

Comparative Study on Management of Acute Lateral Ankle Sprain using Immobilization with Below Knee Slab versus Flexible Ankle Brace

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Abstract

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Background: Acute lateral ankle sprains are common musculoskeletal injuries presenting to emergency departments. Optimal conservative management remains debated. Immobilization and functional treatment using ankle braces are widely used, each with distinct advantages. To compare clinical and functional outcomes of below-knee slab immobilization versus flexible ankle brace treatment in acute lateral ankle sprain.

Methods: This was a prospective comparative quasi-experimental study conducted at Kathmandu Medical College Teaching Hospital from May 2023 to May 2024. Sixty patients aged 18–50 years presenting within 72 hours of a Grade II or III lateral ankle sprain were alternately assigned to two groups. Group A received a flexible ankle brace while Group B received below-knee slab immobilization. Outcomes were assessed using the Karlsson score at days 10 and 30, ankle-girth difference at day 30, and VAS pain scores at day 10. Data were analyzed with SPSS 20 and $p < 0.05$ was significant.

Results: At day 10, mean Karlsson scores were comparable between the brace (48.7 ± 8.50) and slab (50.2 ± 8.14) groups ($p > 0.05$). By day 30, the brace group showed higher scores (78.4 ± 1.73 vs. 66 ± 1.98 , $p < 0.05$). Swelling at day 30 was lower in the brace group (0.66 ± 1.72 cm vs. 1.8 ± 2.45 cm, $p < 0.05$). VAS pain scores at day 10 showed no significant difference ($p > 0.05$).

Conclusion: Functional treatment with a flexible ankle brace provides faster recovery, greater functional improvement, and reduced swelling compared to below-knee slab immobilization. Functional bracing should be preferred in suitable cases.

Keywords: Ankle Injuries, Braces, Immobilization, Splints, Sprains and Strains

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Introduction

Ankle injuries are common musculoskeletal conditions, accounting for 19–23% of sports injuries.¹⁻³ Lateral ligament sprains constitute the majority, representing one-fifth of sports injuries and 2–6 % of emergency department visits.^{4, 5} In Nepal, however, epidemiological data remain limited.

The lateral ankle ligament complex comprising anterior talofibular (ATFL), calcaneofibular (CFL), and posterior talofibular ligaments (PTFL), provide stability against inversion forces. Injury is graded by severity: Grade I - mild stretching of fibers; Grade II - partial tear with mild instability; and Grade III - complete rupture with marked instability and functional loss.⁶

Despite high prevalence, no standardized management protocol exists. Non-surgical methods predominate, including immobilization and functional treatment.⁷ Immobilization restricts motion to allow healing using below-knee slabs, whereas functional treatment promotes early controlled mobilization using elastic bandages or braces enhancing proprioception and faster recovery.

This study compares functional outcomes, pain relief, and swelling reduction between below-knee slab immobilization and flexible ankle brace to determine the more effective conservative modality.

Methods

This study was designed as a prospective comparative quasi-experimental study conducted in the Department of Orthopaedic Surgery at Kathmandu Medical College and Teaching Hospital, Sinamangal, Kathmandu, Nepal, over a one-year period from May 2023 to May 2024. Ethical approval was obtained from the Institutional Review Committee of Kathmandu Medical College. Written informed consent was obtained from all participants prior to enrolment.

Patients aged 18 to 50 years presenting within 72 hours of injury and clinically diagnosed with Grade II or Grade III lateral ankle sprain were included in the study. Grading of injury was done using the Lateral Ankle Sprain Grading Scale as described by Cavazos.⁸ Patients with chronic sprains, associated fractures, deltoid ligament injury, neurological or psychiatric illness, or delayed presentation beyond 72 hours were excluded.

A total of sixty patients were alternately allocated into two groups of thirty each: Group A, treated with a commercially available flexible ankle brace (Figure 1) and early ankle range-of-motion exercises as tolerated, and Group B, treated with below-knee slab (Figure 2) immobilization for two weeks followed by gradual mobilization. Both groups were advised rest, limb elevation, and analgesics as needed. Sample size was calculated based on previous studies that reported mean Karlsson scores of 79.8 ± 5.3 in the brace group and 72.0 ± 10.3 in the slab group.⁷ Using a pooled

standard deviation of 8.2, an expected mean difference of 7.8, a power of 90%, and a 5% level of significance, the minimum required sample size was 24 patients per group. To account for a potential 25% dropout rate, 30 patients were enrolled in each group (Total n = 60). The primary outcome was functional recovery, assessed using the modified Karlsson scoring system at day 10 and day 30 following injury. Secondary outcomes included pain relief, measured by the Visual Analogue Scale (VAS) at day 10, and reduction of swelling, measured by ankle girth difference between the injured and normal sides at the end of day 30. Ankle girth was defined as the circumferential measurement of the ankle at the level of both malleoli and noted in centimeters using a tape measure.

All data were recorded in a structured proforma. Statistical analysis was performed using SPSS version 20. Continuous variables were expressed as mean \pm standard deviation and analyzed using Student's t-test. Categorical variables were analyzed with the chi-square test. A p-value less than 0.05 was considered statistically significant.

Results



Figure 1 Flexible Ankle Brace



Figure 2 Below Knee Slab

A total of sixty patients with acute Grade II and Grade III lateral ankle sprains were enrolled in the study and completed follow-up. Thirty patients were allocated to the flexible ankle brace group (Group A) and thirty to the below-knee slab group (Group B). The two groups were comparable in baseline characteristics, including age, sex, occupation, and side of injury (Table 1). No patients were lost to follow-up.

The mean Karlsson score for brace group was 48.7 ± 8.50 and for slab group was 50.2 ± 8.14 ($p > 0.05$) at day 10. Although improvement was seen in both groups, the difference remained statistically insignificant. The mean Karlsson score for brace group was 78.4 ± 1.73 and for slab group was 66 ± 1.98 ($p < 0.05$) at day 30. Patients treated with the flexible ankle brace demonstrated significantly better functional recovery compared to those immobilized with a below-knee slab at day 30 (Table 2).

Baseline swelling was similar between the two groups showing no significant difference ($p > 0.05$). At day 30 post-intervention, the brace group demonstrated a statistically significant reduction in swelling compared to the slab group ($p < 0.05$) (Table 3).

The mean VAS score at Day 10 was 44.86 ± 3.07 in the brace group and 46.46 ± 5.17 in the slab group. Although pain scores improved in both groups by Day 10, the difference between groups was not statistically significant ($p > 0.05$) (Table 4).

Table 1: Demographic and Clinical Characteristics

Characteristic	Brace (n = 30)	Slab (n = 30)	p-value
Sex			
Male	16 (53.3 %)	14 (46.7 %)	>0.05
Female	14 (46.7 %)	16 (53.3 %)	
Occupation			>0.05
Professional	8 (26.7 %)	7 (23.3 %)	
Student	7 (23.3 %)	6 (20 %)	
Business	6 (20 %)	6 (20 %)	
Labor	6 (20 %)	6 (20 %)	
Unemployed	3 (10 %)	5 (16.7 %)	
Side of injury			>0.05
Right	18 (60 %)	19 (63.3 %)	
Left	12 (40 %)	11 (36.7 %)	
Age (mean \pm SD)	31.10 ± 1.12	30.78 ± 0.47	>0.05

Table 2: Functional Outcome (Karlsson Score)

Time	Brace (Mean \pm SD)	Slab (Mean \pm SD)	p-value
At Presentation	33.1 ± 7.20	32.4 ± 6.82	>0.05
Day 10	48.7 ± 8.50	50.2 ± 8.14	>0.05
Day 30	78.4 ± 1.73	66 ± 1.98	<0.05

Table 3: Swelling (Ankle Girth Difference in cm)

Time	Brace (Mean \pm SD)	Slab (Mean \pm SD)	p-value
At Presentation	3.16 ± 2.4	3.66 ± 2.5	>0.05
Day 30	0.66 ± 1.72	1.8 ± 2.45	<0.05

Table 4: Pain Assessment (VAS Score)

Time	Brace (Mean \pm SD)	Slab (Mean \pm SD)	p-value
At Presentation	74.86 ± 3.07	75.66 ± 3.27	>0.05
Day 10	44.86 ± 3.07	46.46 ± 5.17	>0.05

Discussion

Ankle sprain is a frequent presentation in orthopaedic practice, yet there remains no universally accepted standard of management. Treatment approaches commonly depend on the clinician's experience and clinical discretion.

The management of ankle sprains can be categorized into three principal approaches: immobilization with a cast or below knee slab, functional treatment involving external support with early mobilization and rarely surgical repair.⁷ Although surgical intervention may be warranted in severe cases associated with mechanical instability, the majority of studies have shown no significant long-term advantage over conservative treatment.⁹ Within conservative management, functional treatment such as that with a brace is generally recognized as yielding superior outcomes compared to immobilization; nevertheless, the optimal form of functional support for the ankle joint remains a subject of ongoing debate.⁶ In their systematic review, Petersen et al. concluded that the majority of grade I, II, and III lateral ankle ligament ruptures can be effectively managed without surgical intervention.¹⁰

This study compared the outcomes of functional bracing and below-knee slab immobilization in the management of acute lateral ankle sprains. Patients treated with flexible ankle brace showed a statistically significant improvement in functional outcomes compared to those managed with below-knee posterior slab. The mean Karlsson score at day 30 was 78.4 ± 1.73 in the brace group versus 66 ± 1.98 in the slab group ($p < 0.05$), indicating faster recovery of ankle function with the use of a brace. These findings align with those of Bhandari et al., who reported superior functional scores with ankle brace compared to below knee slab in similar injury grades.⁷ A meta-analysis of twenty-one randomized controlled trials comparing immobilization and functional treatment also demonstrated significantly better outcomes with functional methods.¹¹ Parameters such as earlier return to sport and work, reduced swelling, higher patient satisfaction, and less residual instability all favored functional treatment. They concluded that immobilization should no longer be the conservative treatment of choice for patients with acutely sprained ankles.

Our study found that swelling decreased significantly in both groups at day 30, with the flexible ankle brace group showing greater reduction, supporting the benefit of early mobilization. The observed reduction in swelling and improved comfort among patients treated with flexible ankle brace may be attributed to easier application of cold compression, allowance of toe and ankle range of movement, and enhanced venous return. Functional bracing facilitates early controlled motion, which enhances collagen alignment and proprioceptive recovery. Conversely, immobilization, though protective, may delay return to normal activity, contribute to stiffness, and reduce muscle strength. These outcomes however were not directly measured in our study. Although some earlier studies

reported no significant difference in swelling between treatment groups, methodological differences such as the use of manual circumference measurements versus volumetric methods may account for this discrepancy.⁶

Pain reduction occurred similarly in both groups, suggesting that either approach offers adequate analgesia during the acute phase.

Overall, our results confirm that functional bracing offers superior short-term functional recovery compared to immobilization. However, both groups showed progressive improvement over time, suggesting that ankle sprains generally heal well with conservative measures, regardless of the specific device used.

The relevance of these findings is particularly important in the Nepalese context, where access to structured physiotherapy may be limited and patients often prioritize rapid return to work or daily activities. Functional bracing provides a practical and cost-effective alternative, allowing early mobilization without relying heavily on formal physiotherapy services, making it well-suited for resource-constrained settings.

Our study has certain limitations. The sample size was relatively small, and follow-up was limited, restricting long-term assessment of instability or recurrence. Allocation was performed alternately rather than randomly, introducing potential selection bias. Variations in analgesic use, patient adherence, and crutch prescription could also have influenced recovery. Additionally, accurate grading of ankle sprain severity can be challenging in the acute phase due to pain and muscle spasm, which may limit the precision of stress testing.

Despite these limitations, the findings highlight the practical benefits of functional treatment, especially in busy emergency settings where resource constraints limit the use of advanced rehabilitation modalities. Beyond clinical outcomes, functional bracing may offer economic advantages by promoting faster return to work and reducing overall treatment duration.

Conclusion

Treatment of moderate and severe lateral ligament ankle sprains, presenting within 72 hours of injury, with a flexible ankle brace, results in significantly better early functional outcomes and faster swelling reduction compared to below-knee slab immobilization, without compromising pain relief. Functional bracing should therefore be considered the preferred conservative management approach

for most acute lateral ankle sprains, particularly in patients requiring early return to activity.

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