

## Functional Treatment Comparing with Immobilization after Acute Ankle Sprain

Hamidreza Mohammadi,<sup>1</sup> Hamireza Ghafarian-Shiraz,<sup>2</sup> Fateme Saniee,<sup>3</sup> Hamdollah Delaviz\*<sup>4</sup>

1. Department of Orthopedics, Faculty of Medicine, Yasuj University of Medical Sciences, Yasuj, Iran
2. Department Epidemiology & Biostatistics, Faculty of health, Tehran University of Medical Sciences, Tehran, Iran
3. Department in Physical Therapy, Yasouj Rehabilitation Center, Yasuj, Iran
4. Department of Anatomy, Cellular and Molecular Research Center, Yasouj University of Medical Sciences, Yasuj, Iran

Article information	Abstract
<p>Article history: Received: 19 Sep 2011 Accepted: 19 Oct 2011 Available online: 28 Oct 2012 ZJRMS 2013; 15(2): 28-31</p> <p>Keywords: Ankle Acute Functional Treatment Immobilization Injury</p> <p>*Corresponding author at: Department of Anatomy, Cellular and Molecular Research Center, Yasouj University of Medical Sciences, Yasuj, Iran E-mail: hamdidelaviz@yahoo.com</p>	<p><b>Background:</b> Ankle injuries are among the most prevalent injuries with which a physician may encounter. In this study, the efficiency of the functional treatment was compared with the immobilization treatment in healing the acute ankle sprain.</p> <p><b>Materials and Methods:</b> This clinical trial study was carried out on 100 male patients whose ankle sprain had been diagnosed by Yasuj Shahid Beheshti Hospital. Using block allocation randomization method and regardless of damage degree, patients were divided into two groups, functional method (1st group) or immobilization with plaster (2nd group), for treatment. Several variables such as range of motion, pain intensity, inflammation, joint tenderness and returning to work after 2, 6 and 12 weeks were examined.</p> <p><b>Results:</b> After two weeks, the average pain intensity in the first group (<math>33.2 \pm 3.2</math>) has been decreased compared to the second group (<math>55 \pm 1.2</math>), which showed a significant difference between the two groups (<math>p &lt; 0.05</math>). The average ankle range of motion in the first and second groups was <math>29.08 \pm 1.2</math> degrees and <math>20.4 \pm 2.2</math> degrees, respectively which had been increased significantly in the first group compared to the second group (<math>p &lt; 0.03</math>). Similarly, a considerable difference was observed in decreased inflammation and tenderness in the first group compared to the second one.</p> <p><b>Conclusion:</b> In acute ankle sprains, the functional treatment is better than the immobilization treatment in alleviating pain, inflammation and improving the range of joint motion.</p> <p>Copyright © 2013 Zahedan University of Medical Sciences. All rights reserved.</p>

### Introduction

Damages caused by sports injuries are among the most prevalent cases which a physician is encountered in clinics or emergency departments. The statistical analyses show that ankle damages account for nearly 16% of sport injuries [1]. Ankle ligament injuries are classified into three cases based on the injuries intensity. For the first type, joint is stable but the ligaments are strained. For the second type, ligaments are ruptured very trivially, but in the third type the rupture of ligament is complete [2]. In spite of high frequency of such injuries, there is no single acceptable treatment preferable to the other current treatments. The common treatments are surgical repair of injuries, immobilization with plaster, elastic bondage, injection of steroid and prescribing non-steroid sedatives [3]. Decreasing treatment period, achieving a stable joint, preventing from recurrence and repetition of such injuries are of the most important objectives which are followed by treating acute ankle injuries. Ankle ligament damages bring about wide degrees of disabilities; Hence on-time diagnosis and treatment of such injuries are helpful in the final outcome of such treatment [4]. Most authors prefer on-surgical treatments to heal mild to intermediate injuries. However, there are disputes over treating severe injuries, what is more accepted is that both the initial non-surgical

treatments and the late surgical treatments will achieve similar results [5]. The experimental studies have shown that following immobilization technique applying the functional treatment to heal the second type injuries is effective to repair and strengthen the damaged ligaments [6, 7]. According to a number of reports, the range of motion is limited in the result of ankle acute injuries and in turn decreases collagen synthesis in the damaged ligament which slows down the healing process [8]

Moreover, a long-term immobilization of a limb by plaster makes short and tender the soft tissues around the joints of athletes, as their return to athlete world will be very hard or even impossible. In this case, there is much controversy among authors on how to treat acute ankle injuries. Those who propose immobilization with plaster emphasize that the treatment bring about further stability for the ankle joint; while specialists who believe in the functional treatment point out to faster regain of the range of motion before injury and lower muscular atrophy as the advantages of the treatment [9]. In order to achieve a common objective in using the motor treatments, it is suggested to examine these methods in various clinics and for various kinds of ankle injuries and their resulted to be compared. Thus, in this study, we have tried to analyze different variable such as pain, inflammation, back to

work and joint motion in both functional and immobilization by plaster treatment of ankle ligament acute injuries.

**Materials and Methods**

A non-blind clinical trial study was carried out in the emergency department of Yasuj’s Shahid Beheshiti Hospital after verification by the Ethics Committee of Yasuj University of Medical Sciences. After explaining all condition and constraints of the study to patients, they enrolled for the study after signing the preset written consent. 16-50 year-old patients with acute ankle injuries were qualified for being included in the study. Moreover, they should refer to the hospital in less than 48 hours from injury, and they should have ankle sprain history. The patients who didn’t show cooperation or a condition in which follow up was impossible made up our exclusion condition. All patients were examined precisely and routinely lateral and oblique radiographs of patients’ ankles were obtained. They were analyzed in terms of pain, inflammation, ecchymosis, range of motion and joint stability. The pain intensity was evaluated based on the Visual Analogue Scale (VAS) in patients.

Ankle injuries were classified into three degrees: I, II, and III, based on clinical examination and radiologic results. The qualified patients were allocated to one of the two mentioned groups through block randomization and with foursome blocks. Sampling was continued until reaching the required sample size (100 patients, 50 for each group). Regardless of their injury degree, patients were divided into two allocated and treatment groups. The first group was subject to functional treatment including elastic bondage along with an axillary crutch without bearing the body weight for 48 hours since experiencing injury. The bondage was wrapped after 48 hours and the patient was given a brace and the initial movements along with physiotherapy were started. The second group was treated via immobilization with plaster method. The plaster was removed after two weeks and the physiotherapy program was started. The patients were examined after 48 hours, 2, 6 and 12 weeks and pain intensity, range of motion, tenderness, arthritis and back to work were examined each time and they were recorded in the questionnaires which have been prepared formerly. The collected data were analyzed using SPSS-17 and independent *t*-Test. All data were expressed as Mean ± SE and *p* < 0.05 was considered as the significance level.

**Results**

During the examination and treatment period, 18 and 13 patients were excluded from group I and group II, respectively. The average age (year) and average weight (kg) of the first group (functional treatment) were 27.2 ± 1.1 and 68.4 ± 5.2, respectively and for the second group they were (immobilization treatment) were 29.2 ± 1.3 and 71.2 ± 3.3, respectively. The comparison of range of motion of ankle after two weeks demonstrated the average

plantar flexion (degree) in group I and II were 29.08 ± 1.2 and 13.6± 0.1, respectively, so there was a significant difference (*p* < 0.001). The statistical results showed that since the sixth week onward, there were not significant changes between the two groups (Table 1).

The statistical results showed that in comparison to immobilization with plaster, the functional treatment during the entire treatment period was more effective in maintaining range of motion and the average difference in the second week was found considerably higher than the other weeks.

Comparing the pain intensity based VAS showed that after two weeks the pain intensity in group I (33.41±4.11) was considerably lower than that in group II (57.31±11.21), which significant statistical changes were seen in this case. The difference was seen significantly during the 6th week. However, at the end of the 12th week, the pain had been alleviated completely for both groups (Table 2).

The results indicated that the highest difference in pain intensity was recorded in the second week after injury, and the difference was gradually decreased from 2nd week to 12th week.

The arthritis was decreased in both groups over the time. After six weeks, it was increased in group I more than the other group and a significant difference was reported between them in this issue (Table 3). The tenderness degree has been decreased considerably in the group II. There was a significant statistical difference in tenderness degree of the two groups in 2nd and 6th week (*p*=0.01). Fifty two percent of members of the group I returned to their work after two weeks, while none of members of group II could return to their works in this period. Finally, after two months 96% and 92% of members of group I and II returned to their works, respectively.

**Table 1.** Comparison of average range of motion in both studied groups during second, sixth and twelfth weeks

	Time	The first group	The second group	<i>p</i> -Value
Average plantar flexion (degrees)	Second week	29.08±1.2	20.4±2.2	0.03
	Sixth week	41.2±2.1	38.5±1.5	NS
	Twelfth week	44.4±3.5	40.3±1.4	NS
Average dorsal flexion (degrees)	Second week	12.7±3.1	5.2±2.1	0.01
	Sixth week	15.6±1.1	13.8±1.3	NS
	Twelfth week	19.8±1.6	18.6±0.3	NS

NS: Not Significant

**Table 2.** Comparison of pain intensity in the studied patients based on VAS

Time	The first group	The second group	<i>p</i> -Value
Second week	33.41±4.11	57.31±11.21	0.01
Sixth week	19.4±0.4	29.1±2.3	0.05
Twelfth week	10.6±1.9	11.1±0.5	NS

NS: Not Significant

**Table 3.** Comparing inflammation and tenderness rates in our patients

	Time	The first group	The second group	p-Value
Swelling	Second week	28±6.6	36±7.5	NS
	Sixth week	8±2.3	16±4.8	0.01
	Twelfth week	4±1.2	0±0	NS
Tenderness	Second week	44±12.6	60±11.7	0.01
	Sixth week	4±2.1	12±5.4	0.01
	Twelfth week	-	-	-

## Discussion

For treating ankle acute injuries, the results showed that in comparison to immobilization with plaster treatment, the functional treatment is significantly effective in improving the range of motion, alleviating pain and helping patient to back to their work during the two first weeks. Ankle acute injuries are among the most prevalent injuries of athletes' musculoskeletal system [10]. Leaving the ankle sprains untreated will cause chronic problems, decreased motion range, pain and joint instability which impact their daily activities [11].

Recent studies showed that the on-time diagnosis and treatment is important to achieve fast recovery and to decrease the joint secondary damages [12]. The standard treatment of ankle acute sprains are supporting, resting, applying ice pack and lifting the limb. The lifting the limb is effective in decreasing inflammation and authors believe that six week immobilization after surgery is necessary for recovery [13]. The study showed that starting the initial movements after ankle sprain is necessary and facilitates people's return into work and is free of negative impacts in ankle joint stability. Other evidence represent that the functional treatment immediately after surgery is not only useful to maintain the range of motion, but also it increases power of muscles around the ankle during certain movements such as plantar flexion [8], while long-term immobilization of ankle causes muscular atrophy and negative impacts on muscular fibers type I. Fibroblast cells proliferation is increased subsequent to damaging ligaments and collagen synthesis is boosted [13].

Recent results indicate that joints motion after injuries is effective to direct collagen bundles which accelerate the repair procedure; however, reinforcing such ligaments may last several months [15]. According to other evidence, our results indicated that the functional treatment not only keeps the joint range of motion, but protects ligaments against next injuries. Usually, feet are injured upon circling inward or when it is in plantar flexion state which accounts for 25% of musculoskeletal system's diseases [14]. If the feet are kept fixed and motionless for a long time because of fixing by plaster, motions of ankle, particularly dorsi-flexion is limited. Therefore, the long-term physiotherapy treatments are necessary to recover the ability; however, sometimes athletes fail to return the professional sport again. Thus, bondage treatment or using brace along with the initial movements maintains range of motion. The statistical results showed that, two weeks after injury, the dorsi

flexion range in the group I, that have used the functional treatment, has been improved in comparison to that in the group II. A systematic review showed that the short term treatments without external supports for ruptured external ligaments of ankle will result in persisting various symptoms such as pain, inflammation and joint instability, while surgical treatment bring about better long-term outcomes [17].

The difference between such results and the results of our own study may be rooted in the injury intensity of the ankle. Most of our patients suffer from type II injuries that did not need surgery, while patients of the mentioned studies suffered from full rupture of lateral ligaments of ankle [17]. There is evidence which show that leaving ruptured ankle ligaments untreated will cause secondary complications which in turn bring about ankle instability [18, 19]. It seems that there are several disputes over the pain intensity in such patients. Most authors believe that continuing pain in long term after injury depends on the initial injury severity and does not depend on the treatment type [20, 21]. Thus, using anti-inflammatory drugs may be effective to control pain. The results showed that after 12 weeks since injury, no considerable difference was seen between results of the functional treatment and immobilization treatment. However, a number of authors have reported that immobilization may cause some complications such as deep vein thrombosis and superficial wounds [22, 23].

In this study, a number of undesirable variables such as sport history and people's former job have been considered effective somehow in repairing acute ankle injuries, hence the mentioned cases can be some of limitations of the study. However, generally, it is concluded that for treating ankle acute injuries functional treatments along with brace or bondage are more effective in pain control, maintain joint range of motion and help patient to return their work than the ankle immobilization with plaster treatment. Therefore, using plaster is only suggested for a limited number of patients and for short-term treatments. Finally, while removing intervening factors, more studies are suggested to compare functional treatments impacts with the surgical ones.

## Acknowledgements

All surgeons and orthopedists of Yasuj Shahid Beheshti Hospital as well as Research Deputy of Yasuj University of Medical Sciences are acknowledged for assisting us in this project (23-5-78-74). The reg. Number of clinical trial: RCTnumber: IRCT201102035619N2

## Authors' Contributions

All authors had equal role in design, work, statistical analysis and manuscript writing.

## Conflict of Interest

The authors declare no conflict of interest.

## Funding/Support

Tarbiat Modares University.

## References

1. Moreira V, Antunes F. [Ankle sprains: From diagnosis to management the physiatric view] Portuguese [Abstract]. *Acta Med Port* 2008; 21(3): 285-92.
2. Jones MH, Amendola AS. Acute treatment of inversion ankle sprains: Immobilization versus functional treatment. *Clin Orthop Relat Res* 2007; 455:169-72.
3. Ekman EF, Fiechtner JJ, Levy S, et al. Efficacy of celecoxib versus ibuprofen in the treatment of acute pain: A multicenter, double-blind, randomized controlled trial in acute ankle sprain. *Am J Orthop* 2002; 31(8):445-451.
4. Dubin J, Comeau D, McClelland R, et al. Lateral and syndesmotic ankle sprain injuries: A narrative literature review. *J Chiropr Med* 2011; 10(3): 204-219.
5. Giza E, Fuller C, Junge A and Dvorak J. Mechanisms of foot and ankle injuries in soccer. *Am J Sports Med* 2003; 31(4):550-4.
6. Kerkhoffs GM, Rowe BH, Assendelft WJ, et al. Immobilisation and functional treatment for acute lateral ankle ligament injuries in adults. *Cochrane Database Syst Rev* 2002; (3): CD003762.
7. Kerkhoffs GM, Handoll HH, de Bie R, et al. Surgical versus conservative treatment for acute injuries of the lateral ligament complex of the ankle in adults. *Cochrane Database Syst Rev* 2007; (2): CD000380.
8. Karlsson J, Lundin O, Lind K and Styf J. Early mobilization versus immobilization after ankle ligament stabilization. *Scand J Med Sci Sports* 1999; 9(5): 299-303.
9. Kannus P, Jozsa L, Renstrom P, et al. The effects of training, immobilization and remobilization on musculoskeletal tissue: remobilization and prevention of immobilization atrophy. *Scand J Med Sci Sports* 1992; 2(4): 164-176.
10. Noh JH, Yang BG, Yi SR, et al. Outcome of the functional treatment of first-time ankle inversion injury. *J Orthop Sci* 2010; 15(4): 524-530.
11. Purcell SB, Schuckman BE, Docherty CL, et al. Difference in ankle range of motion before and after exercise in 2 tape conditions. *Am J Sports Med* 2009; 37(2): 383-9.
12. Chorley JN. Ankle sprain discharge instructions from the emergency department. *Pediatr Emerg Care* 2005; 21 (8): 498-501.
13. Refshauge KM, Raymond J, Kilbreath SL, et al. The effect of ankle taping on detection of inversion-eversion movements in participants with recurrent ankle sprain. *Am J Sports Med* 2009; 37(2): 371-5.
14. Kannus P. Immobilization or early mobilization after an acute soft-tissue injury? *Phys Sportsmed* 2000; 28(3): 21-28.
15. Povacz P, Unger SF, Miller WK, et al. A randomized, prospective study of operative and non-operative treatment of injuries of the fibular collateral ligaments of the ankle. *J Bone Joint Surg Am* 1998; 80(3): 345-51.
16. Garrick J G, Requa RK. The epidemiology of foot and ankle injuries in sports. *Clin Sports Med* 1988; 7(1): 29-36.
17. Pijnenburg A, Vandijk CN, Bossuyt PM, et al. Treatment of ruptures of the lateral ankle ligaments: A meta-analysis. *J Bone Joint Surg* 2000; 82(6): 761-71.
18. Freeman MA. Instability of the foot after injuries to the lateral ligament of the ankle. *J Bone Joint Surg Br* 1965; 47(4): 669-77.
19. Freeman MA, Dean RM, Hanham IW. The etiology and prevention of functional instability of the foot. *J Bone Joint Surg* 1965; 47(4): 678-685.
20. Dijk V, Bossuyt CN, Marti PM. Medial ankle pain after lateral ligament rupture. *J Bone Joint Surg* 1996; 78(4): 562-567.
21. Moppes V, Hoogenband VD. [Diagnostic and therapeutic aspects of inversion trauma of the ankle joint] [dissertation]. Maastricht: Universiteit van Limburg; 1982.
22. Nesheiwat F, Sergi AR. Deep venous thrombosis and pulmonary embolism following cast immobilisation of the lower extremity. *J Foot Ankle Surg* 1996; 35(6): 590-594.
23. Kujath P, Spannagel U, Habscheid W. Incidence and prophylaxis of deep venous thrombosis in outpatients with injury of the lower limb. *Haemostasis* 1993; 23(1): 20-26.

**Please cite this article as:** Mohammadi H, Ghafarian Shiraz H, Saniee F, Delaviz H. Functional treatment comparing with immobilization after acute ankle ligament sprain. *Zahedan J Res Med Sci (ZJRMS)* 2013; 15(2): 28-31.