limbs

Patient's main complaint: Pain in ankle towards the end of the day and difficulty in walking due to joint stiffness.

Problem from the patient's perspective [Open-end Q]:
Persistent pain and stiffness in the right ankle joint four weeks post injury (inversion trauma). Patient is unable to stand for long periods of time and complains about ankle pain at the end of the day. Walking is painful.

History: Current
Pain and stiffness in the right ankle joint which is worse towards the end of the day
Inversion trauma, Right ankle, 4/52 ago. Patient followed the RICE principle directly after the injury.
Obvious bruising, lateral side of ankle below malleolus, and swelling the day after the injury.
Medication: Cataflam for 3 days, currently none. Aids: used a soft brace for 1 week post injury, currently none. Brace helped to decrease the pain. Three weeks post trauma the patient spent a weekend at the sea, did a lot of walking on the beach. Ankle improved (increase in dorsiflexion, decrease in pain) by doing that.
No pain at night. Cold weather conditions increase the pain
Initially the patient only had pain around the lateral ankle pain [A1], about three weeks post trauma the patient also developed pain on the anterior-lateral side of the knee, anterior to the superior tib/fib joint [A2] without any specific incident.

Now:
Impairment:
× Main complaint of stiffness in dorsiflexion. Stiffness is worst in the morning and improves during the course of the day. At the end of the day the ankle is painful and swollen laterally.
× Pain at the lateral side of the foot, around lateral malleolus, and on the dorsum of the foot. NPS in the morning 2/10, NPS at the end of the day 4/10
× Patient also complains about constant pain on the anterior-lateral side of the leg just below the
knee, NPS 4/10

× Swelling and Heat can be palpated, and slight bruising were still visible on the lateral side of the foot.

Disability:
× Patient finds it difficult to walk and stand due to pain and stiffness, and swelling
× Patient is unable to squat, decreased dorsiflexion does not allow the movement

Handicap:
× Patient struggles to work which requires standing for long periods of the day, as well as squatting while working with patients. Patient can’t participate in sport activities

Previous relevant history:
No previous ankle or other relevant injuries of history to mention
**Area(s) of Symptoms** (map on body chart: specific area; nature; constant/intermittent; severity using shading; depth. Mark non-involved areas with a □)

**Area 1**
- Lateral side of right lateral maleollus and dorsum of the foot
- Superficial pain
- 2/10 in the morning and 4/10 at the end of the day which involves a lot of walking and standing

**Area 2**
- Pain anterior-ateral to the right knee joint (not knee pain)
- Constant, deep pain
- 4/10, pain is increased by dorsiflexion
Association of symptoms:
A2 developed more or less three weeks after the initial ankle injury. The patient thinks it is due to an adjusted/compromised gait pattern.

Behavior of Symptoms: [For each symptomatic area: 24 hrs; aggravating and easing factors]
Area 1:
No pain at night; Pain aggravated by: weight bearing, standing and walking (dorsiflexion), uneven surfaces
Pain relieved by: elevation, rest and non-weight bearing
Stiff in the morning, stiffness improves during the course of the day

Area 2:
Pain worse towards the end of the day; Constant pain of 4/10 during the day
Aggravated by: dorsiflexion activities (walking, squatting); relieved by: refraining from activities

Applicable screening for red flags
No paraesthesias or any other symptoms of concern

Other resources of information: [Medical records, investigations, reports, referral source, etc.]
No X-rays

Summarise and check with patient:
Checked

Self administered questionnaires/standardised outcome measurement tools:
Lower Extremity Functional Scale (LEFS): Patient scored 41 out of 80 (51,25%)
**Appendix 1: Patient Assessment & Clinical Reasoning Form**

### Clinical Reasoning Form – Hypotheses Generator

<table>
<thead>
<tr>
<th>COMPLETE AFTER INTERVIEW</th>
<th>Decision and motivation for answer [where applicable] &amp; implications PE and treatment</th>
</tr>
</thead>
</table>
| Interpretation of History: | The injury follows the normal course of healing; however there is still swelling present four weeks post trauma. It can be due to the patient not resting the ankle in the early stages. The level of irritability should be kept in mind when evaluating and treating the ankle. Stage of healing: regeneration phase  
Stage of disorder [healing, degeneration, natural course]  
Stability of condition | |
| Pain Drivers | Somatic pain from the ligaments at the ankle and possibly from sub-talar and/or inferior tib/fib joint in A1, and the superior tib/fib joint or the tibialis anterior muscle in A2. |
| Input: | Cognitive: Patient is frustrated with the fact that she can not work without pain. Being a physiotherapist herself she is confident that therapy will help. However too much medical knowledge may worry her about possible side effects eg reflex sympathetic dystrophy. |
| Possible processing Drivers: | None to mention |
| Central neurogenic | |
| Relevant Cognitive &/or Affective factors | |
| Output Drivers: | |
| Behaviour changes | |
| Autonomic | |
| Total | Pain is driven by nociceptive structures.  
Total Nociceptive Processing Problem | |
| Nociceptive Input | There are clear aggravating and relieving factors  
Four weeks post injury is still within the normal healing phase of tissue |
| Mechanical / Inflammatory | |
| M ---X----------------------------- I | The injury is past the inflammation stage and is in the regeneration phase. Painful stretching of ligaments post injury is normal. This prevents normal joint accessory movements needed for full pain free range of motion. |
| Irritability | Irritability is low. Pain after squatting subsides immediately after abandoning the movement and the ankle is only more painful at the end of the day. |
| High------------------------X----------Low | |
| SIN | It is purely a nociceptive problem with a mechanical cause and a low irritability. NPS score is only 2/10 – 4/10 |
| High ---------------------------X--Low | |
| Regular [typical] or Irregular [Atypical] pattern of Symptoms | Typical symptoms of an inversion sprain initially, however currently also pain more proximal |
Do you see a pattern of implications indicating caution? | No
---|---
Contributing Factors to be considered in physical exam [physical, environment, health] | No
Prognosis/Expected rate of recovery | Good prognosis for full recovery

**From the INTERVIEW list your hypotheses in order of most likely to least likely:**
A Hypothesis must explain the whole current clinical picture of the patient – OR their must be two concurrent hypotheses – each of these situations to be listed from most likely to least likely

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Positive Evidence</th>
<th>Negative Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right ankle joint pain and stiffness due to a positional fault and scar tissue formation of the lateral capsule and ligament as part of the normal healing process after an inversion ligament sprain. Stiffness in the inferior tib/fib joint could gradually lead to pain in the superior tib/fib joint</td>
<td>✗ Area of pain, bruising, swelling ✗ nature of trauma ✗ morning stiffness ✗ Pain towards end of the day after loading the ankle for too long. ✗ A2 develops pain after activities because the inferior tib/fib joint is stiff and effects the superior tib/fib joint movement.</td>
<td>✗ Swelling purely from a talo-fib ligament sprain should have been better by now</td>
</tr>
<tr>
<td>Right ankle joint pain and stiffness due to a positional fault and scar tissue formation of the lateral capsule and ligaments as part of the normal healing process after and inversion ligament sprain. Stiffness in the inferior tib/fib joint could gradually lead to pain in the tibialis anterior muscle.</td>
<td>✗ Area of pain, bruising, swelling ✗ nature of trauma ✗ morning stiffness ✗ Pain towards end of the day after loading the ankle for too long. ✗ Swelling from a pure ligament sprain must have been less by now ✗ A2 pain develops after activities because the inferior tib/fib joint is stiff and compensatory muscle action is activated</td>
<td>✗ Swelling purely from a talo-fib ligament sprain should have been better by now</td>
</tr>
</tbody>
</table>
Right ankle pain and stiffness due to avulsion fracture of lateral malleolus (consolidation phase)  
× Local sensitivity on palpation over the malleoli  
× Tender on the tap test  
× Nature of the trauma  
× Pain is intermittent  
× Stiffness that is worse in the morning  
× Weight bearing is possible and doesn’t produce a deep ache.

List the structures you would examine together with the tests you would perform on that structure. List these in order of priority from most to least likely:

##Highlight with an asterisk the tests which must be performed on the first day

<table>
<thead>
<tr>
<th>Area of symptoms</th>
<th>Muscles - underlying or possibly referring</th>
<th>Neural - underlying or possibly referring</th>
<th>Joint – underlying or possibly referring</th>
<th>Other structures / problems</th>
</tr>
</thead>
</table>
| Area 1 and 2: Lat Ankle and Knee | Peroneus Longus muscles  
Tibialis Anterior  
Test:  
× Palpation  
× Length test  
× RIC | *Sural nerve  
*Peroneal nerve  
Test:  
× Neurodynamic test (Dorsiflexion and inversion; DF/PF)  
× Palpation to test mechanosensitivity  
× Sensitivity tests | * Talocrural joint  
* Sub-talor joint  
* Inferior tib/fib joint  
* Superior tib/fib joint  
Test:  
× ROM  
× Functional activities | * Lateral ligaments of the ankle joint. |
|                  |                                           |                                          |                                          | Test:  
× Integrity of all three ligaments (Ant.Talofibular lig, Post.Talofibular lig, Calcaneofibular lig) in plantar flexion, neutral position and in dorsiflexion.  
× Ant. Draw Test. |

Precautions / Contra-indications [Possible Red Flags]:
No

Definite Red Flags [Possible referral]:
No

Possible ‘Barriers to improvement’ [Yellow Flags]:
Patient is frustrated with the situation, and may put to much strain on the ankle with insufficient rest and elevation.
THE PHYSICAL EXAMINATION

Observation:
Patient limbs and prefer non-weight bearing positions

Functional demonstration of most problematic movement, if applicable:
- Walking forward: right heel comes off the floor earlier than on the left side
- Walking backwards: problem free
- Walking sideways towards right: patient has to make a rotation at the hips to clear the foot off the floor
- Walking sideways towards left: normal / problem free
- Down stairs: unable to step through
- Upstairs: No abnormal movement pattern observed. Not complaining about pain
- Standing on heels (weight bearing, active, plantar flexion): visible difference between right << left. No actual reading taken
- Standing on toes (weight bearing, active, plantar flexion): right = left
- Standing on lateral and medial sides of the feet (weight bearing, active, inversion and eversion): Not tested due to fear and pain

Movement Tests (record ROM, quality of movement through range and end feel, overpressure where applicable, pain response):

Weight bearing ankle lunge test: Right = 6cm       Left = 8.5cm

Strength tibialis anterior (dorsiflexion of foot, knee in extension): Right = Left, muscle contraction does not cause pain
Strength peroneus longus (eversion and plantar flexion, knee in extension): Right = Left, muscle contraction does not cause pain

Non weight bearing active dorsal flexion: Right = -10° (stopped by stiffness)       Left = 92°
Non weight bearing passive dorsal flexion: Right = 90° (stopped by stiffness)       Left = 102°
Non weight bearing inversion (decreased): Right =30 ° Left = 45° (visual estimation) Mmnt. stopped by P
Non weight bearing eversion (decreased): Right = 5° Left = 15° (visual estimation) Mmnt. stopped by P
Non weight bearing active plantar flexion: ROM Right = ROM Left   (O/P does not evoke pain)

AP on inferior tib/fib joint: Pressure on the lateral malleoli is painful. Very little movement when compared with the left side. Stiff end feel.
AP on superior tib/fib joint: Movement feels the same as on the left side. Structure is not painful.
Longitudinals cephalad: Movement in the superior tibio-fibular joint is normal when compared with the left side
anterior talo-fibular ligament is painful and allowed decrease movement, stiff end feel

Balance/Proprioception: fine/normal when standing on flat foot [right one leg stand], however balance on right leg is severely compromised when standing on the ball of the foot.
Neuroconductive Tests [i/a]:
Neurodynamics: no positive results
Sensitivity was normal. Poor motor control notices, proprioception is affected.

Other testing/measurement procedures: [Tests not included in the above]
None

Palpation:
× Heat. Lat ankle is slightly warmer than the normal side
× Swelling. Ankle looks swollen, however measurement of the circumference equals the normal side (52 cm)
× Bruising. The severe deep blue/purple bruising described by the patient has mostly disappeared. There is still a bluish color left on the lateral aspect of the foot.
× Touch. Most sensitive over the lateral malleolus, lateral metatarsals and the lateral ligaments around the ankle
× No heat or swelling around Area 2, however palpation is painful over the tibialis anterior and peroneus muscle.

RE-ASSESSMENT after P/E:
C/O: Pain in ankle not worsened or improved by assessment.
O/E: * No increase in ROM when measured, but ankle feels more mobile.

PLANNING AFTER THE PHYSICAL EXAMINATION

1a Do your physical findings support your primary hypothesis? Mostly, except the superior tibio-fibular joint did not show decreased accessory movements. The tibialis anterior was painful on palpation and during isometric muscle contraction

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Physical findings supporting the hypothesis</th>
<th>Physical findings negating the hypothesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right ankle joint pain and stiffness due to a positional fault and scar tissue formation of the lateral capsule and ligaments as part of the normal healing process after an inversion ligament sprain. Stiffness in the inferior tib/fib joint could gradually lead to pain in the tibialis anterior muscle</td>
<td>Active dorsal flexion: Right = 10° (stopped by stiffness) Left = 92° Passive dorsal flexion: Right = 90° (stopped by stiffness) Left = 102° Inversion right is decreased compared to left side: Right = 30° Left = 45° Movement stopped by Pain Eversion right is decreased compared to left side: Right = 5° Left = 15° Movement stopped by Pain Active plantar flexion: Right = Left</td>
<td></td>
</tr>
</tbody>
</table>
1b If not, what is now your primary hypothesis?
Mostly, except the superior tibio-fibular joint did not show decreased accessory movements. The tibialis anterior was painful on palpation and during isometric muscle contraction.

List the objective findings which have made you alter your opinion:
 n/a

2. Do you have any reasons to change your thoughts regarding source(s) of symptoms?
 No

3. Do you have any reasons for changing your thoughts regarding pain mechanisms?
 No

4. Is there any reason from the physical examination which would indicate caution or contra-indications in your management?
 No

5. Any clues to treatment from the physical examination?
 Dorsiflexion is decreased. Mulligan MWM techniques are very successful techniques to use to improve ROM.

6. What is your first choice of treatment technique?
   ✗ Mulligan MWM to improve dorsiflexion. First in non weight bearing position then progress to mobilization in weight bearing

6a. What is your short-term management plan?
   ✗ Pain relief
   ✗ Improvement of stiffness

6b. What is your long-term management plan?
   ✗ Restore quality of healed tissue
   ✗ Improve/Restore proprioception
   ✗ Resume every day life activities as normal
Treatment 1 / Date: 12/04/2010
Re-Assessment:

Treatment: Non-weight bearing MWM gliding the talus dorsally while asking the patient to perform active dorsiflexion. Procedure was performed 6 times;
No other treatment was given

Outcome:
Active dorsiflexion in the right ankle measured -10°
Passive dorsiflexion in the right ankle measured 92°
Weight bearing ankle lunge test: Right = 6cm

------------------------------------------------------------------------------------------------------------------

Treatment 2 / Date 16/04/2010
S: A1: Ankle feels much better. Walking has improved by being less painful and able to keep the heel on the ground for longer during the stance phase. Area is less tender when touched.
A2: Still tender to touch but not painful all the time. Pain worse towards the end of day.

O/e:
Active dorsal flexion: Right = -5°
Passive dorsal flexion: Right = 92°
Inversion right side is decreased in comparison with the left side (by visual estimation)
Eversion is a lot decreased in comparison with the left side (by visual estimation)
Active plantar flexion: Right = Left

Weight bearing ankle lunge test: Right = 6cm (unchanged)

Treatment: Non-weight bearing MWM gliding the talus dorsally while asking the patient to perform active dorsiflexion. Procedure was performed 6 times.
No other treatment were given

Outcome:
Active dorsiflexion in the right ankle increased to 92°
Passive dorsiflexion in the right ankle increased to 100°
Still unable to “step through” when going down stairs
Walking forward: heel still comes off the ground sooner during the stance phase than on the left side
Sideways walking towards right: unchanged
Weight bearing ankle lunge test: Right = 8cm

------------------------------------------------------------------------------------------------------------------

Treatment 3 / Date 19/04/2010
S: A1: Still more improvement. Pain is now only towards the end of the day. Walking doesn’t have the stiff feeling anymore. Going down stairs has also improved, but patient still unable to step through, however it is not painful anymore.
A2: Patient still complains about the pain at the lateral side of the knee. Although the pain has improved it is still present.
O/e:
Active dorsal flexion: Right = 92°
Passive dorsal flexion: Right = 100°
Inversion right side is decreased in comparison with the left side but to a lesser extend that at the previous treatment.
Eversion is decreased in comparison with the left side
Active plantar flexion: Right = Left

Weight bearing ankle lunge test: Right = 8cm
Superior tib/fib joint has sufficient mobility during ankle movements.
Painful spots found in the tibialis anterior which gives a familiar pain when palpated

Treatment:
Non-weight bearing MWM gliding the talus dorsally while asking the patient to perform active dorsiflexion. Procedure was performed 6 times.
Soft tissue treatment of the tibialis anterior
Weight bearing MWM gliding the talus dorsally while asking the patient to perform active dorsiflexion. The procedure was performed 6 times.

Outcome:
No change in the active and passive dorsiflexion, but walking down stairs improved, stiffness does not bother patient anymore. She is able to step through when going down stairs.
Weight bearing ankle lunge test: Right = 8cm

Treatment 4 / Date 23/04/2010
S: Patient is happy with the functional ability of the ankle. Stairs are not problematic anymore. Walking is normal. No more pain present, even at the end of the day. No more complaints in either of the two areas.

O/e:
Active dorsal flexion: Right = 92° (unchanged)
Passive dorsal flexion: Right = 100° (unchanged)
Inversion and eversion same as on the left side.
Active plantar flexion: Right = Left

Weight bearing ankle lunge test: Right = 8cm (unchanged)

Painful spots in calf muscles when palpated

Treatment:
Soft tissue treatment on the calf muscles

Stability training: Standing on one leg (eye open, eyes closed)
Walking taking slow and big steps
Standing on one leg and performing other activities with the arms and/or bending the knees/hips.

**Outcome:**
Treatment was terminated
Complete the following table using the information you now have at your disposal. [After the Physical Examination]

<table>
<thead>
<tr>
<th>Patient Perspective</th>
<th>Body Structure/Function</th>
<th>Participation Limitation</th>
<th>Activity Restriction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name:</strong></td>
<td><strong>Medical diagnosis:</strong></td>
<td><strong>Primary goal of rehabilitation:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Age:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>right ankle is stiff and painful especially towards the end of the day.</td>
<td>Walking, climbing stair, squatting and running is a problem</td>
<td>Patients struggles to work</td>
<td></td>
</tr>
<tr>
<td><strong>Body Structure/Function</strong></td>
<td><strong>Impairment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Participation Limitation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>stiffness and pain in the right ankle due to sprained ligaments on the lateral side after a inversion trauma four weeks ago</td>
<td>Walking, climbing stair and running is problematic and painful.</td>
<td>Work Sport and leisure activities</td>
<td></td>
</tr>
<tr>
<td><strong>Activity Restriction</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Contextual Factors:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental: Patients’ job requires a lot of standing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal: Patient is frustrated with the situation, however the patient has a positive attitude towards life.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The Lower Extremity Functional Scale (LEFS)

Overview: The Lower Extremity Functional Scale (LEFS) can be used to evaluate the functional impairment of a patient with a disorder of one or both lower extremities. It can be used to monitor the patient over time and to evaluate the effectiveness of an intervention. The authors are from McMaster University in Hamilton Ontario.

Patient instructions: Today do you or would you have any difficulty at all with these activities?

Activities (20):

<table>
<thead>
<tr>
<th>Activities</th>
<th>1&lt;sup&gt;st&lt;/sup&gt;</th>
<th>2&lt;sup&gt;nd&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) any of your usual work housework or school activities</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>(2) your usual hobbies recreational or sporting activities.</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>(3) getting into or out of the bath</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>(4) walking between rooms</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>(5) putting on your shoes or socks</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>(6) squatting</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>(7) lifting an object like a bag of groceries from the floor</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>(8) performing light activities around your home</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>(9) performing heavy activities around your home</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>(10) getting into or out of a car</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>(11) walking 2 blocks (about 1/6th mile or about 250 meters)</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>(12) walking 1 mile (1.6 km)</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>(13) going up or down 10 steps (about 1 flight of stairs)</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>(14) standing for 1 hour</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>(15) sitting for 1 hour</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>(16) running on even ground</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>(17) running on uneven ground</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>
Appendix 2: Lower Extremity Functional Scale (LEFS)

<table>
<thead>
<tr>
<th>Response</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>unable to perform activity or extreme difficulty</td>
<td>0</td>
</tr>
<tr>
<td>quite a bit of difficulty</td>
<td>1</td>
</tr>
<tr>
<td>moderate difficulty</td>
<td>2</td>
</tr>
<tr>
<td>a little bit of difficulty</td>
<td>3</td>
</tr>
<tr>
<td>no difficulty</td>
<td>4</td>
</tr>
</tbody>
</table>

| (18) making sharp turns while running fast    | 0      | 3 |
| (19) hopping                                  | 0      | 3 |
| (20) rolling over in bed                      | 4      | 4 |
| TOTAL SCORE                                   | 41     | 74 |