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Multimodal Physiotherapy in Sciatica: A Case Report on Pain and Functional Improvement

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Abstract
Background: Sciatica is a neuropathic pain condition characterized by radiating pain along the sciatic nerve, often associated with lumbar nerve root compression and functional disability. Although physiotherapy is recommended as first-line management, evidence regarding structured multimodal interventions in clinical settings remains limited.
Objective: This study aimed to evaluate the effects of multimodal physiotherapy on pain and functional outcomes in a patient with sciatica.
Methods: A single-subject case report (n=1) was conducted following CARE guidelines. A 46-year-old female presented with a 3-month history of left-sided radiating pain. The patient underwent eight physiotherapy sessions over four weeks, including Transcutaneous Electrical Nerve Stimulation, Shortwave Diathermy, myofascial release, nerve gliding, and William flexion exercises. Outcomes were assessed using the Numerical Rating Scale (NRS), range of motion, Manual Muscle Testing, and Oswestry Disability Index (ODI). Clinical significance was evaluated using minimal clinically important difference thresholds (NRS ≥2; ODI ≥10).
Results: Pain intensity decreased from NRS 8 to 3 (Δ=5), exceeding the MCID. Functional disability improved from ODI 40% (moderate disability) to 18% (mild disability) (Δ=22 points), also exceeding the MCID. Range of motion increased across all directions, and trunk muscle strength improved from grade 4 to grade 5.
Conclusion: This case suggests that multimodal physiotherapy may provide clinically meaningful improvements in pain and functional outcomes in patients with sciatica. These findings highlight the potential benefit of combining electrotherapy and exercise-based interventions in clinical practice.

Keywords
Sciatica; Physical Therapy Modalities; Exercise Therapy; Transcutaneous Electric Nerve Stimulation; Rehabilitation

Introduction

Sciatica is a neuropathic pain syndrome characterized by radiating pain along the distribution of the sciatic nerve, typically resulting from compression or irritation of lumbosacral nerve roots.[1] The condition is most commonly associated with lumbar disc herniation, spinal stenosis, or degenerative spinal changes, and is frequently accompanied by sensory disturbances, motor weakness, and functional limitations.[2] These impairments may substantially affect daily activities and quality of life, particularly in individuals of working age.[2]

From an epidemiological perspective, sciatica represents a significant contributor to global disability, with increasing prevalence linked to aging populations, sedentary lifestyles, and occupational risk factors.[3] The clinical course of sciatica varies considerably, ranging from acute self-limiting episodes to persistent or recurrent conditions requiring prolonged management.[4] Although spontaneous recovery may occur in a proportion of cases, many patients experience ongoing symptoms that necessitate structured therapeutic intervention.[5]

Current clinical guidelines recommend conservative management as the first-line approach for most patients with sciatica, particularly in the absence of severe neurological deficits or surgical indications.[6] Physiotherapy plays a central role in this approach, aiming to reduce pain, restore function, and prevent recurrence through a combination of modalities.[7] Interventions such as Transcutaneous Electrical Nerve Stimulation (TENS), Shortwave Diathermy (SWD), manual therapy, and therapeutic exercise are commonly employed, each targeting different aspects of the underlying pathophysiology.[6,8]

TENS is proposed to modulate pain through activation of descending inhibitory pathways and the gate control mechanism, while SWD provides deep thermal effects that enhance local circulation and reduce muscle spasm.[9] In parallel, core strengthening exercises are designed to improve spinal stability and neuromuscular control, thereby reducing mechanical stress on affected nerve structures.[10] Neural mobilization techniques, such as nerve gliding, may further contribute by improving neural mobility and decreasing mechanosensitivity.[11] The integration of these modalities within a multimodal framework is considered clinically relevant, as it addresses both symptomatic relief and functional restoration.[7]

Despite the widespread use of these interventions, current evidence predominantly evaluates individual modalities rather than structured multimodal protocols delivered in real-world clinical settings.[7] Moreover, there is limited documentation of integrated physiotherapy approaches within low- and middle-income healthcare contexts, where resource availability and clinical practices may differ from those reported in high-income settings.[12] This gap highlights the need for detailed clinical reports that illustrate the application and outcomes of multimodal physiotherapy in routine practice.

This case is notable because it presents a structured combination of electrotherapy, manual therapy, and exercise-based interventions with a clearly documented clinical response over a defined treatment period. The case also provides insight into the temporal progression of recovery, which is often underreported in the literature.

Therefore, this study aimed to evaluate the effects of multimodal physiotherapy on pain and functional outcomes in a patient with sciatica. It was hypothesized that a combined intervention approach would result in clinically meaningful improvements in both pain intensity and functional disability.

Methods

This study was conducted as a single-subject case report in accordance with the CARE (CAse REport) guidelines to ensure transparency and completeness of clinical reporting.[13] The design aimed to provide a detailed and reproducible description of patient characteristics, clinical findings, intervention procedures, and outcome progression over time. This case was selected due to the persistence of symptoms despite conservative self-management and the presence of functional limitations affecting daily activities, making it clinically relevant for physiotherapy intervention.

A 46-year-old female presented with a three-month history of radiating pain along the posterior aspect of the left lower limb. The patient reported gradual onset without trauma and had daily activities involving repetitive bending and prolonged standing. Information regarding body mass index and comorbidities was not documented. The patient had no history of spinal surgery, fracture, malignancy, or severe neurological disorders. Written informed consent was obtained prior to intervention.

Baseline clinical examination revealed radiating pain, reduced lumbar range of motion, and decreased trunk muscle strength. Neurological findings included hypoesthesia, although standardized dermatomal mapping and reflex grading were not systematically recorded. Provocation tests showed a positive Straight Leg Raise (SLR) at 40°, with positive Bragard and Neri signs, indicating lumbosacral nerve root involvement. Differential diagnoses such as piriformis syndrome and lumbar disc herniation were considered based on clinical findings, although detailed imaging interpretation was not available.

The intervention was delivered over four weeks, with a frequency of two sessions per week (total of eight sessions). A multimodal physiotherapy approach was applied, combining electrotherapy, manual therapy, and therapeutic exercise. Transcutaneous Electrical Nerve Stimulation (TENS) was administered using a conventional mode; however, detailed parameters such as frequency, pulse duration, and intensity were not fully documented. Shortwave Diathermy (SWD) was applied for 15 minutes per session, although the operational mode (continuous or pulsed) was not specified. Manual therapy consisted of myofascial release targeting the lumbar and gluteal regions, as well as neural mobilization (nerve gliding). TENS was applied using a conventional mode with a frequency of approximately 80–100 Hz and pulse duration of 100–200 μs, adjusted to a strong but comfortable sensory intensity according to patient tolerance. SWD was administered in continuous mode for 15 minutes per session to achieve a mild thermal effect.

Therapeutic exercise focused on William flexion exercises aimed at improving core stability and reducing lumbar lordosis. Each exercise was performed for 10 repetitions with an 8-second hold. Although the intervention was delivered progressively, detailed documentation of progression parameters was limited. The patient also received ergonomic education related to posture and daily activities. Adherence was monitored through attendance, and no adverse events were reported.

Outcome measures were collected at four time points: baseline (T0), week 1 (T1), week 2 (T2), and post-intervention at week 4 (T3). Pain intensity was assessed using the Numerical Rating Scale (NRS), functional disability using the Oswestry Disability Index (ODI), range of motion using goniometry, and muscle strength using Manual Muscle Testing (MMT), all of which are widely used and validated in musculoskeletal assessment.[14–16] To enhance clarity of the intervention process and outcome progression, the clinical timeline is presented in Table 1.

Table 1. Clinical Timeline of Assessment and Intervention

Time Point	Clinical Events	Intervention	Outcome Assessment
T0 (Baseline)	Initial presentation with radiating pain, positive SLR (40°), reduced ROM and strength	No intervention	NRS, ROM, MMT, ODI
Week 1 (T1)	Early treatment phase	TENS, SWD, myofascial release, nerve gliding, William flexion exercise	NRS, ROM
Week 2 (T2)	Progressive improvement in pain and mobility	Continued multimodal intervention	NRS, ROM, MMT
Week 4 (T3)	Post-intervention evaluation	Completion of 8 sessions	NRS, ROM, MMT, ODI

Outcome data were analyzed descriptively using absolute change scores between baseline and post-intervention values. Clinical significance was interpreted based on minimal clinically important difference (MCID) thresholds, defined as ≥2 points for NRS and ≥10 points for ODI.[16] Due to the single-case design, no inferential statistical analysis was performed. Although this is a single-case report, the intervention approach reflects routine outpatient physiotherapy practice, which may support its applicability in similar clinical settings.This case report was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Formal ethical clearance was not obtained, as this study involved a single patient case report without experimental intervention. Written informed consent was obtained from the patient for participation and for the publication of anonymized clinical data.

Results

The results are presented to describe changes in pain intensity, range of motion, muscle strength, functional disability, and neurological findings across the intervention period. Outcome measurements were collected at baseline (T0) and post-intervention at week 4 (T3), with intermediate assessments used for clinical monitoring. To provide a clear overview of the primary outcomes, changes in pain intensity and functional disability are summarized in Table 2.

Table 2. Changes in Pain Intensity and Functional Disability

Outcome	T0 (Baseline)	T3 (Post-intervention)	Absolute Change
NRS (movement pain)	8	3	−5
NRS (tenderness)	5	2	−3
NRS (rest pain)	3	1	−2
ODI (%)	40 (moderate)	18 (mild)	−22

As shown in Table 2, pain intensity decreased across all indicators, and functional disability scores were lower at the end of the intervention period. Changes in lumbar range of motion are presented in Table 3 to illustrate improvements in trunk mobility across different movement planes.

Table 3. Lumbar Range of Motion (degrees)

Movement	T0	T3	Reference Value
Flexion–extension	20–0–65	26–0–80	30–0–85
Lateral flexion (right/left)	15–0–15	25–0–25	30–0–30
Rotation (right/left)	25–0–27	40–0–40	45–0–45

The data indicate increases in range of motion in all measured directions, approaching normal reference values. Muscle strength outcomes are summarized in Table 4.

Table 4. Trunk Muscle Strength (MMT)

Muscle Group	T0	T3
Trunk flexors	4/5	5/5
Trunk extensors	4/5	5/5

Muscle strength improved from grade 4 to grade 5 in both trunk flexors and extensors. Functional capacity was further evaluated using the Oswestry Disability Index, as shown in Table 2, demonstrating a reduction in disability classification from moderate to mild. Neurological and provocation test findings are presented in Table 5 to describe changes in nerve-related clinical signs.

Table 5. Neurological and Provocation Test Findings

Parameter	T0	T3
Sensory examination	Hypoesthesia (7/10)	Near normal (9/10)
Straight Leg Raise (SLR)	Positive at 40°	Positive at 75°
Bragard test	Positive	Negative
Neri test	Positive	Negative
Patrick test	Negative	Negative
Anti-Patrick test	Positive	Negative

To provide a clearer representation of the temporal progression of clinical outcomes throughout the intervention period, the changes in key parameters are summarized in Table 6 using a longitudinal format. This presentation allows for a structured comparison of patient status from baseline to post-intervention without redundancy with previously reported outcome tables.

Table 6. Longitudinal Progression of Clinical Outcomes

Time Point	Pain Intensity	Range of Motion	Muscle Strength	Neurological Findings
T0 (Baseline)	High (NRS 8)	Limited	Reduced (MMT 4/5)	Positive SLR (40°), positive Bragard and Neri, hypoesthesia
T1–T2 (Week 1–2)	Decreasing	Improving	Mild improvement	Partial reduction in provocation signs
T3 (Post-intervention)	Low (NRS 3)	Near normal	Normal (MMT 5/5)	SLR improved (75°), Bragard and Neri negative, sensory improvement

As shown in Table 6, a progressive improvement was observed across all clinical parameters over the four-week intervention period. Pain intensity decreased consistently, accompanied by gradual improvements in range of motion and muscle strength. Neurological findings also showed favorable changes, particularly in provocation test responses and sensory function. To further illustrate the temporal pattern of clinical improvement, longitudinal trends of pain intensity and functional disability are presented in Figure 1 and Figure 2. Both graphs demonstrate a consistent reduction in NRS and ODI scores across the intervention period (T0–T3), indicating progressive improvement in pain and functional status.

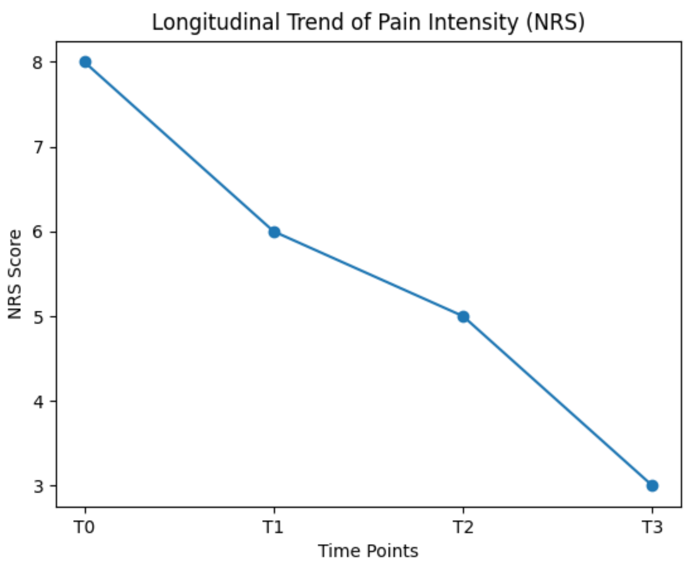

Figure 1. Longitudinal trend of pain intensity measured by NRS across four time points

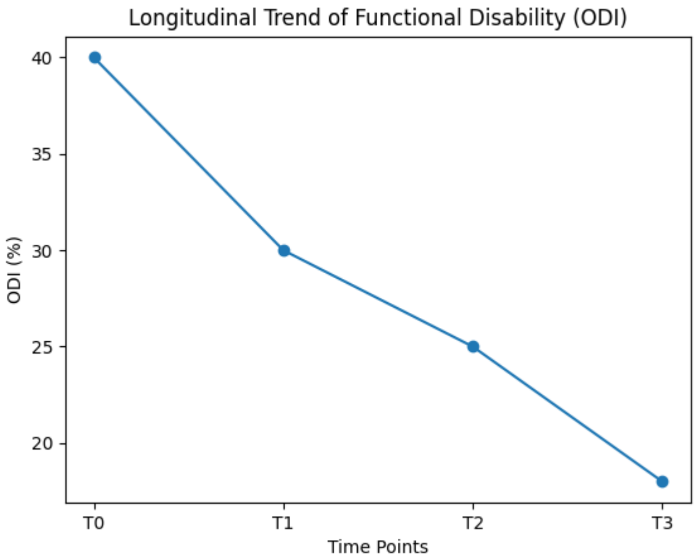

Figure 2. Longitudinal trend of functional disability measured by ODI across four time points

Discussion

This case report demonstrates clinically meaningful improvements in pain intensity and functional disability following a four-week multimodal physiotherapy intervention. The reduction in pain, as reflected by changes in the Numerical Rating Scale (NRS), and the improvement in functional status, as measured by the Oswestry Disability Index (ODI), exceeded commonly accepted minimal clinically important difference (MCID) thresholds, suggesting that the observed changes are not only measurable but also relevant from a clinical perspective.[14,16] However, given the single-case design, these findings should be interpreted with caution and not generalized beyond the individual patient context.

The observed reduction in pain may be explained by the combined effects of electrotherapy and manual therapy. Transcutaneous Electrical Nerve Stimulation (TENS) is believed to modulate nociceptive input through activation of descending inhibitory pathways and the gate control mechanism, thereby reducing pain perception.[9] In addition, Shortwave Diathermy (SWD) may contribute to pain relief through deep thermal effects that enhance tissue extensibility, increase local circulation, and reduce muscle spasm.[8] The integration of these modalities likely produces a complementary effect, where symptomatic relief facilitates patient participation in active rehabilitation.

Improvements in range of motion and muscle strength observed in this case are consistent with the role of therapeutic exercise in restoring musculoskeletal function. Core strengthening exercises, particularly those based on the William flexion approach, aim to reduce lumbar lordosis and improve segmental stability, which may decrease mechanical stress on affected nerve roots.[10] Enhanced neuromuscular control resulting from these exercises may also contribute to improved movement efficiency and reduced recurrence risk. Furthermore, neural mobilization techniques such as nerve gliding may improve neural tissue mobility and reduce mechanosensitivity, which is often implicated in radicular pain conditions.[1,11]

These findings are in line with previous studies indicating that multimodal physiotherapy approaches are more effective than single-modality interventions in managing sciatica.[6,7] A recent systematic review reported that combined conservative interventions may lead to improvements in pain and disability, although the quality of evidence remains variable.[6] Similarly, other studies have emphasized the importance of integrating passive and active interventions to address both symptom modulation and functional restoration.[6,7]

Despite these positive outcomes, several important considerations must be addressed. First, the natural history of sciatica is characterized by a tendency toward gradual improvement over time, even without intensive intervention.[4,5] Therefore, it is possible that part of the observed improvement reflects spontaneous recovery rather than a direct effect of the intervention. Second, placebo effects associated with electrotherapy modalities such as TENS cannot be excluded, particularly in the absence of a control condition. Third, measurement bias may have influenced the results, as some assessments, such as Manual Muscle Testing (MMT), rely on subjective clinical judgment and have limited sensitivity to small changes.

Additional methodological limitations include the lack of detailed intervention parameters, particularly for TENS and SWD, which limits reproducibility. The absence of standardized neurological assessment, including dermatomal mapping and reflex testing, also restricts the precision of clinical interpretation. Moreover, patient-reported experience and long-term follow-up data were not collected, making it difficult to assess the sustainability of the observed improvements. These limitations are inherent to single-case designs and highlight the need for cautious interpretation.

From a clinical perspective, this case underscores the potential value of a structured multimodal physiotherapy approach in the management of sciatica, particularly in outpatient settings. The combination of electrotherapy for pain modulation and exercise-based interventions for functional restoration appears to offer a pragmatic and accessible strategy. However, the findings should be considered hypothesis-generating rather than confirmatory.

Future research should focus on well-designed randomized controlled trials to evaluate the effectiveness of integrated physiotherapy protocols, with standardized intervention parameters, larger sample sizes, and longer follow-up periods. In addition, further investigation into the mechanisms underlying multimodal intervention effects, including central sensitization and neuromuscular adaptation, may provide deeper insight into optimizing treatment strategies.

Learning points from this case include the potential synergistic effect of combining passive and active physiotherapy interventions, the importance of incorporating exercise into rehabilitation programs, and the need for careful monitoring of clinical progression over time.

Conclusion

This case report suggests that a multimodal physiotherapy approach combining Transcutaneous Electrical Nerve Stimulation, Shortwave Diathermy, manual therapy, and core strengthening exercises may lead to clinically meaningful improvements in pain intensity and functional disability in a patient with sciatica. The observed changes exceeded established clinical thresholds, indicating potential relevance in practice. From a practical perspective, the integration of passive modalities for pain modulation and active exercise for functional restoration may represent a feasible strategy in outpatient physiotherapy settings. However, given the single-case design and short follow-up period, these findings should be interpreted as preliminary. Further research using controlled experimental designs with larger sample sizes, standardized intervention parameters, and longer follow-up durations is recommended to confirm the effectiveness and generalizability of this approach.

Author Contribution

Candra Arung Ariyani: Conceptualization, Investigation, Data curation, Formal analysis, Writing original draft, Writing review and editing.
Wahyu Tri Sudaryanto: Supervision, Methodology, Validation, Writing review and editing.
Yunita Nur Rochmah: Supervision, Validation, Project administration, Writing review and editing.

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Conflict of Interest Statement

The authors declare no conflict of interest.

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Ethics Statement

This case report was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Formal ethical clearance was not obtained as this study involved a single patient without experimental intervention. Written informed consent was obtained from the patient for participation and publication of anonymized clinical data.

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