CASE REPORT

Delayed conservative treatment of an acute lateral ankle sprain in a non-athlete female following walking boot immobilisation

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SUMMARY

Lateral ankle sprains are a common injury with an estimated occurrence rate of 23 000 per day in the USA. Prolonged immobilisation and delayed referral to physical therapy are associated with poorer outcomes. The patient was a 49-year-old woman working as a surgical technologist. She sustained an inversion injury to her left ankle while descending from a stool. Her primary care physician examined her, issued a Controlled Ankle Movement (CAM) walking boot and immobilised her ankle for 6 weeks. Patients with grade I and II lateral ankle sprains who are treated with early mobilisation and referral to physical therapy have demonstrated earlier return to function compared with patients who are treated with prolonged immobilisation and delayed referral. Nevertheless, it remains common for individuals who have sustained a lateral ankle sprain to be immobilised. This case study highlights the importance of early mobilisation and early physical therapy referral for patients with lateral ankle sprains.

BACKGROUND

Ankle sprains are a very common lower quarter injury with a rate of occurrence estimated at 23 000 ankle sprains per day in the USA.[1] Ankle sprains occur more frequently in those who participate in sports versus the general population and more frequently in adolescents than adults.[2] Lateral ankle sprains are the most common types of ankle sprain making up 85% of all occurrences.[3] Major contributors to the stability of the ankle joint include articular surface congruence when the joint is loaded, passive restraints (eg, ligaments, joint capsule and so on) and the musculotendinous attachments of lower extremity musculature crossing the ankle joint. The lateral stabilising ligaments include the anterior talofibular ligament (ATFL), the calcaneofibular ligament and the posterior talofibular ligament.[4] The ATFL is injured in isolation in 73% of lateral ankle sprains.[5] The most common mechanism of injury for a lateral ankle sprain is forced ankle inversion, plantar flexion and internal rotation of the foot on the leg. With severe inversion injuries, structures other than the lateral ligaments can be affected including the medial subtalar ligaments, fibularis tendons, fibular nerve, extensor and peroneal retinacula, inferior tibiofibular ligamentand the talus.[4]

Lateral ankle sprains are organised into three grades based on ligamentous damage and the associated degree of swelling and loss of range of motion (ROM). Grade I is the least severe, and grade III is the most severe. Grade I and II lateral ankle sprains are typically first treated with conservative interventions before surgery is considered; however, little research has explored the use of conservative treatment over surgery.[6] Pihlajamäki *et al* reported that long-term outcomes for conservative and surgical treatments were equally effective but with a greater recurrence rate in the conservative group. The surgical group had a lower ankle sprain recurrence rate but elevated risk of post-traumatic arthritis.[7]

Reliable prognostic factors have been poorly defined in the literature. One study demonstrated that individuals who regularly engaged in physical activity three times or more a week had a greater likelihood for residual symptoms such as pain, swelling and feelings of instability following an ankle sprain injury.[8] A known concern with management of acute lateral ankle sprains is the potential for recurrent episodes of sprain and the development of chronic ankle instability (CAI). Indeed, some estimates indicate that 75% of individuals who have incurred a lateral ankle sprain will develop CAI.[9]

In the acute stages of injury, early management should include rest, ice, compression and elevation commonly referred to as RICE.[10] A common error in the treatment of acute lateral ankle sprains is prolonged immobilisation.[11] Functional loading of a joint and its associated ligaments is crucial in collagen remodelling.[12] While grade III sprains are considered unstable and thus may warrant a limited period of immobilisation, Grade I and II sprains are considered stable and thus rehabilitation should began immediately.[10] Kerkhofft *et al*[11] reported that individuals with acute lateral ankle sprains who received 4 weeks of immobilisation had poorer outcomes in function, pain, ROM and strength when compared with individuals who participated in 4 weeks of functional support and exercise. In severe acute lateral ankle sprains, a period of immobilisation is beneficial in reducing pain and oedema. This period should not exceed 10 days, however, to avoid the negative outcomes associated with prolonged immobilisation.[13]

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Early intervention is warranted in acute lateral ankle sprains. Physical therapy management may include: manual therapy for reduction in oedema and pain, and improvement in ROM; cryotherapy for pain and oedema reduction and therapeutic exercise that targets ankle strength, ankle ROM and balance activities.[4] The purpose of this case study is to describe and discuss the examination findings, clinical reasoning, decision-making and outcomes for the physical therapy management of an acute lateral ankle sprain in a non-athlete woman who demonstrated recalcitrant recovery secondary to delayed therapy intervention following a prolonged period of walking boot immobilisation.

CASE PRESENTATION

The patient was a 49-year-old woman who worked as a surgical technologist. The patient reported left lateral ankle pain, weakness, swelling and difficulty ambulating. Her symptoms first began 6 weeks prior to the initial evaluation when she stepped down from a stool onto her left lower extremity at work. She reported her left ankle 'gave out', and she felt a painful pop. She stated that she was able to continue working on her feet but noticed that pain and swelling increased as the day progressed. The patient was prescribed a Controlled Ankle Movement (CAM) walking boot by her referring physician 6 weeks prior to her initial physical therapy evaluation. She used the boot for 4 weeks following her initial injury and then switched to a lace-up ankle brace which she wore to her initial physical therapy evaluation. At the time of the initial evaluation, the patient reported a pain level of 3/10 on the Numerical Pain Rating Scale (NPRS). She reported that her pain would increase to 10/10 following a day of work, which required her to stand for several hours at a time. She denied ever experiencing numbness or tingling. No red flags were identified during the subjective intake. Radiographic images were taken of the patient's left ankle and demonstrated normal ankle alignment, soft tissue swelling about the ankle, and no sign of fracture. The patient expressed her main goals for physical therapy were to return to full work duty without pain and improve her ambulation. On completion of the subjective examination, the differential diagnostic hypothesis list included syndesmotic sprain, medial ankle sprain and lateral ankle sprain. Fracture was ruled out via radiographic imaging. The physical examination was designed to test for these competing diagnoses and guide treatment planning.

Self-report outcome measures

The Foot and Ankle Disability Index (FADI) was administered to measure the patient's subjective perception of her lower extremity pain and function. The FADI is a 1-page, 26-item questionnaire that has excellent reliability (intraclass correlation coefficient (ICC) >0.89).[14] The minimal detectable change for the FADI is +/−4.48 points.[14] A greater percentage score represents greater functional loss and disability. The patient's FADI score was 45%, which indicates a significant level of impairment.

INVESTIGATIONS

Visual examination was unremarkable with the exception of slight non-pitting oedema on the lateral side of the left ankle. No sign of any residual ecchymosis was present. Observation of ambulation revealed an antalgic gait favouring the left lower extremity with decreased stance time on the left. A light touch screen revealed no decrease or absence of sensation in either lower extremity.

The patient's left ankle active range of motion (AROM) was as follows: dorsiflexion (DF) with the knee in full extension was −4°, plantarflexion (PF) was 20°, eversion was 15° and inversion was 0°. Left ankle passive range of motion (PROM) was as follows: DF with the knee in full extension was 20°, PF was 50°, eversion was 30° and inversion was 35°. Ankle right AROM was as follows: DF with the knee in full extension was 20°, PF was 50°, eversion was 30°, and inversion was 35°. Strength testing of the ankle was performed using manual muscle testing (MMT). Left ankle strength was as follows: PF was 3/5, DF was 3/5, eversion was 3/5, and inversion was 3/5. Right ankle strength was 5/5 in all planes. The patient reported pain localised to the lateral side of the left ankle with all movements, and this tenderness may have limited her performance during formal strength testing.

An anterior draw test was performed with the patient in supine. The ankle was positioned in slight PF. An anterior glide was performed on the calcaneus while the distal leg was stabilised. The test was positive since there was appreciably greater anterior translation of the talus relative to the stabilised ankle mortise compared with the uninvolved ankle, and the patient reported an increase in pain during the test.[11] An inversion stress test was performed with the patient in supine. The patient's lower extremity was stabilised at the malleoli, while the ankle was forced into end-range inversion.[11] The test was positive since there was more movement when compared with the uninvolved ankle, and the patient reported an increase in pain during the test. An eversion stress test was performed with the patient in supine. The patient's lower extremity was stabilised at the malleoli while the ankle was forced into end-range eversion. The test was negative as there was equal movement when compared with the uninvolved ankle, and the patient reported no pain during the test.[15] To assess for the presence of a syndesmotic sprain, the syndesmotic squeeze test was performed. The patient was positioned in supine, and a compression force was applied to the tibia and fibula at the midshaft level. The test was negative since there was no reproduction of symptoms.[15]

A functional assessment of the patient's balance was performed. The patient was able to maintain single leg stance on the right for 60 s but was only able to maintain single leg stance on the left for 15 s. The patient was instructed in the performance of the Y-balance test and performed this test while she stood on the left lower extremity. The Y-balance test is performed with the subject standing on a single leg in the centre of three intersecting lines marked with tape. The lines are oriented anteriorly, posterolaterally and posteromedially. The posterior lines are separated from the anterior by 135° and from each other by 90°. While maintaining single leg stance, the subject is asked to reach with their lower extremity as far as possible down each of the three lines while maintaining balance. Attempts are not counted if the subject is unable to maintain single leg stance throughout the full movement. Each reach is marked with tape and measured with the average of three trials in each direction being used for scoring. This process is repeated for both lower extremities. The patient was unable to perform the test successfully while standing on the left lower extremity for three trials without loss of balance.[16]

Based on all of the patient's subjective and objective evaluation data, a working diagnosis of lateral ankle sprain was established. Subjective reports including pain in the area inferior and anterior to the lateral malleolus, and the patient's description of the mechanism of injury supported this diagnosis. Objective findings including weakness, swelling, reduced ROM and positive anterior drawer, and inversion stress tests lent further

credence to this diagnosis. The patient's global weakness was somewhat unexpected; however, this might be explained by the patient's extended period of immobilisation in a CAM walking boot causing disuse atrophy or from fear avoidance behaviour. Medial ankle sprain was ruled out due to lack of pain located on the medial side of the ankle and a negative eversion stress test. Furthermore, the reported mechanism of injury of forced ankle inversion is not consistent with a medial ankle sprain. The presence of a syndesmotic sprain was ruled out due to a negative syndesmotic squeeze test and lack of pain or swelling superior to the malleoli. This patient presented to physical therapy 6 weeks after sustaining an acute lateral ankle sprain. Immediately following her injury, the patient was immobilised first with a CAM walking boot followed by a lace up ankle brace. At the time of evaluation, the patient presented with many of the complications associated with prolonged immobilisation and delayed rehabilitation.[11]

TREATMENT

With a working diagnosis of acute lateral ankle sprain established, conservative treatment using physical therapy intervention was judged appropriately. Interventions in this case study consisted of ankle strengthening, and proprioception and balance retraining. The patient was seen for seven supervised physical therapy visits spread over the course of 8 weeks. The rehabilitation process was spread between two major phases, the protected motion phase and progressive loading/sensorimotor retraining phase. The goals of the first phase included reduction of pain and oedema as well as promotion of full weight bearing and normalisation of gait. The patient was instructed to weight bear as tolerated and to begin weaning from her ankle brace. The patient was encouraged to ice and elevate her ankle several times a day for pain relief and reduction of swelling. Interventions in this phase included strengthening of the ankle including DF, PF, eversion and inversion against progressive Theraband resistance. She was asked to perform these exercises for three sets of 10, twice a day. She was also instructed in performance of AROM exercises for the ankle joint in all planes including being asked to trace her 'ABCs' with her foot. The patient was instructed in gait retraining with verbal cueing and demonstration to walk with a heel to toe gait pattern. This tasked was broken down to the different phases of gait with the patient first practising weight shifting onto the affected limb and progressing over the course of two visits to advancing over the affected limb with a normalised single leg stance time. Based on the patient's report of reduced pain levels, improvement in strength and normalisation of gait pattern, the patient was deemed appropriate to progress to the next phase of rehabilitation.

After 2 weeks and two visits, the patient entered into the progressive loading/sensorimotor phase of rehabilitation. The goals of this phase were to maximise strength and promote proprioception and balance. The Theraband resisted ankle exercises described in the first phase were continued at home with the resistance progressively increasing based on the patient's subjective report of difficulty of the exercise. To promote additional strength of the affected ankle, the patient was instructed in the following ankle strengthening progression; seated calf raises, standing calf raises, standing calf raises with eccentric lowering on the affected limb and single-leg calf raises on the affected limb. The patient would perform three sets of 10 and would progress to the next level of intensity when able to complete three sets of 15 with appropriate form and full excursion. Proprioception and balance exercises included use of the Biomechanical Ankle Platform System board with clockwise and counter-clockwise motions performed first in sitting and progressing to standing, and tandem balance progressing to single-limb balance on a foam pad with a ball toss for external perturbation. Dynamic balance interventions included double-limb hopping in forward, lateral, anterolateral and anteromedial directions progressing to single-limb hopping and the Y-balance test. This phase lasted the remainder of the patient's episode of care.

OUTCOME

On discharge, the patient reported improvements on the FADI, NPRS and performance of occupational tasks. Furthermore, the patient also improved in objective measures of strength and balance. The patient was seen for a total of seven visits over a period of 8 weeks. During this time, she reported a change of maximal pain levels of 10/10 on the NPRS after standing for a 4-hour work shift to 0/10 following a full 8-hour work shift. Her FADI score improved from the initial 45% to 9% at discharge, representing a self-perceived functional improvement and a minimal detectable change. At discharge, the patient was able to maintain single leg stance on the involved lower extremity for 60 s without loss of balance. The patient was also able to complete the Y-balance test successfully within 3 cm of the non-involved extremity indicating improvement in both static and dynamic balance. The patient's left ankle AROM improved to the following: DF with the knee in full extension was 20°, PF was 50°, eversion was 30° and inversion was 35°. The patient improved her ankle MMT to 5/5 in all directions, demonstrating a significant improvement in strength. Retesting of the anterior drawer and inversion stress tests revealed continued laxity compared with the non-involved extremity but with no provocation of pain.

DISCUSSION

This case study describes the examination, clinical reasoning, conservative treatment approach and intervention outcomes for an individual who presented with an acute lateral ankle sprain. Lateral ankle sprains are well researched though the vast majority of research pertains to intervention for athletes. A diagnosis of lateral ankle sprain can be reasonably made with the use of subjective history and clinical examination.[4] Radiographic imaging may be used to rule out fracture as indicated by the Ottawa Ankle Rules.[17] If the patient is unresponsive to 6 weeks of conservative care, an MRI may be useful to assess the ligamentous integrity and assist in the differential diagnosis.[18]

The patient described in this case study had many of the typical subjective complaints for individuals who have incurred lateral ankle sprains, including mechanism of injury, pain anterior and inferior to the lateral malleolus, swelling and reports of instability. Objective findings supported the provisional diagnosis, specifically, positive anterior drawer and inversion stress tests, weakness especially in eversion and poor single-leg balance of the involved extremity. The intervention for the patient described in this case report included progressive resistance exercises for the ankle, and static and dynamic balance exercises. Other recommended interventions supported by the literature include manual mobilisation of the talocrural joint.[4] While considerable research is available regarding interventions for lateral ankle sprains, consensus on which interventions are most effective is lacking.[4] Conservative management has been effective in 50%–85% of individuals who have lateral ankle sprains. van Rijn *et al*[19] reported that significant functional improvement was achieved for individuals who were given a progressive ankle

strengthening programme compared with individuals who were treated with bracing only. Webster and Gribble[20] reported that therapeutic programmes including proprioceptive exercises as well as single leg balancing on unstable surfaces were effective in restoring dynamic postural control. Early weight bearing as tolerated with use of least restrictive orthoses leads to quicker recovery times compared with those who are treated with immobilisation.[11] Considering this, it is possible that the patient may have recovered ankle function sooner with a shorter period of immobilisation. Strong evidence exists suggesting passive modalities such as ultrasound, interferential current and diathermy are not effective in the treatment of lateral ankle sprains, and so these modalities were not included in this patient's interventions.[4] Strong evidence also exists supporting that manual mobilisation of the talocrural joint can improve dorsiflexion range of motion, reduce pain and promote proprioception.[4] This intervention was not included in the plan of care due to the patient already possessing full passive range of motion in all planes.

Of particular concern in individuals with an acute ankle sprain is the potential development of CAI. Unfortunately, accurate predictive factors for the development of CAI have been not been identified. The research available indicates that individuals are at increased risk for developing CAI if they have an increased talar curve, do not use an external support or do not perform exercises targeting balance and proprioception following an acute ankle sprain.[4] Considering the likelihood of developing CAI may approach 75%, all individuals being treated for first time, lateral ankle sprain should undergo a rehabilitation programme including interventions for prevention of recurrent sprains.[9]

At 6 weeks postinjury, the patient presented with significant pain, weakness, reduced ROM and impaired function. This is in contrast to the typical timeline of recovery for grade I and grade II lateral ankle sprains in the literature. Naeem *et al*[21] reported that the majority of individuals with acute lateral ankle sprains who received 6 weeks of physical therapy immediately following injury demonstrated normal gait mechanics, ability to sustain single-leg stance on affected lower extremity (LE), full ankle ROM, absent oedema and minimal levels of pain. The deficits found in this patient at initial evaluation support the current evidence that prolonged immobilisation and delayed rehabilitation may contribute to delayed functional improvement. In this patient's case, a return to functional use of the affected ankle occurred 14 weeks after initial injury compared with similar outcomes usually achieved in only 6–8 weeks when receiving early mobilisation and early referral for physical therapy.[19–22]

In retrospect, additional testing and intervention could have been used to promote improved outcomes. Measurement of ankle girth should have been done during the initial assessment. While visual inspection showed only mild swelling at the time of the initial evaluation, a more objective measurement using the figure-of-eight method would have enabled documentation of any increase or decrease in oedema. The decision to not perform manual mobilisations of the ankle was made based on the full ankle PROM that the patient possessed at the initial evaluation. Despite this, manual mobilisation of the talocrural joint can be beneficial in pain modulation, proprioception and early improvement in AROM and could have been beneficial in the early stages of the intervention programme when the patient's symptoms were more irritable. An anterior to posterior glide of the subtalar joint is supported by the literature to improve these clinical outcomes.[20]

A wealth of research is available regarding the conservative management of lateral ankle sprains in athletes; however, scarce literature has described the management, prognosis and outcomes of lateral ankle sprains in the non-athlete.[4] The patient described in this case study responded well to a combination of ankle strengthening, proprioception and balance exercises. This case study highlights a successful conservative treatment approach for a non-athlete with an acute lateral ankle sprain following prolonged immobilisation and delayed physical therapy intervention. Primary care clinicians are encouraged to avoid prolonged immobilisation and to make early referral for rehabilitation for patients who have incurred grade I and grade II lateral ankle sprains.

Learning points

- Ankle sprains are a very common lower quarter injury with a rate of occurrence estimated at 23 000 ankle sprains per day in the USA.
- It is common for individuals who have sustained a lateral ankle sprain to be treated with prolonged immobilisation.
- Patients with grade I and II lateral ankle sprains who are treated with early mobilisation and referral to physical therapy have demonstrated earlier return to function and overall better outcomes compared with patients who are treated with prolonged immobilisation and delayed referral.

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