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Multimodal Physiotherapy for Calcaneal Spur: A Case Report

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Abstract

Background: Calcaneal spur is a bony outgrowth commonly associated with plantar heel pain, leading to functional limitations in standing and walking. Multimodal physiotherapy combining electrotherapy and exercise has been widely used; however, evidence from detailed clinical case reports remains limited.

Objective: To evaluate the clinical effectiveness of a multimodal physiotherapy program in reducing pain and improving functional ability in a patient with calcaneal spur.

Methods: This case report describes a 54-year-old female with left calcaneal spur who underwent six physiotherapy sessions over three weeks in an outpatient rehabilitation setting. Interventions included therapeutic ultrasound (1 MHz, 1.2 W/cm², 5 minutes), conventional transcutaneous electrical nerve stimulation (TENS; 80–100 Hz, 15 minutes), and structured exercise therapy (stretching, strengthening, balance, and gait training). Outcomes were assessed using the Numeric Rating Scale (NRS) for pain, ankle range of motion (ROM), and the Foot and Ankle Disability Index (FADI) for functional ability.

Results: Pain intensity decreased from NRS 5 to 2, indicating a clinically meaningful reduction. Ankle dorsiflexion improved from 15° to 20°. Functional ability increased substantially, with FADI scores improving from 52% to 90% (absolute improvement: 38%). Clinically, the patient demonstrated improved gait pattern and reduced pain during weight-bearing activities. No adverse events were reported.

Conclusion: A structured multimodal physiotherapy program demonstrated clinically meaningful improvements in pain, joint mobility, and functional performance in this case. These findings highlight the potential benefit of combined interventions; however, further studies with larger samples and long-term follow-up are required.

Keywords
Calcaneal spur; Physical therapy; Ultrasound therapy; Transcutaneous electrical nerve stimulation; Exercise therapy

Introduction

Calcaneal spur is a fibrocartilaginous bony outgrowth that develops at the calcaneus, most commonly at the insertion of the plantar fascia. It is generally considered an adaptive response to repetitive mechanical loading and chronic traction forces, which stimulate ossification at the enthesis.[1] This condition is frequently associated with plantar heel pain, a common musculoskeletal complaint that can significantly impair functional activities such as standing, walking, and weight-bearing tasks.[1]

Epidemiological studies indicate that calcaneal spur is more prevalent in middle-aged and older adults, with a higher incidence reported in females.[2] The presence of calcaneal spur is often linked to several risk factors, including increased body weight, prolonged standing, reduced ankle flexibility, and biomechanical abnormalities such as excessive foot pronation.[1,2] These factors contribute not only to the development of the spur itself but also to persistent pain and functional limitations, ultimately affecting quality of life and daily productivity.[1] These findings suggest the presence of modifiable risk factors, including obesity, prolonged mechanical loading, and inappropriate footwear, which may contribute to increased stress on the plantar fascia and development of calcaneal spur.[2]

From a clinical perspective, plantar heel pain associated with calcaneal spur represents a complex condition involving both structural and functional impairments.[3] Pain is typically most pronounced during initial weight-bearing activities, particularly during the heel strike phase of gait, and may lead to compensatory movement patterns that further exacerbate dysfunction.[4] Consequently, effective management requires a comprehensive approach targeting pain modulation, tissue healing, and restoration of functional biomechanics.[1]

Physiotherapy is widely recognized as a primary conservative management strategy for calcaneal spur.[5] Therapeutic ultrasound has been reported to improve tissue extensibility, enhance local circulation, and reduce pain through thermal and non-thermal effects.[6] In addition, transcutaneous electrical nerve stimulation (TENS) is commonly used for pain modulation via neurophysiological mechanisms, including activation of the gate control system and endogenous opioid release.[7] However, evidence regarding its effectiveness remains variable, although randomized controlled trials have demonstrated that TENS can significantly reduce pain and improve functional outcomes in patients with plantar heel pain conditions.[8,9]

Exercise therapy plays a critical role in addressing underlying biomechanical dysfunction. Interventions such as plantar fascia stretching, strengthening of intrinsic foot muscles, and balance training have been shown to improve functional outcomes by enhancing flexibility, stability, and neuromuscular control.[10,11] When combined, these modalities may produce synergistic effects, leading to more comprehensive clinical improvements compared to single-modality interventions.[6,12]

Despite the availability of evidence supporting individual physiotherapy modalities, there is still limited documentation of integrated multimodal physiotherapy approaches reported in real-world clinical settings, particularly in the form of detailed case reports. Existing literature tends to focus on controlled trials with homogeneous populations, which may not fully capture the

complexity and variability of individual patient responses in routine clinical practice. This highlights a gap in clinically contextualized evidence that reflects individualized treatment strategies and outcomes.

Furthermore, few reports explicitly describe the clinical reasoning underlying the selection of combined interventions, the progression of therapy over time, and the functional impact on patient-specific outcomes.[13] As a result, the translation of evidence into practice remains suboptimal, especially in settings with limited resources or varying patient characteristics.

Therefore, this case report aims to provide a detailed clinical description of a multimodal physiotherapy program combining ultrasound, TENS, and exercise therapy in the management of calcaneal spur. The specific objective is to evaluate its effectiveness in reducing pain, improving joint mobility, and enhancing functional ability in a patient with calcaneal spur within a real clinical setting.

Methods

This study was designed as a single-patient case report following the CARE (CAse REport) guidelines to ensure transparency, completeness, and reproducibility in clinical reporting.[14] The report describes the clinical presentation, diagnostic process, intervention protocol, and outcome evaluation of a patient with calcaneal spur managed in a real-world outpatient rehabilitation setting.

The subject was a 54-year-old female teacher presenting with recurrent left heel pain. The patient had a prior history of ankle injury two years earlier and was previously diagnosed with calcaneal spur based on radiographic examination. At the time of presentation, the patient reported a stabbing pain localized at the plantar aspect of the left heel, with a baseline intensity of 5 on the Numeric Rating Scale (NRS), indicating moderate pain. Symptoms were aggravated by prolonged standing and walking.

Her body mass index (BMI) was 31 kg/m², which is classified as obese according to World Health Organization criteria. The patient had no history of comorbidities such as diabetes mellitus, hypertension, or inflammatory joint disease. Occupational history revealed that prior to symptom recurrence, the patient was able to stand for approximately 2–3 hours during teaching activities; however, due to pain, she currently limits standing to around 30 minutes and performs most teaching activities in a seated position.

The patient reported no history of smoking. Relevant lifestyle factors included frequent use of high-heeled footwear prior to symptom onset, which was discontinued after the recurrence of symptoms. Additionally, the patient reported no regular participation in physical exercise. The diagnosis of calcaneal spur was previously confirmed through radiographic examination, which demonstrated a bony outgrowth at the inferior aspect of the calcaneus. However, detailed radiological parameters and severity grading were not available in the current report, which represents a limitation in diagnostic characterization. The diagnosis was established based on the combination of localized plantar heel pain, tenderness at the calcaneal insertion, and prior radiographic confirmation, making alternative diagnoses such as isolated plantar fasciitis or Achilles tendinopathy less likely.

Baseline clinical assessment included subjective and objective examinations. Pain intensity was measured using the Numeric Rating Scale (NRS), a valid and reliable tool for assessing musculoskeletal pain with high responsiveness in clinical settings.[15] Functional ability was assessed using the Foot and Ankle Disability Index (FADI), which has demonstrated good validity and reliability for evaluating functional limitations in foot and ankle disorders.[16] Joint range of motion (ROM) of the ankle was measured using a standard goniometer, while muscle strength was assessed using Manual Muscle Testing (MMT).[17,18] Balance was evaluated using the one-leg stance test, which is commonly used to assess postural stability and fall risk.

Initial clinical findings revealed tenderness upon palpation at the plantar calcaneus, tightness in the gastrocnemius muscle, reduced ankle dorsiflexion (15°), and moderate functional limitation (FADI 52%). The patient demonstrated an antalgic gait pattern characterized by reduced weight-bearing on the affected side. These findings supported the clinical diagnosis of calcaneal spur, which had previously been confirmed radiographically. Differential diagnoses such as isolated plantar fasciitis without spur and Achilles tendinopathy were considered less likely based on symptom localization and clinical examination.

To provide a clear and structured overview of the patient's clinical course, a chronological timeline of symptom onset, assessment, intervention, and outcome evaluation is presented in Table 1. This timeline summarizes the sequence of key clinical events and facilitates understanding of disease progression and treatment response.

Table 1. Clinical timeline of patient management

Time Point	Clinical Events
August 2025	Recurrence of left heel pain characterized by stabbing sensation, aggravated by prolonged standing and walking
Baseline (T0)	Initial assessment: NRS 5/10, ankle dorsiflexion 15°, FADI 52%, antalgic gait, tenderness at plantar calcaneus
Week 1 (Session 1–2)	Initiation of physiotherapy: ultrasound, TENS, and exercise therapy; patient education on home exercise program
Week 2 (Session 3–4)	Continued intervention with progressive exercise; reduction in pain during weight-bearing activities reported
Week 3 (Session 5–6)	Further improvement in functional mobility and gait pattern; increased tolerance to activity
Post-intervention (T6)	Final evaluation: NRS 2/10, ankle dorsiflexion 20°, FADI 90%, improved gait and reduced heel pain

The intervention program was designed as a multimodal physiotherapy approach combining electrotherapy and exercise therapy. The selection of modalities was based on clinical reasoning targeting pain modulation, tissue healing, and functional restoration. Ultrasound therapy was administered using a frequency of 1 MHz and an intensity of 1.2 W/cm² in continuous mode for 5 minutes. This parameter selection was based on its ability to target deeper tissues such as the plantar fascia and produce thermal effects that enhance tissue extensibility and local circulation.[19] Transcutaneous Electrical Nerve Stimulation (TENS) was applied using a conventional mode with a frequency of 80–100 Hz for 15 minutes. This parameter range is commonly used for pain modulation through activation of the gate control mechanism and endogenous opioid pathways.

Exercise therapy consisted of a structured and progressive program including plantar fascia stretching, gastrocnemius stretching, intrinsic foot muscle strengthening (short foot exercise), heel raises, balance training, and gait training. Exercises were performed with moderate intensity, typically 8 repetitions for 3 sets, and were adjusted progressively based on patient tolerance and clinical response. The patient was also instructed to perform selected exercises independently at home to improve adherence and functional carryover. The intervention protocol followed the FITT principle (frequency, intensity, time, and type), although modifications were made during the treatment period in response to clinical improvements. No additional concurrent therapies were reported during the intervention period. Patient adherence was monitored through direct supervision during sessions and verbal confirmation for home exercises.

Outcome evaluation was conducted at baseline (T0) and after the sixth session (T6). The primary outcomes were pain intensity (NRS) and functional ability (FADI), while secondary outcomes included ankle ROM and balance performance. Changes in outcomes were analyzed descriptively by comparing pre- and post-intervention values, consistent with the methodological approach of case reports. Clinical significance was interpreted based on the magnitude of change and functional improvement observed. The

reduction in pain from NRS 5 to 2 exceeds the commonly accepted minimal clinically important difference (MCID) of approximately 2 points, indicating a clinically meaningful improvement.[1]

The improvement in FADI score (52% to 90%) reflects substantial functional recovery; however, the absence of a universally established MCID for FADI limits precise interpretation of clinical significance, and changes are therefore interpreted relative to baseline severity.[3]

This case report was conducted in accordance with ethical principles for clinical research involving human subjects. Formal ethical clearance was not required for this study as it involved a single case report without experimental intervention. However, written informed consent was obtained from the patient prior to data collection and publication. The patient was informed about the purpose of the study, the procedures involved, and the use of anonymized clinical data for publication. All identifying information has been removed to ensure patient confidentiality. To enhance clarity and ensure compliance with CARE reporting standards, the chronological progression of the patient's clinical course—from symptom onset to final evaluation—is summarized in Table 2. This structured presentation facilitates a clear understanding of the temporal relationship between diagnosis, intervention, and clinical outcomes.

Table 2. Clinical flow of patient management (CARE-based)

Clinical Stage	Description
Symptom recurrence (August 2025)	The patient experienced recurrence of left heel pain characterized as stabbing pain, aggravated by prolonged standing and walking
Initial assessment (T0)	Baseline evaluation revealed NRS 5/10, ankle dorsiflexion 15°, FADI 52%, antalgic gait pattern, and tenderness at the plantar calcaneus
Diagnosis confirmation	Calcaneal spur diagnosis was established based on clinical findings and prior radiographic evidence showing a bony outgrowth at the calcaneus
Physiotherapy intervention (6 sessions over 3 weeks)	The patient underwent a multimodal physiotherapy program (ultrasound, TENS, and exercise therapy) across six sessions within three weeks
Progressive improvement during sessions	Gradual reduction in pain and improved tolerance to functional activities were observed during the intervention period
Final evaluation (T6)	Post-intervention assessment showed NRS 2/10, ankle dorsiflexion increased to 20°, and FADI improved to 90%
Outcome	Overall outcomes included reduced pain, improved joint mobility, and enhanced functional ability

Results

This study aimed to evaluate changes in pain intensity, ankle joint mobility, and functional ability following a structured multimodal physiotherapy program. The results are presented sequentially according to the outcome measures defined in the Methods section. To provide a clear overview of changes in pain intensity across the intervention period, the NRS scores at baseline (T0) and post-intervention (T6) are presented in Table 3.

Table 3. Changes in pain intensity (Numeric Rating Scale)

Measurement Condition	Baseline (T0)	Post-intervention (T6)
Pain at rest	0	0
Pain on movement	5	2
Pain on palpation	7	3

The data demonstrate a reduction in pain intensity across all measurement conditions, with the most notable decrease observed during movement and palpation. To describe changes in ankle joint mobility, range of motion (ROM) measurements are summarized in Table 4.

Table 4. Changes in ankle range of motion (degrees)

Movement	Baseline (T0)	Post-intervention (T6)
Dorsiflexion	15	20
Plantarflexion	50	50
Inversion	30	30
Eversion	15	15

An increase in dorsiflexion range was observed, while other ankle movements remained stable throughout the intervention period. To present functional improvement, changes in Foot and Ankle Disability Index (FADI) scores are shown in Table 5.

Table 5. Changes in functional ability (FADI)

Time Point	FADI Score (%)
Baseline (T0)	52
Post-intervention (T6)	90
Absolute change	+38

The FADI score increased substantially from baseline to post-intervention, indicating improved functional performance. In addition to quantitative outcomes, observational clinical findings indicated improvements in gait pattern, characterized by increased weight-bearing on the affected limb and reduced pain during the heel strike phase. Balance performance also improved, as reflected by increased tolerance during the one-leg stance test.No adverse events or complications were reported during the intervention period.

Discussion

This case report demonstrates that a structured multimodal physiotherapy program combining ultrasound, transcutaneous electrical nerve stimulation (TENS), and exercise therapy was associated with clinically meaningful improvements in pain intensity, ankle dorsiflexion, and functional ability in a patient with calcaneal spur. These findings support the role of integrated conservative management in addressing both symptomatic and functional impairments in plantar heel pain conditions.[1,3]

The reduction in pain from NRS 5 to 2 exceeds the commonly accepted minimal clinically important difference (MCID) of approximately 2 points, indicating a clinically meaningful improvement.[15] Although no universally established MCID exists for the Foot and Ankle Disability Index (FADI), the observed improvement of 38% suggests substantial functional recovery when interpreted

relative to baseline severity. [7] Additionally, it may stimulate endogenous opioid release, contributing to analgesic effects. However, evidence regarding its effectiveness remains variable, although systematic reviews have shown that electrotherapy modalities, including transcutaneous electrical nerve stimulation (TENS), may contribute to short-term pain reduction and functional improvement in patients with plantar heel pain, albeit with heterogeneity in treatment protocols and overall evidence quality.[20,21]

Ultrasound therapy, applied at 1 MHz in continuous mode, likely contributed to pain reduction and tissue recovery through its thermal and mechanical effects. Increased local circulation, enhanced collagen extensibility, and improved metabolic activity may facilitate the healing of chronically stressed plantar fascia.[11,19] Previous randomized controlled trials have reported similar findings, indicating that ultrasound can significantly reduce pain and improve functional outcomes in patients with plantar fasciitis, a condition closely related to calcaneal spur.[19]

Beyond pain modulation, the improvement in ankle dorsiflexion observed in this study may be attributed to the effects of exercise therapy, particularly stretching of the gastrocnemius muscle and plantar fascia. Limited dorsiflexion has been identified as a key biomechanical factor contributing to plantar heel pain, as it increases strain on the plantar fascia during gait.[1,2] Therefore, improving flexibility in this region is likely to reduce mechanical stress and facilitate more efficient movement patterns.

In this case, the presence of obesity (BMI 31 kg/m²), history of prolonged standing, and habitual use of high-heeled footwear may have contributed to increased mechanical loading on the plantar fascia, thereby predisposing the patient to calcaneal spur formation and symptom recurrence. These findings are consistent with previous evidence identifying elevated body mass index and biomechanical stress as key risk factors for plantar heel pain.[1,2,4]

The substantial increase in functional ability, as reflected by the FADI score, highlights the importance of combining pain-relieving modalities with active rehabilitation strategies. Exercise therapy, including strengthening of intrinsic foot muscles, balance training, and gait retraining, plays a central role in restoring functional capacity.[5,6,10] These interventions not only address local impairments but also improve neuromuscular control and postural stability, which are essential for sustainable recovery.

Importantly, the combination of modalities in this study may have produced a synergistic effect. While electrotherapy modalities such as TENS and ultrasound primarily target pain and tissue-level changes, exercise therapy addresses underlying biomechanical dysfunction. This integrated approach aligns with current rehabilitation principles emphasizing multimodal and individualized treatment strategies.[3,5] However, direct comparisons with previous studies are limited, as most available evidence focuses on single-modality interventions or controlled trial settings rather than real-world clinical practice.

Despite these positive findings, several limitations must be acknowledged. First, as a single case report, the results cannot be generalized to broader populations. Second, the absence of long-term follow-up limits the ability to determine the sustainability of the observed improvements. Third, potential sources of bias, including measurement bias and placebo effects, cannot be entirely excluded. Additionally, the lack of standardized reporting of minimal clinically important difference (MCID) for FADI and NRS limits the interpretation of clinical significance. The reduction in pain from NRS 5 to 2 exceeds the commonly accepted minimal clinically important difference of approximately 2 points, indicating a clinically meaningful improvement.[1] The improvement in FADI score (52% to 90%) indicates substantial functional recovery. However, the absence of a universally established minimal clinically important difference (MCID) for FADI limits precise interpretation of clinical significance, and changes are therefore best interpreted in relation to baseline severity and functional improvement.[1]

Another limitation relates to the absence of detailed quantification of contributing factors such as body mass index, occupational load, and biomechanical assessment, which may influence both the development of calcaneal spur and response to treatment. Future studies should incorporate these variables to provide a more comprehensive understanding of patient-specific outcomes. Additionally, the absence of detailed patient characteristics such as BMI, biomechanical assessment, and long-term follow-up limits the ability to fully interpret treatment outcomes and generalize findings. Although several risk factors such as BMI and occupational load were identified, objective biomechanical assessments (e.g., foot posture analysis) were not performed, which may limit the comprehensive evaluation of contributing factors.

From a clinical perspective, this case report provides practical insight into the application of multimodal physiotherapy in a real-world setting.[5,6,19] The structured combination of ultrasound, TENS, and progressive exercise therapy may serve as a feasible and effective approach for managing calcaneal spur-related symptoms, particularly in outpatient rehabilitation contexts.

Future research should focus on larger sample sizes, controlled study designs, and longer follow-up periods to establish stronger evidence regarding the effectiveness and optimal parameters of multimodal physiotherapy interventions. Additionally, studies exploring individualized treatment protocols based on patient-specific characteristics are warranted to enhance clinical decision-making.

The patient reported a noticeable reduction in pain during daily activities, particularly during prolonged standing and walking. She also expressed improved confidence in weight-bearing on the affected limb and satisfaction with the overall physiotherapy program. No discomfort or adverse effects were reported during the intervention period.

Conclusion

This case report demonstrates that a structured multimodal physiotherapy program combining ultrasound, transcutaneous electrical nerve stimulation (TENS), and exercise therapy was associated with clinically meaningful improvements in pain, ankle mobility, and functional ability in a patient with calcaneal spur after six treatment sessions. From a practical perspective, this integrated approach may be considered a feasible option in outpatient rehabilitation settings to address both symptomatic and functional impairments in plantar heel pain conditions. However, given the single-case design and absence of long-term follow-up, these findings should be interpreted with caution. Future research should involve larger samples, controlled study designs, and extended follow-up periods to confirm the effectiveness, optimize treatment parameters, and improve generalizability of multimodal physiotherapy interventions in patients with calcaneal spur.

Author Contribution

Alreda Fitriana contributed to conceptualization, data collection, intervention implementation, manuscript drafting, and final manuscript preparation.
Tiara Fatmarizka contributed to supervision, methodology development, critical revision of the manuscript, and scientific validation.
Kingkinarti contributed to clinical supervision, patient management, data interpretation, and manuscript review.

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Conflict of Interest Statement

The authors declare no conflict of interest.

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Ethics Statement

Formal ethical approval was not required for this case report. Written informed consent for participation and publication was obtained from the patient. All data were anonymized to ensure confidentiality.

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