JAOA

ORIGINAL CONTRIBUTION

Osteopathic Manipulative Treatment in the Emergency Department for Patients With Acute Ankle Injuries

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Study Objective: **The purpose of this study was to evaluate the efficacy of osteopathic manipulative treatment (OMT) as administered in the emergency department (ED) for the treatment of patients with acute ankle injuries.**

Methods: **Patients aged 18 years and older with unilateral ankle sprains were randomly assigned either to an OMT study group or a control group. Independent outcome variables included edema, range of motion (ROM), and pain. Both groups received the current standard of care for ankle sprains and were instructed to return for a follow-up examination. Patients in the OMT study group also received one session of OMT from an osteopathic physician.**

Results: **Patients in the OMT study group had a statistically significant ($F = 5.92$, $P = .02$) improvement in edema and pain and a trend toward increased ROM immediately following intervention with OMT. Although at follow-up both study groups demonstrated significant improvement, patients in the OMT study group had a statistically significant improvement in ROM when compared with patients in the control group.**

Conclusions: **Data clearly demonstrate that a single session of OMT in the ED can have a significant effect in the management of acute ankle injuries.**

Ten percent of emergency department (ED) visits are related to ankle injury, and approximately 75% of these injuries are sprains.[1,2] The current standard of care for acute ankle sprains includes resting the ankle, cryotherapy, compression dressings, elevation of the affected ankle, analgesia (specifically, nonsteroidal anti-inflammatory drugs [NSAIDs]), and early mobilization.[3,4]

Despite this current practice, 25% to 40% of ankle sprains are associated with recurrent injury or prolonged disability.[6-8] Some authors have postulated that such common complications are the result of inadequate treatment of the initial injury because insufficient consideration is given to the exact nature of the pathologic process in each patient.[5-8]

Osteopathic manipulative treatment (OMT) has been proven efficacious in the setting of acute sprains and strains. In 1980, Blood[9] reported using OMT to treat patients with ankle sprains. He describes a method of correcting the underlying somatic dysfunctions, restoring functional anatomy, and decreasing edema. To date, no study has evaluated the efficacy of OMT on acute ankle sprains. The primary objective of this study was to evaluate quantitatively the effect of OMT on ED patients with acute ankle injuries. The specific aim of this study was to assess the immediate effects of a single session of OMT when performed in the ED, as well as determining what additional benefit patients may receive when OMT is added to the current standard of care for acute ankle sprains.

Methods

Study Design

This is a prospective, randomized, controlled, nonconsecutive clinical trial of adult patients presenting to an urban, university-affiliated ED with acute ankle injury.

Patient Population

All patients 18 years of age or older who presented within 24 hours of their injuries were considered for study enrollment. Patients with an ED diagnosis of acute unilateral first- or second-degree ankle sprain by ED history, physical examination, and radiographic interpretation were considered for study inclusion.

Patients were excluded if they were younger than 18 years (as nondisplaced Salter-Harris I fractures may be missed on radiographic evaluation), had a positive ankle drawer test (indicating ankle instability and a third-degree sprain), had a chronic ankle injury on the contralateral side, or if they were

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inebriated or otherwise had an altered mental status when presenting to the ED. If the official radiographic interpretation was significant for a fracture missed by the ED physician, the patient was removed from the follow-up analysis. The ED presentation was maintained in our intention-to-treat analysis.

After providing informed consent for participation in the study, patients were randomly assigned as subjects in either the OMT study group or in the control group. Patients in both groups were evaluated for edema, range of motion (ROM), and pain. Edema was measured in centimeters as the maximal circumference about the medial and lateral malleoli and was compared with measurements taken of the uninjured ankle (ie, delta circumference). Using a goniometer placed at the lateral malleolus with the approximate axis of motion at an imaginary line between the medial and lateral malleoli, investigators (A.W.E. and T.J.G.) measured patients' ROM as the degrees of motion from full, patient-active plantar flexion to dorsiflexion. Investigators compared these results with the same measurement in the uninjured ankle (ie, delta range). Patients were then asked to quantify their pain using a 1 to 10 visual analog pain scale.

OMT Study Group

One of the authors (A.W.E.) provided OMT to patients in the OMT study group. The specific osteopathic manipulative techniques administered to each patient varied based on the osteopathic physician's assessment of the patient's physical examination and included a combination of the soft-tissue techniques listed in the *Figure*. The duration of each treatment session was 10 to 20 minutes. Immediately following the treatment session, the sprained ankle was reevaluated for edema, ROM, and pain.

Discharge Treatment and Instructions

Patients in both groups received the current standard of care for acute ankle sprains: *RICE* therapy (rest, ice, compression, elevate) and analgesics. Patients were advised to rest and ice the ankle for 20-minute intervals. Patients' injured ankles were then placed in a Jones compression dressing (ie, alternating layers of elastic bandages and compression bandages) and they were instructed to elevate the ankle. Patients were given prescriptions for ibuprofen unless they gave a history of peptic ulcer disease or intolerance to aspirin or NSAIDs. Such patients were instead offered acetaminophen. Patients were also instructed on the safe and proper use of crutches. Each patient was further instructed to return in 5 to 7 days for a follow-up examination.

At follow-up, a research assistant repeated the aforementioned measurements on the sprained and on the uninjured ankle. Patients were offered continued follow-up in the outpatient clinics.

- The fibula and tibia should be palpated. There is often a slight torsion of the interosseous ligament with the proximal fibula noted to be more posterior. This effect can be reduced using simple torsion and soft tissue techniques.

- Using soft tissue and fascial techniques, the osteopathic physician can evaluate and then treat the patient by examining the relationships of the bones from the toes to the ankle. For example, given the common laxity of the fibularis muscles, there is often a dropped cuboideum (cuboid bone), which has to be reduced.

- A patient who has pain and tenderness along the fibularis muscles and tendons can be treated by the osteopathic physician using muscle energy and strain and counterstrain techniques. Additionally, strain and counterstrain techniques will often help if used directly on the anterior talofibular ligament, especially in cases of first-degree sprains.

- Lymphatic drainage techniques should be used to reduce pain from edema.

Sources: Pennington GM, Danley DL, Sumko MH, Bucknell A, Nelson JH. Pulsed, non-thermal, high-frequency electromagnetic energy (DIAPULSE) in the treatment of grade I and grade II ankle sprains. *Mil Med*. 1993;158:101-104.
Blood SD. Treatment of the sprained ankle. *J Am Osteopath Assoc*. 1980;79:680-692.

Figure. *Soft tissue techniques for the assessment and management of acute ankle sprains. In keeping with osteopathic principles and practice, the osteopathic manipulative technique or techniques used by the osteopathic physician to provide individualized treatment is based on the physician's palpatory findings and is unique to each patient. However, a common pattern of injury has been described for the care and management of acute ankle sprains, so a uniform treatment regimen could often be followed. Each patient in this study was treated in one session only while lying in the supine position.*

Statistical Analysis

This study used repeated observations of each patient in the OMT study group and in the control group. Observations were made on both the injured ankle and on the uninjured ankle.

In this study, several analyses were used: (1) a 2-way repeated analysis of variance (ANOVA) was used with each measure; (2) repeated measures analysis of covariance to determine whether use of the uninjured ankle as a covariate would improve the analysis; and (3) repeated measures ANOVA and the Student *t* test on the OMT study group to assess the immediate effectiveness of the additional intervention (ie, the OMT session).

Another way of adjusting for initial difference is to use percentages using the normal, uninjured ankle as the denominator. This procedure has been used in analogous studies.[10,11] The covariance analyses were conducted with these percentages as well.

Results

A total of 55 patients were enrolled in this study: 28 in the OMT study group and 27 in the control group. The mean age was 31 years, and 62% of participants were women. *Table 1* summarizes the demographic characteristics of the patient population for this study and outlines the means for each observation and outcome measure. There were no statistically significant differences between the delta ankle circumference (as a measure to evaluate edema), mean ROM, or the patients' subjective evaluations of their levels of pain at the baseline measure.

Results of a single session of OMT provided in an ED are presented in *Tables 1* through *3*. To assess the effectiveness of OMT in this setting, Student *t* tests were conducted on the means of each measure between the initial sprain and after OMT was provided (*Table 2*) and subsequently at 1-week follow-up (*Table 3*).

The repeated ANOVA for each of the measures yielded a significant within-subjects effect, indicating that one OMT intervention session was effective with respect to reducing edema and pain. Although there was a trend in improved ROM (11 degrees), this finding was not statistically significant. Similar results were found in the analyses of the percentages, except that a significant interaction was found for ROM ($F = 5.92$, $P = .02$). Analyses run with the uninjured ankle as a covariate did not change these findings.

Table 1
Characteristics of Study Subjects and Baseline Outcome Variables, N = 55*

Characteristic†	Treatment, No. (%) (n = 28)	Control, No. (%) (n = 27)	*P*
■ Age, y	29.9 ± 9.8	32.8 ± 13.3	
■ Sex			
□ Male	11 (39)	10 (37)	
□ Female	17 (61)	17 (63)	
■ Race or ethnicity			
□ African American	7 (25)	9 (33)	
□ Hispanic	9 (32)	9 (33)	
□ White (non-Hispanic)	12 (43)	9 (33)	
Baseline Outcome Variable			
■ Edema (cm)	26.95 ± 2.5	26.83 ± 1.8	—
□ Delta circumference: injured-contralateral (degrees)	2.07 ± 1.3	1.67 ± 0.8	.15
■ Range of motion (degrees)	28.21 ± 19.9	22.41 ± 13.3	—
□ Delta range: injured-contralateral (degrees)	−31.24 ± 12.4	−28.85 ± 16.1	.54
■ Pain scale (1 to 10)‡	6.50 ± 2	7.25 ± 2.5	.22

* All values are expressed as mean ± SD for continuous variables.
† Percentages reported were rounded for each demographic characteristic. Therefore the sum of these percentages may not equal 100%.
‡ Patients were asked to quantify their pain using a 1 to 10 visual analog pain scale.

Table 2
Osteopathic Manipulative Treatment: Outcome Measures Before and After One Session in Emergency Department, N = 28*

Variable	Before Treatment	After Treatment	*P*
■ Edema (cm)	26.95 ± 2.5	25.79 ± 2.2	—
□ Delta circumference: injured-contralateral (cm)	2.07 ± 1.3	0.91 ± 1.0	<.001
■ Range of motion (degrees)	28.21 ± 19.9	39.23 ± 10.3	—
□ Delta range: injured-contralateral (degrees)	−31.24 ± 12.4	−20.23 ± 27.7	.08
■ Pain scale (1 to 10)†	6.50 ± 2	4.1 ± 1.7	<.001

* All values are expressed as mean ± SD for continuous variables.
† Patients were asked to quantify their pain using a 1 to 10 visual analog pain scale.

Table 3
One-Week Follow Up:
Outcome Measures for Patients Who Received Osteopathic Manipulative Treatment and Control Subjects, N = 40*

Variable	Treatment (n = 20)†	Control (n = 20)†	*P*
■ Edema (cm)	25.75 ± 2.0	25.45 ± 1.9	———
□ Delta circumference: injured-contralateral (cm)	0.77 ± 1.1	0.57 ± 1.0	.48
■ Range of motion (degrees)	42.5 ± 14.4	39.0 ± 15.4	———
□ Delta range: injured-contralateral (degrees)	−5.25 ± 8.8	−13.5 ± 12.4	.01
■ Pain scale (1 to 10)‡	3.15 ± 1.4	3.5 ± 2.8	.61

* All values are expressed as mean ± SD for continuous variables.
† Fifteen patients (27%) were lost to follow-up. The 8 patients in the treatment group and the 7 patients in the control group did not differ with regard to baseline characteristics.
‡ Patients were asked to quantify their pain using a 1 to 10 visual analog pain scale.

Seventy-three percent of the patients enrolled returned for follow-up evaluation. The 15 patients lost to follow-up did not differ with regard to baseline characteristics. All patients had a statistically significant improvement in all three outcome measures at follow-up. Comparison of the two study groups at follow-up revealed a statistically significant improvement in ROM in the group that received OMT in addition to the current standard of care for acute ankle sprains.

Comment

An ankle sprain is a traumatic, ligamentous injury at the level of the ankle mortise. Three levels of ankle sprain severity are commonly described.[1,2,12-15] Multiple studies have confirmed that the majority of ankle sprains occur from a foot inversion mechanism, with as many as 85% of inversion injuries causing isolated anterior talofibular ligament tears.[1,2,6,14,15] The second most commonly affected structure is the calcaneofibular ligament at the fibular origin—most often an accompanying injury to an anterior talofibular ligament sprain.[2] The traumatic vector of force occurs with ankle inversion, internal rotation, and plantar flexion of the foot relative to the leg.[9] This force exceeds the ROM of the lateral ligaments and results in injury to them.

For clinicians treating patients with such injuries, two general treatment goals exist: the restoration of functional anatomy and a decrease in edema. When these goals are accomplished, an increased ROM and patient comfort will follow. Additionally, restoring functional anatomy will allow for easier drainage of excess fluids, or edema. It is important to reduce the accumulation of fluids surrounding the injury because fluid around the joint increases pain. Obviously, the more pain a patient has, the less likely he or she is to attempt mobilization. Also, tissue swelling increases the likelihood of adhesions that can delay healing and decrease ROM.[6] Simko et al[16] state that the recovery rate for ankle function following an inversion sprain may be related to the effectiveness of edema control at the injury site. Fluids must be mobilized back into the lymphatic system for optimal healing to occur.[17]

The results of our study indicate statistically significant reductions in edema and pain—and a trend toward increased ROM—immediately following one OMT intervention session. Although both groups had significant improvement at follow-up, the OMT study group had a statistically significant improvement in ROM when compared with the control group. Our results imply that there is both an immediate advantage and a delayed benefit to adding OMT in the acute care setting of ankle injuries. After a brief OMT session in the ED, patients will have a significant reduction in swelling and, consequently a reduction in their level of pain. Patients who receive OMT as an adjunct to traditional pain management will have greater ROM.

This study has some limitations. It was based on a "convenience sample," and the same osteopathic physician (A.W.E.) treated all patients. Although we were able to show the efficacy of OMT in the ED, the external validity of a study must come into question when only one physician performs the investigational intervention.

In addition, other studies involving OMT have used sham treatments. Our study design did not include such a placebo control. In the design phase of the trial, we decided that the OMT session would be tested against what is currently practiced in the ED. Future studies should include larger cross-sections of osteopathic physicians at all levels of training (ie, interns, residents, and attending physicians), and sham therapy should be considered the most appropriate control.

Finally, we report preliminary data regarding the immediate and short-term impact of OMT in ED patients with acute ankle injury. Future research should include the investigation of the role of OMT as provided in the ED in long-term outcome measures, including prevention of recurrent injury and long-term disability.

The efficacy of OMT has been demonstrated in multiple settings. This study illustrates an approach to a common presentation in emergency medicine using osteopathic principles and practice. Our data clearly demonstrate that a single session of OMT in the ED can have a significant effect on the management of acute ankle injuries.

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