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Functional outcome of stirrup ankle brace versus below-knee posterior slab in management of acute mild to moderate lateral ankle sprain

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Abstract

Background: Ankle sprain is the most frequently occurring lower limb injury among athletes and physically active individuals. There are no specific treatment guidelines for acute lateral ankle sprain. The purpose of the study is to find the functional outcome of a stirrup ankle brace versus a below-knee posterior slab in the management of acute mild to moderate lateral ankle sprain.

Methods: This is a hospital-based prospective comparative study done at Universal College of Medical Science between January 29, 2025, and July 29, 2025. A total of 60 patients with grade I and grade II ankle sprain diagnosed clinically were included; 30 patients were treated with a stirrup ankle brace and 30 with a below-knee posterior slab. Final follow-up was done at the end of the third week; the primary outcome was measured with the modified Karlsson score and secondary outcomes with the VAS score and measurement of ankle swelling.

Results: The mean age of patients was 31.05±13.01 years. The most common mechanism was sports-related twisting injury 30(50%). The change in girth of the ankle between the ankle stirrup and slab groups at the third week was 0.2±0.11 cm and 0.29±0.06 cm, p = 0.001. The Modified Karlsson score of the stirrup ankle brace group was 81.86±1.77, and the below-knee posterior slab was 80.0±2.28, P=0.001 at third-week follow-up, respectively.

Conclusion: Although both treatment options are effective, functional outcome is better seen with a stirrup ankle brace than a below-knee slab.

Keywords: Ankle sprain; below-knee posterior slab; Stirrup ankle brace

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Introduction

Ankle sprain is the most frequently occurring lower limb injury among athletes and physically active individuals.[1] In all sports injuries, the rate of ankle sprains ranges from 15 to 20%.[2,3] The most common mechanism is secondary to an inversion of a plantar-flexed foot.[4] Despite having a high incidence, there are no specific treatment guidelines.[5] The suggested management options for acute mild to moderate lateral ankle sprain are functional, immobilization, and surgical treatment.[6] The functional supports consist of ankle binder, crepe bandage, strapping, tape, lace-up boots, or stirrup braces, which help to promote early mobilization of the ankle joint. For immobilization, we can use either a below-knee posterior slab or a boot cast. One group favors immobilization for joint stability, whereas the others support functional treatment for faster recovery and reduced muscle atrophy.[7] Currently, functional treatment that allows immediate weight bearing is being recommended.[8]

Methods

This is a hospital-based prospective comparative study carried out at Universal College of Medical Science in the outpatient department and emergency department from January 29, 2025 to July 29, 2025 after ethical clearance from IRC (UCMS/IRC/13/25). A total of 60 patients were included. Systematic random sampling was used to divide patients into two groups.

Inclusion criteria: All patients aged 16 to 60 years presenting within 24 hours of acute mild (grade I) to moderate (grade II) lateral ligament sprain diagnosed clinically by the West Point grading for lateral ankle sprain grading system (Table1) were included in the study.[9,10]

Exclusion criteria: Age below 16 years and above 60 years, medial (deltoid ligament) injuries, severe (grade III) lateral ankle sprain, ankle fracture, syndesmotic injuries, multiple injuries, neurological conditions including dementia and intoxications (any drugs or alcohol) were excluded from the study.

All patients presenting with clinical signs and symptoms of acute ankle injury were evaluated and recorded clinically and radiologically after obtaining consent. Standard radiographs for the ankle (Anteroposterior, Lateral, and Mortise Views) were done to exclude fracture. One group was managed using a stirrup ankle brace (FM) and allowed weight-bearing as much as tolerable, whereas another group of patients was managed using a below-knee posterior slab and non-weight-bearing for 2 weeks. All patients were given a standard advice sheet with the principle of RICE (rest, ice, compression, and limb elevation) and analgesics for 5 days. The first follow-up was done between 24 and 72 hours after presentation to evaluate complications related to the injury and patient compliance. The second follow-up was done at the end of the second week, during which we had removed below knee posterior slab and ankle stirrup and allowed rehabilitation with physiotherapy (ankle ROM, peroneal strengthening, and proprioception exercise). Final follow-up was done in the third week to assess the primary outcome by the modified version of the Karlsson scoring scale[11] and secondary outcome by VAS score[12] and measurement of ankle swelling at bimalleolar level.[13]

The data obtained from clinical examination findings were entered in SPSS 21.0 software. The swelling and VAS score were analyzed using an ANOVA test, and the Karlsson score was analyzed using Student's t-test.

Table 1. West Point grading system of lateral ankle sprain

Grade	Clinical Features	Functional Status	Stability Tests
I (Mild)	Mild tenderness and swelling, localized pain	Full weight bearing possible: minimal functional loss	Anterior drawer: negative; Talar tilt: negative
II (Moderate)	Moderate tenderness, swelling, ecchymosis, pain on inversion	Partial weight bearing; moderate functional loss	Anterior drawer: laxity with firm end point; Talar tilt: mild laxity
III (Severe)	Severe pain, marked ecchymosis	Unable to bear weight; significant functional loss	Anterior drawer: gross laxity/no end point; Talar tilt: gross instability

Results

The mean age of patients was 31.05 (±13.01) years, with male dominance, 34 (56%). The right side was common: 33 (55%). Most of them were students, 25 (41.6%). Grade I ankle sprain account 33(55%) and remaining 27 (45%) grade II. The most common mechanism was sports-related twisting injury, 30 (50%). The table for demographic and epidemiologic parameters is given in Table 2.

The time to return to work in the stirrup ankle brace group was 10.86±4.14 days, whereas in the below-knee posterior slab group it was 12.83±4.39 days. (Table 3)

The difference in ankle swelling of the stirrup ankle brace group at presentation and at the third week follow-up was 1.70±0.38 cm and 0.20±0.11 cm, respectively, whereas the swelling of the below-knee posterior slab group was 1.74±0.30 cm and 0.29 ±0.06 cm, respectively. The VAS score of the stirrup ankle brace group was 7.16±0.790 and 0.7±0.65 at presentation and 6 weeks, respectively. The VAS score of the below-knee posterior slab group was 6.63±1.21 and 0.76±0.62 at presentation and the third week, respectively. (Table 3)

The modified Karlsson score of the stirrup ankle brace group was 7.23±2.09 and 81.86±1.77 at presentation

Table 2. Demographic Characteristics

Parameters	N(%)
Gender	
Male	34(56%)
Female	26(44%)
Side	
Right	33(55%)
Left	27(45%)
Profession	
Students	25(41.6%)
Office worker	10(16.6%)
Farmers	15(25%)
Others	10(16.6%)
Mechanism of injury	
Sports related	30(50%)
Road traffic accidents	10(16.66%)
Fall related	8(13.33%)
Others	12(20%)

Table 3. Comparison of Clinical Outcomes Between Ankle Stirrup Brace and Below-Knee Posterior Slab

Outcome Measure	Ankle Stirrup Brace	Below-Knee Posterior Slab	P-value
Return to work (days)	10.86±4.14	12.83±4.39	0.08
Ankle girth difference (cm)			
Presentation	1.70±0.38	1.74±0.30	0.69
Third week	0.20±0.11	0.29±0.06	<0.001
VAS score			
Presentation	7.16±0.79	6.63±1.21	0.048
Third week	0.70±0.65	0.76±0.62	0.71
Karlsson's score			
Presentation	7.23±2.09	6.73±0.82	0.23
Third week	81.86±1.77	80.00±2.28	0.001

and at the third week, respectively, whereas the Karlsson score of the below-knee posterior slab group was 6.73±0.82 and 80.00±2.28 at presentation and at third-week follow-up, respectively. (Table 3)

Discussion

Lateral ligament injuries account for the majority of ankle sprains, with the anterior talofibular ligament (ATFL) being the most frequently affected structure, involved in approximately 80–85% of cases.[14–16] Management of acute ankle sprains ranges from functional treatment and immobilization to surgical intervention.[17,18] Although nonsurgical management is generally preferred, the choice between functional treatment and immobilization remains influenced by injury severity and clinical presentation.[19] Historically, strict immobilization using a below-knee posterior slab was widely practiced. However, contemporary management increasingly favors functional treatment incorporating external support, early mobilization, and weight-bearing.[8] Evidence from a meta-analysis suggests that functional treatment provides better pain relief in mild-to-moderate ankle sprains, whereas immobilization may facilitate recovery in severe injuries.[20] Despite these developments, the assessment of injury severity remains inconsistent, with approaches ranging from clinical examination alone to stress radiography and arthroscopy.[21]

The present study compared functional treatment using a stirrup ankle brace with immobilization using a below-knee posterior slab in 60 patients with clinically diagnosed mild-to-moderate lateral ankle sprains over a three-week follow-up period.

The demographic profile of the study population was broadly comparable to that reported in previous studies of acute ankle sprains. A male predominance was observed, consistent with the findings of Pariyar et al., who reported a similar sex distribution.[8] The mean age of patients in the present study was also comparable to that reported by Pariyar et al. and Bhandari et al., suggesting a similar age profile across these study populations.[5,8] Right-sided ankle involvement was predominant in the study by Pariyar et al., as well as in both treatment groups in the study by Bhandari et al. Students constituted the largest occupational group in the present study, accounting for 41.6% of patients in both treatment groups. This differed from the occupational distributions reported by Pariyar et al., in which servicemen accounted for 15.9% of participants, and Bhandari et al., who reported a higher representation of professionals in both treatment groups.[5,8] These differences indicate variation in the occupational composition of the study populations, although the available data do not establish whether occupation influenced injury occurrence or recovery.

Functional recovery, assessed using the Karlsson score at the third-week follow-up, was significantly better in the stirrup ankle brace group than in the below-knee posterior slab group. The mean scores were 83.29 ± 2.37 and 80.00 ± 2.28, respectively, with a statistically

significant between-group difference (p = 0.001). This finding suggests that functional treatment may facilitate better early functional recovery than immobilization in patients with mild-to-moderate lateral ankle sprains. One possible explanation is that immobilization may contribute to ankle stiffness and restrict early joint mobilization, potentially affecting functional recovery. However, the present study did not directly evaluate the mechanisms underlying the observed difference.

The findings are consistent with those of Pariyar et al., who reported higher Karlsson scores in the ankle brace group than in the posterior slab group at three weeks, with a statistically significant difference (p = 0.031).[8] Similarly, studies by Bhandari et al., Naeem et al., and Garg et al. reported favorable functional outcomes with functional treatment, including improvements in ankle functional scores, reduced pain, and fewer days of work absence among patients with Grade II and Grade III ankle sprains.[5]

Although the stirrup ankle brace group demonstrated a shorter mean time to return to work than the posterior slab group, the difference was not statistically significant (p = 0.08). Therefore, the observed difference should be interpreted as a numerical trend rather than evidence of a definitive advantage in return-to-work outcomes. Kannus et al. reported shorter return-to-work and return-to-sport times, along with better early range of motion, with conservative treatment.[22] These findings provide a broader context for the potential benefits of early mobilization, although differences in study populations and treatment protocols should be considered when comparing outcomes. Taken together, the functional outcome findings suggest that both treatment approaches are associated with favorable short-term recovery, with the stirrup ankle brace demonstrating a statistically significant advantage in the Karlsson score at three weeks.

Pain scores improved substantially in both treatment groups over the three-week follow-up period. The mean VAS score decreased from 7.79 ± 1.20 to 0.95 ± 0.75 in the functional management group and from 7.57 ± 1.17 to 0.79 ± 0.50 in the immobilization group.

Despite the improvement in both groups, no statistically significant between-group difference was observed at presentation (p = 0.50) or at the third-week follow-up (p = 0.35). These findings suggest that both treatment approaches were associated with considerable pain reduction, without evidence of a statistically significant difference in pain outcomes between the groups at the evaluated time points. The results are consistent with those of Pariyar et al., who reported comparable VAS scores between the ankle brace and posterior slab groups at three weeks, with no statistically significant difference (p = 0.64).[8] The consistency of these findings suggests that, although functional treatment may offer advantages in certain aspects of early recovery, pain relief may be comparable between functional bracing and immobilization over the short-term follow-up period.

Ankle swelling, assessed by the difference in ankle girth, was comparable between the two groups at presentation (p = 0.69). At the third-week follow-up, the mean ankle girth difference was lower in the stirrup ankle brace group with a statistically significant between-group difference (p = 0.001).

This finding indicates a greater reduction in ankle swelling in the functional treatment group during the study period. The observed difference is consistent with the findings of Pariyar et al., who reported significantly lower ankle swelling in the ankle brace group than in the posterior slab group at three weeks (p = 0.02).[8] Similarly, Bhandari et al. reported a lower mean ankle girth difference in the brace group than in the slab group, with a statistically significant between-group difference.[5]

The consistency of these findings across studies suggests that functional treatment with an ankle brace may be associated with a greater reduction in ankle swelling than immobilization with a posterior slab during early recovery. Nevertheless, the present study assessed swelling over a relatively short follow-up period, and the clinical implications of this difference beyond the third week remain undetermined.

The study has several limitations. It is a single-center study with short-term follow-up. Longer-term follow-up is needed.

Conclusion

The occurrence of ankle sprain is common in students. The most common mechanism is a sports-related twisting injury. Both ankle stirrup ankle brace and below-knee posterior slab are good options in mild to moderate lateral ankle sprain. However, the functional outcome is better with a stirrup ankle brace.

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