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REHABILITATION AND PREVENTIVE MEASURES FOR MODERATE CALCANEOFIBULAR LIGAMENT INJURY IN COLLEGIATE FOOTBALL ATHLETES: A COMPARATIVE STUDY BETWEEN STRUCTURED REHABILITATION VS TRADITIONAL REHABILITATION

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Abstract

Background:
Lateral ankle ligament injuries are among the most common sports-related injuries in football athletes and frequently result in impaired balance, reduced functional performance, and recurrent injury. Although exercise-based rehabilitation is widely recommended, uncertainty remains regarding the optimal rehabilitation approach for athletes with Grade II calcaneofibular ligament injury.[1,2,3]

Objective: To compare the effectiveness of structured rehabilitation and traditional rehabilitation in improving static balance, dynamic balance, and functional performance among collegiate football athletes with Grade II calcaneofibular ligament injury.

Methods:
A comparative experimental study was conducted on 60 collegiate football athletes diagnosed with Grade II calcaneofibular ligament injury. Participants were allocated into two groups: Structured Rehabilitation Group (n=30) and Traditional Rehabilitation Group (n=30). Both groups received rehabilitation three sessions per week for eight weeks. Outcome measures included the Visual Analogue Scale (VAS), Stork Stand Test, and Y-Balance Test. Statistical analysis was performed using SPSS version 26.0, with significance set at $p<0.05$.

Results:
Both groups demonstrated significant improvements following intervention. The structured rehabilitation group showed greater improvement in static balance, with Stork Stand Test scores increasing from 17.42±3.15 to 29.61±3.82 seconds compared with 17.15±3.28 to 23.42±3.67 seconds in the traditional rehabilitation group. Dynamic balance was significantly better in the structured rehabilitation group across all Y-Balance Test directions (Anterior: 89.5±4.2 vs. 83.8±4.6; Posteromedial: 96.2±3.8 vs. 90.1±4.1; Posterolateral: 95.7±3.9 vs. 89.4±4.4; $p<0.05$).

Conclusion:
Structured rehabilitation demonstrated superior improvements in static and dynamic balance compared with traditional rehabilitation in collegiate football athletes with Grade II calcaneofibular ligament injury. The findings support the incorporation of progressive balance, neuromuscular, agility, and sport-specific training into rehabilitation programmes.

Introduction

Lateral ankle sprain is one of the most common musculoskeletal injuries among physically active populations and remains a major cause of recurrent injury and disability in sports participation. Football athletes are particularly vulnerable due to the repetitive demands of acceleration, deceleration, cutting, jumping, landing, and contact activities performed throughout training and competition. Such injuries frequently result in reduced participation, prolonged rehabilitation, and delayed return to sport. [4]

The lateral ligament complex of the ankle consists of the anterior talofibular ligament, calcaneofibular ligament, and posterior talofibular ligament. Among these structures, the calcaneofibular ligament plays a unique biomechanical role because it spans both the talocrural and subtalar joints and contributes substantially to ankle stability during weight-bearing activities. Injury to this ligament compromises functional stability during landing, directional changes, and sport-specific movements.[2]

Grade II calcaneofibular ligament injuries are characterized by partial disruption of ligament fibers accompanied by pain, swelling, impaired dorsiflexion, muscle weakness, and deficits in postural control. Persistent sensorimotor impairments following injury may contribute to chronic ankle instability and recurrent sprains, thereby negatively affecting athletic performance and quality of life. [3,5]

Current evidence supports exercise-based rehabilitation programmes incorporating strengthening, proprioceptive training, balance exercises, and neuromuscular retraining for ankle ligament injuries. However, uncertainty remains regarding the optimal structure and progression of rehabilitation programmes. While traditional rehabilitation often focuses on symptom management and basic strengthening, structured rehabilitation emphasizes progressive neuromuscular training, unstable-surface exercises, agility drills, and sport-specific functional activities.[6,7,8]

Limited evidence specifically examines the effectiveness of structured rehabilitation in collegiate football athletes with Grade II calcaneofibular ligament injury. Therefore, the present study aimed to compare the effectiveness of structured rehabilitation and traditional rehabilitation in improving static balance, dynamic balance, and functional performance among collegiate football athletes with Grade II calcaneofibular ligament injury.[9,10,11]

Materials and Methods

Study Design

A comparative experimental study was conducted to compare the effectiveness of structured rehabilitation and traditional rehabilitation among collegiate football athletes with Grade II calcaneofibular ligament injury. The IMRaD structure and reporting approach used here follow common physiotherapy research manuscript standards.

Study Setting

The study was conducted at the Department of Sports and Musculoskeletal Physiotherapy and selected football training centres affiliated with Pacific Medical University, Udaipur, Rajasthan.

Study Duration

The study was conducted over a period of six months.

Participants

Sixty collegiate football athletes diagnosed with Grade II calcaneofibular ligament injury were recruited using purposive sampling and allocated into:

- Group A: Structured Rehabilitation Group (n=30)
- Group B: Traditional Rehabilitation Group (n=30)

Inclusion Criteria

- Collegiate football athletes aged 18–30 years
- Diagnosed with Grade II calcaneofibular ligament injury
- Male and female athletes
- Willing to provide written informed consent
- Medically fit for rehabilitation

Exclusion Criteria

- Grade III ankle ligament injury
- Fracture or dislocation around the ankle
- Previous ankle surgery
- Neurological disorders affecting balance
- Vestibular disorders
- Lower limb fracture within the previous six months
- Systemic diseases affecting rehabilitation

Outcome Measures

- Visual Analogue Scale (VAS)
- Stork Stand Test
- Y-Balance Test **[42]**

Intervention

Group A: Structured Rehabilitation Programme

Phase I (Weeks 1–2): Pain and swelling management, active ROM exercises, isometric strengthening, weight shifting, double-leg balance training.

Phase II (Weeks 3–4): Theraband strengthening, single-leg stance, wobble board training, heel raises, toe raises, mini squats.

Phase III (Weeks 5–6): Star excursion exercises, BOSU training, lateral hopping drills, side shuffling, jogging drills.

Phase IV (Weeks 7–8): Agility ladder drills, cone drills, zig-zag running, T-test practice, hexagon agility training, football-specific drills.

Group B: Traditional Rehabilitation Programme

Hot fomentation, ankle ROM exercises, static stretching, basic strengthening, walking exercises, heel raises, toe raises, and home exercise programme.

Statistical Analysis

Data were analyzed using SPSS version 26.0. Mean and standard deviation were calculated for continuous variables. Paired t-tests and independent t-tests were used for within-group and between-group comparisons, respectively. Statistical significance was set at $p<0.05$.

Results

Participant Characteristics

A total of 60 collegiate football athletes participated in the study.

Table 1. Demographic Characteristics

Variable	Category	n (%)
Age	18–20 years	18 (30.0)
	21–23 years	24 (40.0)
	24–26 years	12 (20.0)
	27–30 years	6 (10.0)
Gender	Male	42 (70.0)
	Female	18 (30.0)
BMI	Normal Weight	32 (53.3)
	Overweight	22 (36.7)
	Obese Class I	6 (10.0)

Static Balance

Table 2. Stork Stand Test Scores

Group	Pre-test Mean ± SD	Post-test Mean ± SD	p-value
Structured Rehabilitation	17.42 ± 3.15	29.61 ± 3.82	0.002
Traditional Rehabilitation	17.15 ± 3.28	23.42 ± 3.67	0.001

Both groups demonstrated significant improvements; however, the structured rehabilitation group achieved substantially greater gains in static balance.

Dynamic Balance

Table 3. Y-Balance Test Scores

Direction	Structured Group Mean ± SD	Traditional Group Mean ± SD	p-value
Anterior	89.5 ± 4.2	83.8 ± 4.6	0.002
Posteromedial	96.2 ± 3.8	90.1 ± 4.1	0.001
Posterolateral	95.7 ± 3.9	89.4 ± 4.4	0.001

The structured rehabilitation group demonstrated significantly superior dynamic balance outcomes in all reach directions.

Discussion

The present study compared the effectiveness of structured rehabilitation and traditional rehabilitation in collegiate football athletes with Grade II calcaneofibular ligament injury. The findings demonstrated significant improvements in both groups; however, the structured rehabilitation programme resulted in superior gains in static and dynamic balance.

The improvement observed in the structured rehabilitation group may be attributed to the progressive incorporation of neuromuscular retraining, balance training, unstable-surface exercises, agility drills, and sport-specific activities. These interventions target sensorimotor deficits commonly observed following ankle ligament injury and contribute to improved postural control and functional stability. [6,7,10]

The significantly greater Stork Stand Test scores

observed in the structured rehabilitation group indicate enhanced static balance and single-limb postural control. Similarly, superior Y-Balance Test performance suggests improved dynamic stability and neuromuscular control, both of which are essential for football-related activities such as cutting, landing, and directional changes.[9,11]

The findings are consistent with previous literature demonstrating the effectiveness of proprioceptive and balance training in reducing recurrent ankle sprain risk and improving functional outcomes following lateral ankle ligament injury.[7,12,13]

Conclusion

Both rehabilitation approaches improved balance outcomes in collegiate football athletes with Grade II calcaneofibular ligament injury. However, the structured rehabilitation programme produced significantly greater improvements in static and dynamic balance compared with traditional rehabilitation. The findings suggest that progressive neuromuscular, balance, and sport-specific training should be incorporated into rehabilitation programmes to optimize recovery following calcaneofibular ligament injury.

Clinical Implications

Structured rehabilitation may be considered an effective approach for improving postural control and balance in football athletes recovering from Grade II calcaneofibular ligament injury. The programme can be implemented using commonly available rehabilitation equipment and may assist clinicians in facilitating a safe return to sport

Limitations

The study was limited by a relatively small sample size, single-centre recruitment, and an eight-week intervention period. Long-term follow-up, reinjury rates, and return-to-sport outcomes were not assessed. Additionally, outcome measures primarily focused on balance performance.

Future Recommendations

Future studies should include larger sample sizes, randomized controlled designs, longer follow-up periods, and additional functional outcome measures. Investigation of return-to-sport outcomes and reinjury prevention following structured rehabilitation is also recommended.

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