Case Report

Management of chronic ankle pain using joint mobilization and ASTYM[®] treatment: a case report

Emily J Slaven¹, Jessie Mathers²

¹Krannert School of Physical Therapy, University of Indianapolis, IN, USA, ²Department of Physical Therapy, Duke University Medical Center, Durham, NC, USA

Treatment of ankle sprains predominately focuses on the acute management of this condition; less emphasis is placed on the treatment of ankle sprains in the chronic phase of recovery. Manual therapy, in the form of joint mobilization and manipulation, has been shown to be effective in the management of this condition, but the combination of joint mobilization and manipulation in tandem with ASTYM[®] treatment has not been explored. The purpose of this case report is to chronicle the management of a patient with chronic ankle pain who was treated with manual therapy including manipulation and ASTYM treatment. As a result of a fall down stairs 6 months previously, the patient sustained a severe ankle sprain. The soft tissue damage was accompanied by bony disruptions which warranted the patient spending 3 weeks in a walking boot. At the initial evaluation, the patient reported difficulty with descending stairs reciprocally and not being able to run more than 4 minutes on the treadmill before the pain escalated to the level that she had to stop running. After five sessions of therapy consisting of joint mobilization, manipulation and ASTYM, the patient was able to descend stairs and run 40 minutes without pain.

Keywords: Ankle fracture, Joint manipulation, ASTYM treatment

Background

Ankle sprains are a common musculoskeletal injury with almost 23 000 individuals in the United States experiencing an ankle sprain every day.¹ Treatment of ankle sprains has predominately focused on the treatment of the acute symptoms with less emphasis placed on the long-term outcomes following injury.^{2,3} The results of a recent study by Aiken *et al.*⁴ showed that 30 days following ankle sprain injury patients reported an improvement in function, but residual symptoms were still present. This incomplete recovery can place patients at risk of re-injury.⁵

Manual therapy in the form of joint mobilization and manipulation is frequently used in the treatment of patients with ankle sprains. A number of studies have shown that localized manual therapy techniques associated with thrust and non-thrust manipulation do provide favorable outcomes following ankle sprain.⁶⁻⁹ One study has even outlined criteria associated with success with these techniques.⁶ Whitman *et al.*⁶ found favorable outcomes after ankle sprain when the following factors were present: symptoms were worse with standing, symptoms were worse in the evening, a

navicular drop of greater than 5 mm was present, and distal tibiofibular joint hypomobility was detectable. When three out of these four factors were present, patients had a 95% likelihood of success after use of manipulation of the talocrural (TC) joint.

In contrast to studies that support joint manipulation in the treatment of ankle sprains, there is limited evidence for the management of soft tissue dysfunction in this population. One treatment that addresses soft tissue dysfunction is ASTYM[®] treatment (Performance Dynamics, Muncie, IN, USA). ASTYM treatment focuses on activating a physiological response leading to the regeneration of soft tissues. The treatment includes specific protocols and instrumentation to stimulate affected soft tissues to heal and regenerate at a cellular level. Hypothetically, the ASTYM process is used to activate a regenerative response via induction of leakage from dysfunctional capillaries, which leads to fibroblast activation, macrophage mediated phagocytosis (microdebridement), and local release of growth factors that result in additional fibroblast recruitment.^{10,11} A case report by Melham *et al.*¹² describes the outcome after use of ASTYM treatment in the management of a patient who had a chronic ankle sprain. This study focused on the management of soft tissue dysfunction, but it

Correspondence to: E J Slaven, Krannert School of Physical Therapy, University of Indianapolis, IN 46227, USA. Email: slavene@uindy.edu

Figure 1 Radiograph of the ankle.

did not explore the role that manual therapy in the form of joint mobilization and manipulation might have in conjunction with ASTYM treatment.

Overall the evidence is unclear on how ASTYM and joint mobilization or manipulation might be used in combination to improve the overall outcome. Consequently, the purpose of this case report is to describe the management of a patient who presented with chronic ankle pain. A combined manual approach of joint mobilization, manipulation, and ASTYM treatment was used to reduce pain and restore complete function.

Patient Characteristics

The patient was a 35-year-old female working as a physical therapist. She enjoyed running and lifting weights three times a week and had no significant medical history other than a previous left lateral ankle sprain sustained in 1997. Per her report she had a small distal fibula fracture at that time and was treated with immobilization and physical therapy (PT).

Examination

The patient reported that the current injury to her left ankle occurred when she was descending stairs and

missed a step. This caused her to lose her balance, and she reported ‘twisting the ankle back and forth’ as she fell into the wall. She described hearing and feeling popping in the ankle at the time of injury.

Initially, she had pain with any form of weight-bearing. She treated herself with a combination of rest, ice, compression, and elevation. She did see a sports medicine physician 5 days after the injury. During that visit a radiograph was taken, and she was found to have a minimally displaced avulsion fracture of the dorsal talus (Fig. 1). She was given a long walking boot to wear and axillary crutches to use with the recommendation for partial weight-bearing. At that time she scored 42/80 on the lower extremity functional scale (LEFS). Following up with the sports medicine physician 2 weeks later, she underwent another radiograph which showed ‘interval healing of the fracture and excellent placement of the talus fracture’, and she was told to wean from the boot and increase her activities as tolerated.

At the time that the patient presented to PT, 6 months had passed since the initial injury. She had been able to resume almost all of her normal activities, but she reported ankle pain with both running more than 4 minutes on a treadmill and when descending steps reciprocally. Current pain was described as soreness in the anterior and medial aspect of the ankle (Fig. 2); the pain was rated as 1/10 at initial visit on a numeric rating scale with the worst pain being rated 5/10 when running. She was found to have significant loss of dorsiflexion especially when measured in a closed chain position. This motion reproduced her anterior and medial ankle pain. There was a reduction in TC posterior glide in the left lower limb as compared to the right lower limb, and there was tenderness of anterior and medial ankle structures. Table 1 provides a summary of the objective findings. There were no strength or proprioception deficits.

It is notable that in the 2 weeks prior to presenting to PT for her initial evaluation, she had been informally treated twice by a manual physical therapist, who was a fellow in training, using joint manipulation to the TC joint. When this informal

Table 1 Summary of the patient’s symptoms throughout the course of treatment

Visits	Pain (current)	GROC	Level of function	LEFS	Objective measures
1	1	NA	90	61/80	OCDF: 12°, CCDF: 25°, pain descending stairs, squatting, unable to run
2	1	2	90	63/80	OCDF: 12°, CCDF: 30°, pain descending stairs, squatting, unable to run
3	0	5	100	74/80	CCDF: 35°, intermittent pain descending stairs
4	1	6	100	79/80	Treadmill walk/run intervals for a total of 10 minutes, no pain descending stairs
5	0	7	100	78/80	Treadmill running × 40 minutes at 5.5–6 mph, no pain with stairs
3-month follow-up	0	7	100	80/80	Treadmill running × 40 minutes at 5.5–6 mph, no pain with stairs

Note: GROC=global rating of change; LEFS=lower extremity function scale; OCDF: open chain dorsiflexion; CCDF: closed chain dorsiflexion.

Figure 2 Body chart of reported pain.

Figure 3 Talocrural joint manipulation.

treatment only provided a partial reduction in her symptoms, she started formal PT.

Clinical impression and rationale

The patient's presentation is supported by several studies that have highlighted the high incidence of pain and decreased function many months after an ankle sprain.^{1,13,14} Based on her date of injury (6 months prior to presentation to PT), the loss of closed chain ankle dorsiflexion, loss of accessory motion at the TC joint, and soft tissue tenderness, the decision was made to treat not only the hypomobility at the TC joint with the use of thrust and non-thrust mobilizations, but also to address soft tissue dysfunction with ASTYM treatment. The therapist considered that if there had been sufficient force to cause osseous damage (talus fracture) during the fall, it was likely that the soft tissues surrounding the ankle also had been disrupted. The decision to treat the soft tissue dysfunction in addition to joint dysfunction was supported by the fact that this patient's symptoms had not markedly altered following two sessions of TC joint manipulation that had been performed prior to starting formal PT. The therapist chose ASTYM treatment because she had been trained in this process and had personal experience

Figure 4 ASTYM treatment.

clinically with ASTYM resolving soft tissue restrictions in and about the ankle and other joints.

In accordance with Maitland's¹⁵ philosophy of focusing on the patient's response to motion, the most concordant sign was closed chain dorsiflexion. Repeating this motion with overpressure decreased the symptoms; therefore, the standing mobilization with movement (MWM) was used. Thrust manipulation (Fig. 3), specifically TC distraction, was used to achieve mechanical changes at the joint such as increase in joint space and increase in range of motion^{9,16} and to achieve the neurophysiologic effects that are believed to decrease pain.

ASTYM treatment has been used to assess and treat soft tissue restrictions and has been found to reduce subjective complaints of motion restriction and to increase function.¹⁰ In this case ASTYM treatment was utilized to address the soft tissue dysfunction by stimulating re-absorption of inappropriate fibrosis and stimulating the regeneration of healthy tissue in affected areas. This outcome is achieved through a systematic process of strokes that are performed throughout the involved area, utilizing hand-held instruments with a specifically defined edge (Fig. 4). As the instrumentation glides over the dysfunctional areas, it 'catches' on the irregular fibrosis and the clinician and patient experience a sensation of roughness. The ASTYM process appears to activate a healing response via induction of capillary leakage in conjunction with the mechanical stimulus of fibroblasts.^{10,11} Leakage from the capillaries results in the release of white and red blood cells into the area as well as growth factors from the serum, stimulating macrophage-mediated phagocytosis and tissue turnover.¹⁷ Histological studies have demonstrated that ASTYM treatment results in increased fibroblast recruitment and activation.^{18,19}

Interventions

The treatment provided at each session is described in Table 2. Treatment was augmented with a home exercise program targeting the specific limitations that were identified. The author's clinical experience with lack of closed chain dorsiflexion led her to

prescribe soleus stretching, and the stretching component of the ASTYM treatment sequence required that the gastrocnemius and anterior tibial muscles were also stretched. Included in the treatment plan were goals to allow for pain-free running and descent of the stairs.

Outcomes

As reported in Table 1, the patient improved in all recorded variables. TC mobility was no longer restricted when assessed during the final treatment session. Functionally, 6 weeks after starting PT (a total of five treatment sessions), she was able to run 40 minutes on the treadmill at speeds between 5.5 and 6 mph which was the work-out that she was able to perform prior to injury. She reported 100% global rate of function and a 7 (a very great deal better) on the global rate of change. Initially when starting PT, her LEFS was 61/80, and at the final visit it was 80/80. The LEFS was chosen as an outcomes measure for this patient as it has been shown to be sensitive to change after ankle fractures and ankle sprains.^{19,20} At that point the patient was discharged and encouraged to continue her home exercise program.

Discussion

Ankle sprains are a commonly occurring injury that can benefit from PT and more specifically, manual therapy.⁶⁻⁹ This case report outlines the response of a recalcitrant ankle sprain to manual therapy using joint mobilization and manipulation combined with ASTYM treatment.

Braun¹³ assessed the 1-year outcomes of ankle sprains using self-administered surveys. Four hundred sixty-seven (66.5%) of 702 patients who had presented to their primary care physician with ankle sprains were surveyed. Residual symptoms 6 to 18 months after injury were reported by almost all respondents. The patient in this case report continued to experience symptoms that affected daily mobility

and recreational activity 6 months following the original incident. She had previously experienced an ankle sprain, and the results of the study by Braun¹³ also indicated that re-injury occurred in 19.4% of respondents following the original ankle sprain. The patient in this current case report had a history of previous ankle sprain.

Identification of impairments and functional limitations are a key component of the management of patients who present with lingering symptoms following ankle sprain. In the case of this patient, notable limitations of motion were detected and addressed with joint manipulation. Criteria have been established to identify those patients who would benefit from TC joint manipulation following ankle sprain.⁶ However, not all patients who have sustained an ankle sprain meet all or any of the criteria listed in the clinical prediction rule proposed by Whitman *et al.*⁶ The patient in the current study did not meet the criteria of the clinical prediction rule.

Because the patient in this case did not have significant improvement in symptoms following TC joint manipulation, the clinical decision was made to investigate the effect that soft tissue restriction was contributing to her symptoms. Prior to the initial session with ASTYM, the patient reported pain when descending the stairs in the clinic and with single limb flat foot squat. Residual scar tissue and soft tissue restrictions from a previous sprain have the potential to impair movement and proprioception.¹² ASTYM treatment is designed to stimulate tissue turnover with a goal of re-absorption excessive scar tissue and encouraging functional alignment of soft tissue. The instrumentation utilized with the ASTYM process is designed to increase tactile feedback which should allow the clinician to more easily detect areas of fibrosis. Using the ASTYM instrumentation, notable fibrosis was detected over the anterior and medial ankle. Anecdotally, ASTYM treatment also appears to effect neurologic functioning with patients frequently reporting a sense of ease of movement immediately following treatment. The patient in this case reported a noticeable difference in pain (0/10) and increased motion immediately after ASTYM treatment when these activities were retested. With subsequent treatment sessions and the performance of a home stretching program, the patient's ability to run also improved to the level that the patient could run for 40 minutes without pain.

This case report outlines how manual therapy in the form of mobilization and manipulation can be used in combination with ASTYM treatment in the management of a patient with chronic ankle pain. Considering that soft tissue often crosses joints, soft tissue restriction should be also considered as a factor limiting joint mobility. Therefore, soft tissue mobility

Table 2 Summary of treatment provided

Visits	Intervention
1	Initial evaluation, ASTYM, home exercise program (standing gastrocnemius and soleus stretches, kneeling plantar flexion stretch)
2	ASTYM, TC distraction manipulation, standing MWM mobilization into dorsiflexion, above stretches in clinic
3	ASTYM, TC distraction manipulation, standing MWM mobilization into dorsiflexion, above stretches in clinic, recommended trial of walk/run interval on treadmill
4	ASTYM, TC distraction manipulation, standing MWM mobilization into dorsiflexion, recommended running as tolerated on treadmill
5	ASTYM, discharged

should also be assessed and possibly treated concurrently with joint mobilization. A main limitation of this case report, as with any case report, is the generalization of the findings. Future research using an experimental design controlling for confounding variables would increase the strength of the argument that chronic ankle pain treatment should include approaches that address both the involved joint and surrounding dysfunctional soft tissues.

References

- 1 Fallat L, Grimm D, Saracco J. Sprained ankle syndrome: prevalence and analysis of 639 acute injuries. *J Foot Ankle Surg* 1998;37:280–5.
- 2 Lamb S, Nakash R, Withers E, Clark M, Marsh J, Wilson S, *et al* Clinical and cost effectiveness of mechanical support for severe ankle sprains: design of a randomised controlled trial in the emergency department [ISRCTN 37807450]. *BMC Musculoskelet Disord* 2005;6:1.
- 3 Boyce S, Quigley M, Campbell S. Management of ankle sprains: a randomised controlled trial of the treatment of inversion injuries using an elastic support bandage or an Aircast ankle brace. *Br J Sports Med* 2005;39:91–6.
- 4 Aiken A, Pelland L, Brison R, Pickett W, Brouwer B. Short-term natural recovery of ankle sprains following discharge from emergency departments. *J Orthop Sports Phys Ther* 2008;38:566–71.
- 5 Pope R, Herbert R, Kirwan J. Effects of ankle dorsiflexion range and pre-exercise calf muscle stretching on injury risk in Army recruits. *Aust J Physiother* 1998;44:165–72.
- 6 Whitman J, Cleland J, Mintken P, Keirns M, Bieniek M, Albani S, *et al* Predicting short-term response to thrust and nonthrust manipulation and exercise in patients post inversion ankle sprain. *J Orthop Sports Phys Ther* 2009;39:188–200.
- 7 Vicenzino B, Branjerdporn M, Teys P, Jordan K. Initial changes in posterior talar glide and dorsiflexion of the ankle after mobilization with movement in individuals with recurrent ankle sprain. *J Orthop Sports Phys Ther* 2006;36:464–71.
- 8 Green T, Refshauge K, Crosbie J, Adams R. A randomized controlled trial of a passive accessory joint mobilization on acute ankle inversion sprains. *Phys Ther* 2001;81:984–94.
- 9 Pellow J, Brantingham J. The efficacy of adjusting the ankle in the treatment of subacute and chronic grade I and grade II ankle inversion sprains. *J Manipulative Physiol Ther* 2001;24:17–24.
- 10 Gehlsen G, Ganion L, Helfst R. Fibroblast responses to variation in soft tissue mobilization pressure. *Med Sci Sports Exerc* 1999;31:531–5.
- 11 Sevier T, Stover S, Helfst R, Zanas J. ASTYM clinical manual. 7th ed. Muncie, IN: Performance Dynamics; 1996–2009.
- 12 Melham T, Sevier T, Malnofski M, Wilson J, Helfst R. Chronic ankle pain and fibrosis successfully treated with a new non-invasive soft tissue mobilization technique (ASTM): a case report. *Med Sci Sports Exerc* 1997;30:801–4.
- 13 Braun B. Effects of ankle sprain in a general clinic population 6 to 18 months after medical evaluation. *Arch Fam Med* 1999;8:143–8.
- 14 Gerber J, Williams G, Scoville C, Arciero R, Taylor D. Persistent disability associated with ankle sprains: a prospective examination of an athletic population. *Foot Ankle Int* 1998;19:653–60.
- 15 Maitland G. *Peripheral manipulation*. 5th ed. Oxford: Butterworths; 2005.
- 16 Eisenhart A, Gaeta T, Yens D. Osteopathic manipulative treatment in the emergency department for patients with acute ankle sprains. *J Am Osteopath Assoc* 2003;103:417–21.
- 17 Sharma P, Maffuli N. Basic biology of tendon injury and healing. *Surgeon* 2005;3:309–16.
- 18 Davidson C, Ganion L, Gehlsen G, Verhoestra B, Roepke J, Sevier T. Rat tendon morphologic and functional changes resulting from soft tissue mobilization. *Med Sci Sports Exerc* 1997;29:313–9.
- 19 Lin C, Moseley A, Refshauge K, Bundy A. The lower extremity functional scale has good clinimetric properties in people with ankle fracture. *Phys Ther* 2009;89:580–8.
- 20 Bleakley C, O'Connor S, Tully M, Rocke L, MacAuley D, Bradbury I, *et al*. Effect of accelerated rehabilitation on function after ankle sprain: randomised controlled trial. *BMJ* 2010;340:c1964.