

Multimodal Physiotherapy in an Adolescent Soccer Player with Left Ankle Sprain: A Case Report

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Abstract

Background: Ankle sprain is a common musculoskeletal injury in soccer players, often resulting in pain, edema, reduced range of motion, muscle weakness, and functional limitations that may delay return to sport.

Objective: This case report aimed to describe the clinical outcomes of a multimodal physiotherapy intervention in an adolescent soccer player with a left ankle sprain (n=1).

Methods: A 15-year-old male soccer player was treated in an outpatient setting over four sessions within one week. Baseline assessment revealed movement pain (Numeric Rating Scale [NRS] 6/10), tenderness (5/10), limited ankle range of motion, peroneal muscle weakness (Manual Muscle Testing [MMT] grade 3), edema (50.5 cm), and reduced functional ability (Foot and Ankle Disability Index [FADI] 71.15%; FADI Sports 65.62%). The intervention included Transcutaneous Electrical Nerve Stimulation (TENS), therapeutic ultrasound, and structured exercise therapy.

Results: After four sessions, movement pain decreased from NRS 6 to 2 (–66.7%) and tenderness from 5 to 1 (–80.0%). Muscle strength improved from MMT grade 3 to 5. Edema decreased from 50.5 cm to 49.0 cm. Functional outcomes improved, with FADI increasing to 95.19% and FADI Sports to 93.75%.

Conclusion: Multimodal physiotherapy was associated with improvements in clinical and functional outcomes in this case. However, findings should be interpreted cautiously due to the single-case design and short follow-up period.

Keywords

Ankle Sprain; Physical Therapy Modalities; Exercise Therapy; Adolescent Athletes

Introduction

Ankle sprain is one of the most prevalent musculoskeletal injuries among athletes, particularly in sports such as soccer that involve rapid directional changes, high mechanical loads, and frequent physical contact.¹ This injury typically results from excessive inversion mechanisms leading to stretching or tearing of the lateral ankle ligaments, especially the anterior talofibular ligament, which is the most commonly affected structure.² Epidemiological evidence indicates that ankle sprains account for a substantial proportion of sports-related injuries and are associated with high recurrence rates, particularly in young and physically active populations.^{1,3}

Adolescent athletes may be at greater risk due to high training intensity combined with incomplete neuromuscular maturation and dynamic joint instability.⁴ These factors contribute to clinical impairments such as pain, edema, reduced range of motion, muscle weakness, and compromised functional performance, including limitations in walking, running, and sport-specific activities.⁵ If not appropriately managed, ankle sprain may progress to chronic ankle instability, characterized by persistent symptoms, recurrent injury, and long-term functional limitations.⁵

Physiotherapy plays a central role in ankle sprain management, aiming to reduce pain and inflammation, promote tissue healing, and restore functional capacity.⁶ Multimodal rehabilitation approaches are commonly recommended, integrating electrotherapy modalities and exercise-based interventions.⁷ Transcutaneous Electrical Nerve Stimulation (TENS) is frequently used for pain modulation through mechanisms such as gate control theory and endogenous opioid release.⁸ Therapeutic ultrasound is also applied due to its potential thermal and non-thermal effects, including increased tissue extensibility, enhanced circulation, and stimulation of cellular repair processes.^{9,10} Exercise therapy remains the cornerstone of rehabilitation, with strong evidence supporting its role in improving muscle strength, joint stability, proprioception, and neuromuscular control.^{11,12}

Despite these advances, the existing literature predominantly focuses on adult populations or controlled experimental settings, with limited reports describing the implementation of multimodal physiotherapy in adolescent athletes within real-world clinical contexts.^{11,13} In our literature search, we identified only a limited number of case reports describing how combined interventions are implemented, monitored, and progressed in routine clinical practice. This evidence-to-practice gap may make clinical decision-making more challenging when applying findings to young athletic populations.

This case is reported due to the limited availability of detailed clinical reports describing the implementation of multimodal physiotherapy in adolescent athletes within real-world settings, particularly with structured progression and short-term outcome monitoring. Therefore, this case report aims to describe the implementation of a multimodal physiotherapy program and its clinical outcomes in an adolescent soccer player with a left ankle sprain. This report is expected to provide clinically relevant insights into rehabilitation strategies and functional recovery in similar populations.

Methods

This study was conducted as a single-patient case report following accepted case-report reporting standards, including the CARE (Case REport) guideline principles.¹⁴ The study was carried out in an outpatient physiotherapy setting at a soccer club medical unit (PERSIS Solo) between September and October 2025. The subject was a 15-year-old male adolescent soccer player who trained regularly (4–5 sessions per week) and played as a midfielder. The patient presented with a left ankle injury sustained during training, involving a forced inversion mechanism following foot-ground impact. The patient had no prior history of ankle injury, no known comorbidities, and had not received any pharmacological or rehabilitative intervention prior to physiotherapy. These characteristics were considered relevant to minimize potential confounding factors and to represent a typical case of acute sports-related ankle sprain in an adolescent athlete.

At baseline, clinical examination revealed movement-related pain rated 6/10 and tenderness rated 5/10 on the Numeric Rating Scale (NRS), a valid and reliable tool for musculoskeletal pain assessment.¹⁵ Peroneal muscle strength was graded as 3/5 using Manual Muscle Testing (MMT). The reliability of MMT (test–retest and inter-rater agreement) has been supported by a recent systematic review.¹⁶ Ankle range of motion was measured using a standard goniometer, demonstrating limitations in dorsiflexion (10°) and plantarflexion (20°). Edema was assessed using circumferential measurement (figure-of-eight method equivalent), with the affected side measuring 50.5 cm compared to 49 cm on the contralateral side. Functional ability was evaluated using the Foot and Ankle Disability Index (FADI) and FADI Sports, both validated instruments for assessing activity limitations and sports-related function.¹⁷ Baseline scores were 71.15% (FADI) and 65.62% (FADI Sports).

Clinical ligament stability tests, including the Anterior Drawer Test and Talar Tilt Test, were positive, indicating lateral ankle ligament involvement consistent with a Grade II ankle sprain.¹⁸ Imaging was not performed, which is acknowledged as a limitation. Differential diagnoses, including ankle fracture, syndesmotic injury, and medial ligament sprain, were considered clinically unlikely based on the absence of deformity, negative fracture signs, and localized findings on ligament testing.

The physiotherapy intervention was delivered by a licensed physiotherapist with clinical experience in sports rehabilitation. The treatment program consisted of a multimodal approach combining electrotherapy and structured exercise therapy over four sessions. Each session lasted approximately 45–60 minutes and was conducted with continuous clinical monitoring. Transcutaneous Electrical Nerve Stimulation (TENS) was applied using conventional parameters for acute pain modulation: frequency 80–100 Hz, pulse width 100 µs, duration 15 minutes, and intensity adjusted to produce a comfortable sensory-level stimulation without muscle contraction. Therapeutic ultrasound was administered at a frequency of 1 MHz with an intensity of 1.0 W/cm² in pulsed mode (20% duty cycle) for 5 minutes, targeting the affected ligament region. These electrotherapy parameters were selected based on clinical rationale and were applied as part of a multimodal protocol.¹⁸

Exercise therapy was progressively implemented according to patient tolerance and clinical response. The program began with ankle pumping and active-assisted range of motion exercises within pain-free limits, followed by ankle alphabet exercises to facilitate multidirectional mobility. Isometric strengthening of the peroneal muscles was initiated in the early phase, progressing to resistance training using elastic bands (theraband) with gradual increases in load (2–3 sets of 10–15 repetitions). Weight-bearing activities were introduced through weight-shifting exercises, followed by single-leg stance training to improve balance and proprioception. Gait training progressed from partial to full weight-bearing as tolerated.

A structured home exercise program was prescribed to support rehabilitation; however, adherence was not quantitatively monitored using validated adherence measures, which is recognized as a limitation.¹⁹ The selection of a multimodal physiotherapy approach was based on current clinical guidelines recommending integrated strategies to address both symptom modulation and functional restoration in ankle sprain management.¹² Outcome measures were assessed at each session (T1–T4) to monitor longitudinal progress. Pain was measured using the Numeric Rating Scale (NRS), muscle strength using Manual Muscle Testing (MMT), and range of motion using a goniometer. Edema was evaluated through circumferential measurement. Functional outcomes were assessed using FADI and FADI Sports questionnaires. Balance and proprioception were evaluated using the Single Leg Balance Test (SLBT), a commonly used clinical measure of postural stability with established reliability; however, quantitative timing data were not consistently recorded.²⁰ To enhance clarity regarding the sequence of clinical events and interventions, the rehabilitation process is summarized in Table 1.

Table 1. Clinical Timeline of Injury, Intervention, and Outcomes

Time Point	Clinical Event	Intervention	Outcome/Progress
Day 0	Injury during soccer training (inversion mechanism)	–	Pain, edema, limited ROM, partial weight-bearing
Day 1 (T1)	Initial physiotherapy assessment	Baseline evaluation (NRS, MMT, ROM, edema, FADI, SLBT)	Pain: NRS 6 (movement), 5 (tenderness); MMT 3; FADI 71.15%
Session 1 (T1)	Early rehabilitation phase	TENS, ultrasound, ankle pumping, active-assisted ROM	Pain slightly reduced; patient tolerates movement
Session 2 (T2)	Subacute phase (early progression)	Continued electrotherapy, ROM progression, isometric strengthening	Improved ROM; reduced edema; increased tolerance to weight-bearing
Session 3 (T3)	Functional strengthening phase	Theraband strengthening, weight shifting, single-leg stance	Improved muscle strength and balance
Session 4 (T4)	Advanced functional phase	Full weight-bearing, gait training, functional exercises	Pain decreased to NRS 2; MMT improved to 5; FADI increased to 95.19%
Final Evaluation	Post-intervention assessment	Re-evaluation of all outcomes	Significant improvement in pain, ROM, strength, edema, and function

Data analysis was conducted descriptively using a longitudinal approach. Changes in clinical outcomes were reported as absolute differences (delta) and percentage improvements between baseline (T1) and final session (T4). Data analysis was conducted descriptively using a longitudinal approach. Changes in clinical outcomes were reported as absolute differences (delta) and percentage improvements between baseline (T1) and final assessment (T4). For the Numeric Rating Scale (NRS), a reduction of ≥2 points was considered indicative of a clinically meaningful improvement, consistent with previous clinical research. Changes in the Foot and Ankle Disability Index (FADI) were therefore interpreted descriptively, without applying a predefined MCID threshold.²¹ Written informed consent was obtained from the patient and his legal guardian prior to participation, including consent for publication of anonymized clinical data. Patient confidentiality was strictly maintained by removing all identifiable information. Formal institutional

ethical approval was not required for this single case report according to local regulations. All procedures were conducted in accordance with the principles of the Declaration of Helsinki.

Results

This case report (n=1) presents longitudinal clinical outcomes following four sessions of multimodal physiotherapy in an adolescent soccer player with a left ankle sprain. Outcomes were evaluated across four time points (T1–T4) to capture changes in pain, muscle strength, range of motion (ROM), edema, and functional performance. To provide a structured overview of clinical progression, the results are summarized in Table 2.

Table 2. Changes in Clinical Outcomes Across Four Physiotherapy Sessions

Outcome Measure	T1 (Baseline)	T2	T3	T4 (Final)	Δ (T1–T4)	% Change
NRS (Movement Pain)	6	5	3	2	–4	–66.7%
NRS (Tenderness)	5	4	2	1	–4	–80.0%
MMT (Peroneal Muscle)	3	4	4	5	+2 grades	–
ROM Dorsiflexion (°)	10	12	15	18	+8°	+80.0%
ROM Plantarflexion (°)	20	25	30	35	+15°	+75.0%
Edema (cm)	50.5	50.0	49.5	49.0	–1.5 cm	–3.0%
FADI (%)	71.15	78.84	87.50	95.19	+24.04	+33.8%
FADI Sports (%)	65.62	71.87	84.37	93.75	+28.13	+42.9%

Pain outcomes showed a progressive decrease across sessions. Movement-related pain decreased from 6 at baseline to 2 at the final session (Δ –4; –66.7%), while tenderness decreased from 5 to 1 (Δ –4; –80.0%). Muscle strength of the peroneal muscles improved from MMT grade 3 at baseline to grade 5 at the final session. Range of motion increased across the sagittal plane. Dorsiflexion improved from 10° to 18° (Δ +8°; +80.0%), while plantarflexion increased from 20° to 35° (Δ +15°; +75.0%). Edema, measured using circumferential assessment, decreased from 50.5 cm to 49.0 cm (Δ –1.5 cm; –3.0%). Functional outcomes improved across sessions. The FADI score increased from 71.15% to 95.19% (Δ +24.04; +33.8%), while the FADI Sports score improved from 65.62% to 93.75% (Δ +28.13; +42.9%). Balance and proprioception, assessed using the Single Leg Balance Test (SLBT), showed qualitative improvement across sessions; however, quantitative timing data were not consistently recorded, which limits standardized reporting of postural stability outcomes.²² All outcome measures specified in the Methods section were reported in the Results. No adverse events were observed during the intervention period. Return to sport was initiated progressively based on clinical and functional improvement; however, objective return-to-sport criteria, such as those proposed in the PAASS framework, were not formally applied.²³

Discussion

This case report describes the clinical course of an adolescent soccer player with a left ankle sprain who underwent a multimodal physiotherapy program over four sessions. The observed improvements in pain, muscle strength, range of motion (ROM), edema, and functional performance indicate a favorable short-term clinical progression. However, given the single-case design, these findings should be interpreted as descriptive and cannot be considered evidence of intervention effectiveness.

The magnitude of pain reduction in this case exceeded the minimal clinically important difference (MCID) threshold for the Numeric Rating Scale (≥ 2 points), indicating clinically meaningful improvement.²⁴ Similarly, FADI scores increased substantially from baseline, suggesting meaningful functional gains. These findings support the clinical relevance of the observed changes, although causality cannot be established.

The reduction in pain intensity is consistent with previous evidence supporting the use of Transcutaneous Electrical Nerve Stimulation (TENS) as an adjunct modality for musculoskeletal pain management.⁸ TENS is proposed to modulate pain through activation of large-diameter afferent fibers, thereby inhibiting nociceptive transmission and facilitating endogenous opioid release.²⁵

Therapeutic ultrasound may also contribute through thermal and non-thermal effects, including increased local circulation and modulation of inflammatory processes.¹⁰ However, since both modalities were applied concurrently, their individual contributions cannot be isolated, and natural tissue healing may also have influenced the observed outcomes.

Improvements in ROM and muscle strength are likely associated with the structured exercise therapy component. Progressive loading and active mobilization have been widely reported to improve joint mobility and muscular function following ankle sprain.¹² The observed increases in dorsiflexion and plantarflexion are consistent with the role of early mobilization in preventing stiffness and promoting joint recovery. Similarly, improved peroneal muscle strength may enhance dynamic ankle stability, which is important in reducing reinjury risk. However, spontaneous recovery in the acute phase should also be considered as a contributing factor.

The reduction in edema across sessions may be explained by the combined effects of early mobilization, muscle activation, and improved circulation. Exercise interventions such as ankle pumping and progressive weight-bearing can facilitate venous return and lymphatic drainage.²⁶ Although ultrasound has been proposed to support tissue healing at the cellular level, current evidence regarding its clinical effectiveness remains inconclusive, and its role in this case should be interpreted cautiously.

Functional improvements, reflected by increases in FADI and FADI Sports scores, indicate enhanced activity and participation levels. These findings are consistent with previous studies demonstrating that exercise-based rehabilitation, particularly when incorporating proprioceptive and neuromuscular training, can improve functional outcomes and reduce reinjury risk.¹¹ The inclusion of balance training and progressive weight-bearing in this case may have contributed to improvements in sensorimotor control, which is essential for sport-specific performance.²⁷ However, the absence of standardized return-to-sport criteria limits the interpretation of functional readiness, as current consensus recommends a multidimensional assessment including pain, impairments, sensorimotor control, and sport-specific performance.²⁸

When compared with existing literature, the magnitude of improvement observed in this case appears consistent with short-term rehabilitation outcomes reported in similar populations.¹² However, direct comparison is limited due to differences in study design, intervention protocols, and outcome measures. Importantly, this case does not allow differentiation between the effects of the multimodal intervention and the natural healing process, which typically occurs during the early phase following ankle sprain.

Several limitations should be acknowledged. First, this study involved a single subject, limiting generalizability. Second, the absence of a control condition precludes causal inference. Third, the short duration of follow-up does not allow evaluation of long-

term outcomes, including recurrence or progression to chronic ankle instability. Additionally, the absence of medium- to long-term follow-up limits the assessment of sustained recovery. Certain outcome measures, such as balance performance and adherence to the home exercise program, were not quantified objectively. Furthermore, the lack of imaging confirmation may reduce diagnostic precision, although clinical findings were consistent with a Grade II ankle sprain.

Potential observer bias should be considered, particularly for subjective outcomes such as pain ratings, which can be influenced by contextual factors and assessor/observer characteristics.²⁹ Improvements in pain and function may also be influenced by contextual effects and placebo responses associated with the therapeutic encounter, in addition to the specific effects of the electrotherapy modalities³⁰. In addition, the patient's young age and athletic background may facilitate faster recovery due to higher baseline physical capacity.³¹

Despite these limitations, this case provides clinically relevant insights into the application of a multimodal physiotherapy program in an adolescent athlete within a real-world setting. The structured progression of interventions and integration of exercise and electrotherapy modalities reflect current rehabilitation principles.¹⁰ Future research should focus on controlled studies with larger sample sizes, standardized outcome measures, and longer follow-up periods to evaluate the effectiveness of multimodal interventions and to establish evidence-based return-to-sport criteria.

Conclusion

This case report describes the short-term clinical outcomes of a multimodal physiotherapy program in an adolescent soccer player with a left ankle sprain. The intervention was associated with reductions in pain and edema, along with improvements in muscle strength, range of motion, and functional performance over four treatment sessions.

These findings suggest that a structured combination of electrotherapy and progressive exercise may support functional recovery in similar clinical contexts. However, given the single-case design, this interpretation is hypothesis-generating rather than evidence of intervention effectiveness. However, due to the single-case design, short follow-up duration, and absence of a control condition, the results cannot be generalized or interpreted as evidence of effectiveness.

From a practical perspective, this case highlights the importance of integrating progressive exercise therapy with symptom-modulating modalities to facilitate early rehabilitation and functional improvement in adolescent athletes.¹⁰ Future research should focus on controlled studies with larger samples, standardized outcome measures, and longer follow-up periods to determine the comparative effectiveness of multimodal interventions and to establish evidence-based return-to-sport criteria.

Author Contribution

Nadya Fitri Kirana: Conceptualization, Data curation, Investigation, Writing original draft.

Suryo Saputra Perdana: Supervision, Validation, Writing review and editing.

Muhammad Ali Ramdhani: Investigation, Clinical assessment, Writing review and editing.

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Conflict of Interest Statement

The authors declare that there is no conflict of interest related to the publication of this case report.

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This study received no external funding.

Ethics Statement

Written informed consent was obtained from the patient and his legal guardian prior to participation. All procedures were conducted in accordance with ethical standards for case reporting, and patient confidentiality was strictly maintained. Formal institutional ethical approval was not required for this single case report according to local regulations.

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