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Multimodal Physiotherapy for Chronic Lumbar Disc Bulging: A CARE Case Report

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Abstract

Background: Chronic lumbar disc bulging can cause persistent pain, reduced lumbar mobility, muscle weakness, and functional limitations. Multimodal physiotherapy combining TENS, the McKenzie method, and ESWT may support pain relief and functional recovery.

Objective: To describe clinical outcomes following multimodal physiotherapy in a patient with chronic lumbar disc bulging.

Methods: A CARE compliant case report involved a 35-year-old man with L4 to L5 lumbar disc bulging confirmed by MRI. Six physiotherapy sessions over three weeks included TENS, progressive McKenzie exercises, posture correction, home exercises, and ESWT. Outcomes were assessed using NPRS, ODI, trunk ROM, MMT, and WMST.

Results: NPRS decreased from 6/10 to 3/10 and ODI from 16/50 to 9/50. Trunk flexion ROM increased from 30° to 80°, while lumbar mobility improved from 1.5 to 4.5 cm. Trunk muscle strength also improved, with no adverse events reported.

Conclusion: Multimodal physiotherapy was associated with improvements in pain, lumbar mobility, muscle strength, and functional capacity. Findings should be interpreted cautiously due to the single case design and absence of long term follow up.

Keywords

Low Back Pain; Intervertebral Disc Displacement; Transcutaneous Electric Nerve Stimulation; Extracorporeal Shockwave Therapy; McKenzie Method

Introduction

Low back pain (LBP) remains one of the leading causes of disability worldwide and substantially contributes to reduced quality of life, work absenteeism, and long-term functional limitations.[1] Chronic LBP is frequently associated with lumbar disc pathology, particularly lumbar disc bulging involving the L4–L5 and L5–S1 segments because these regions experience repetitive axial loading and biomechanical stress during daily activities.[2–4] Persistent lumbar disc bulging may contribute to nociceptive and radicular symptoms through mechanical compression, inflammatory processes, muscle guarding, and altered spinal biomechanics, thereby reducing lumbar mobility and functional performance.[5] Chronic symptoms are also associated with impaired neuromuscular control and decreased activation of trunk stabilizing musculature, which may perpetuate disability and movement dysfunction.[6]

Occupational and lifestyle factors play an important role in the progression of chronic lumbar disorders. Prolonged sitting posture, limited physical activity, repetitive static loading, and poor ergonomic habits are commonly associated with increased lumbar stress and reduced spinal movement variability.[4] In the present case, the patient worked as a pharmacy administrator with prolonged sitting exposure and limited physical activity, which may have contributed to chronic mechanical loading of the lumbar region and persistence of symptoms. Chronic low back pain may therefore involve not only structural pathology but also multifactorial biomechanical and functional impairments that require comprehensive rehabilitation approaches.[6]

Conservative physiotherapy remains the first-line management strategy for chronic lumbar disc disorders because it is non-invasive, relatively safe, and clinically effective for symptom management and functional restoration.[3] Among commonly used physiotherapy modalities, Transcutaneous Electrical Nerve Stimulation (TENS) is widely utilized for pain modulation through activation of large-diameter afferent fibers and endogenous opioid mechanisms based on the gate control theory.[7] Previous studies have demonstrated that TENS may reduce movement-related pain and improve exercise tolerance in patients with chronic low back pain.[8] In addition, the McKenzie method or Mechanical Diagnosis and Therapy (MDT) is frequently used to improve lumbar extension mechanics, reduce directional preference dysfunction, and promote symptom centralization through repeated lumbar loading exercises.[9] Systematic reviews have reported that McKenzie-based interventions may improve pain intensity, lumbar mobility, and functional disability in chronic mechanical low back pain and lumbar radiculopathy.[10,11]

Extracorporeal Shock Wave Therapy (ESWT) has recently emerged as a modern physiotherapy modality for musculoskeletal rehabilitation. ESWT delivers acoustic waves that may stimulate neovascularization, tissue remodeling, modulation of inflammatory mediators, and reduction of nociceptive substance P activity within painful tissues.[12] Experimental and clinical evidence also suggests that ESWT may improve tissue healing, decrease myofascial trigger point sensitivity, and facilitate movement recovery in chronic musculoskeletal disorders, including chronic low back pain and lumbar radiculopathy.[13,14] These neurophysiological and regenerative mechanisms may support the integration of ESWT with active rehabilitation programs to optimize pain reduction and functional recovery.

Despite increasing evidence supporting TENS, the McKenzie method, and ESWT individually, evidence describing their integrated application within a structured multimodal rehabilitation protocol for chronic lumbar disc bulging remains limited. Previous studies frequently evaluated these modalities separately and primarily focused on short-term pain reduction without comprehensive assessment of lumbar mobility, muscle strength, and functional disability.[12,15] In addition, several reports lacked sufficiently detailed

intervention parameters and rehabilitation progression, thereby limiting reproducibility and clinical applicability in outpatient physiotherapy settings.[16] Current literature also demonstrates limited discussion regarding the potential synergistic interaction between pain modulation, tissue recovery, directional mechanical loading, and functional rehabilitation during chronic lumbar management.[12–14]

This clinical gap is important because chronic lumbar disc bulging commonly presents with multidimensional impairments involving pain sensitization, mobility restriction, muscular dysfunction, reduced occupational tolerance, and limitations in daily functional activities simultaneously. Therefore, integrating electrotherapy, directional exercise therapy, posture correction, home exercise programs, and acoustic-wave intervention may provide complementary therapeutic effects that facilitate pain reduction, improve movement tolerance, restore spinal biomechanics, and support progressive functional recovery.[12,17,18]

Accordingly, this CARE-compliant case report aimed to describe the clinical outcomes of a multimodal physiotherapy rehabilitation program integrating TENS, the McKenzie method, and ESWT in a patient with chronic lumbar disc bulging. Clinical outcomes were evaluated using pain intensity, lumbar mobility, trunk muscle strength, range of motion, and functional disability measurements following a structured three-week rehabilitation program.

Methods

This study used a CARE-compliant single-patient case report design to describe the clinical outcomes of a multimodal physiotherapy rehabilitation program in a patient with chronic lumbar disc bulging. Case reports remain valuable for documenting rehabilitation progression, clinical decision-making, and therapeutic responses in musculoskeletal physiotherapy practice, particularly when integrated multimodal interventions are applied in real-world outpatient settings.[16,19] The study was conducted at the Physiotherapy Outpatient Clinic of Dr. Moewardi General Hospital, Surakarta, Indonesia, during October 2025.

The patient was a 35-year-old male working as a pharmacy administrator with prolonged occupational sitting exposure and limited daily physical activity. The patient reported gradual onset of low back pain approximately four years before physiotherapy referral, with worsening symptoms during the previous three months before intervention. Pain was aggravated during prolonged sitting, standing, bending, and walking activities. Lifestyle assessment revealed limited recreational exercise participation and prolonged static sitting posture during occupational activities. Body mass index was 25.1 kg/m², indicating mild overweight status that may have contributed to increased lumbar mechanical loading.[20]

Magnetic resonance imaging (MRI) performed before physiotherapy referral demonstrated L4–L5 lumbar disc bulging accompanied by mild lumbar stenosis and facet joint arthropathy without evidence of severe nerve root compression or spinal instability. Based on clinical presentation and imaging findings, the primary diagnosis was chronic lumbar disc bulging with associated radicular symptoms. Mild lumbar stenosis was considered a secondary radiological finding rather than the principal diagnosis to maintain diagnostic consistency throughout the manuscript.

During physical examination, tenderness and muscle tightness were identified within the paralumbar, gluteal, and gastrocnemius musculature, predominantly on the right side. Mild antalgic gait was also observed during ambulation assessment. Neurological examination demonstrated no bowel or bladder dysfunction, saddle anesthesia, or progressive neurological deficit. Sensory examination revealed mild radiating discomfort without significant dermatomal sensory loss. Deep tendon reflexes were symmetrical, and Straight Leg Raise testing provoked mild posterior thigh discomfort at approximately 60°. Differential diagnoses including lumbar fracture, malignancy, inflammatory spinal disease, severe lumbar instability, and advanced spondylolisthesis were excluded through clinical examination, medical history review, and imaging findings.

The patient had previously received pharmacological management prescribed by a neurologist consisting of paracetamol 500 mg, ibuprofen 200 mg, gabapentin 300 mg, amitriptyline 25 mg, tizanidine, icobal 500 mg, lansoprazole 30 mg, and sucralfate suspension. No additional physiotherapy, chiropractic manipulation, or alternative rehabilitation program was performed during the intervention period. Pharmacological therapy was maintained throughout the rehabilitation program and was therefore considered a potential co-intervention factor during interpretation of treatment outcomes.

Patient selection followed CARE case-report principles rather than purposive sampling. Inclusion criteria consisted of chronic low back pain lasting more than 12 weeks, confirmed lumbar disc bulging accompanied by radicular symptoms, Numerical Pain Rating Scale (NPRS) score greater than 4/10, lumbar muscle tightness, and willingness to complete the rehabilitation program. Exclusion criteria included spinal trauma, previous lumbar surgery, severe spondylolisthesis, malignancy, coagulation disorders, rheumatologic disease, uncontrolled metabolic disorders, and severe neurological impairment.

The rehabilitation program consisted of six physiotherapy sessions administered twice weekly over three weeks. The intervention integrated Transcutaneous Electrical Nerve Stimulation (TENS), the McKenzie method, posture correction, home exercise education, and Extracorporeal Shock Wave Therapy (ESWT) within a progressive multimodal rehabilitation protocol aimed at reducing pain, improving lumbar mobility, restoring trunk muscle strength, and enhancing functional activity.

The clinical rehabilitation process is presented in Figure 1, beginning with baseline assessment and pain modulation using TENS, followed by ESWT, progressive McKenzie extension exercises, posture and ergonomic education, home exercise prescription, and serial symptom monitoring. Final evaluation was performed after the sixth session.

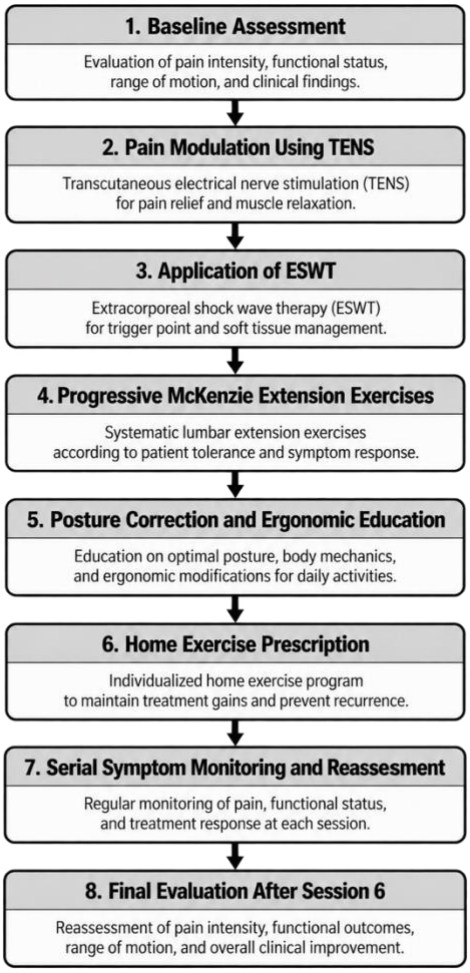

Figure 1. Clinical rehabilitation pathway for lumbar disc bulging management.

TENS was administered during Sessions 1–5 using conventional high-frequency stimulation before exercise therapy to improve pain tolerance during movement training. Electrical stimulation was delivered at a frequency of 80–100 Hz with pulse width of 100 µs for 20 minutes using two adhesive electrodes positioned bilaterally over the paralumbar region surrounding the painful segment. Intensity was adjusted according to patient tolerance until strong but comfortable paresthesia was achieved without visible muscle contraction.[7,8]

ESWT was administered during Sessions 1, 3, and 5 using radial shock wave therapy directed toward paralumbar and gluteal myofascial trigger points. Intervention parameters consisted of 2000 shock waves per session with frequency of 10 Hz, pressure intensity of 2–2.5 bar, and estimated energy flux density of approximately 0.10–0.16 mJ/mm² [21]. A radial applicator probe was used over the painful paralumbar and gluteal musculature with gradual progression according to patient tolerance. Initial treatment targeted generalized lumbar trigger points, whereas later sessions focused on residual muscle tightness and movement-related discomfort.[12–14]

The McKenzie method was progressively applied during all treatment sessions using repeated lumbar extension exercises based on directional preference principles. Initial sessions involved prone lying and prone-on-elbows positioning to facilitate adaptation to lumbar extension and reduce pain sensitivity. Subsequent sessions progressed toward prone press-up exercises, repeated extension in lying, and standing lumbar extension exercises. Each movement was performed for 10 repetitions across 2–3 sets with hold duration of approximately 3–5 seconds per repetition. Home exercise instruction, posture correction, ergonomic education, and activity modification strategies were also provided to improve adherence and support long-term self-management. Exercise progression was monitored according to symptom centralization, pain tolerance, movement quality, and patient compliance.[11,15,18]

Clinical outcomes were evaluated before the first session and after completion of the sixth session. Pain intensity was assessed using the NPRS, whereas functional disability was measured using the Oswestry Disability Index (ODI).[22] Lumbar range of motion was evaluated using a goniometer, trunk muscle strength was assessed using Manual Muscle Testing (MMT), and lumbar segmental mobility was measured using the Wolfson-modified Schober test (WMST).[23–25] These instruments were selected because of their established validity, reliability, and widespread application in musculoskeletal rehabilitation assessment.

To improve patient safety, all interventions were administered according to operational physiotherapy standards and adjusted to patient tolerance. Symptom monitoring was conducted during each session to identify excessive pain, fatigue, neurological worsening, or adverse reactions associated with ESWT and exercise therapy. No adverse events, neurological deterioration, or exercise intolerance were identified throughout the intervention period. Serial outcome monitoring demonstrated gradual symptom improvement across sessions. NPRS scores progressively decreased from 6/10 during baseline assessment to 5/10 after Session 2, 4/10 after Session 4, and 3/10 after Session 6.[26] The patient also reported progressive improvement in sitting tolerance, work-related comfort, and confidence during daily functional activities throughout rehabilitation.

This study received ethical approval from the Health Research Ethics Committee of the Faculty of Health Sciences, Universitas Muhammadiyah Surakarta (No. 2230/KEPK-FIK/V/2026). Written informed consent was obtained before participation, and all patient information was anonymized to maintain confidentiality and compliance with ethical research standards.

Results

The patient completed all six physiotherapy sessions over a three-week rehabilitation period without interruption or adverse events. Progressive improvements were observed in pain intensity, lumbar mobility, trunk muscle strength, and functional performance throughout the intervention period. Clinical outcomes demonstrated consistent recovery trends following the integration of Transcutaneous Electrical Nerve Stimulation (TENS), the McKenzie method, posture correction, home exercises, and Extracorporeal Shock Wave Therapy (ESWT). The clinical course from initial presentation and baseline assessment through six physiotherapy sessions and post-intervention outcomes is presented in Figure 1.

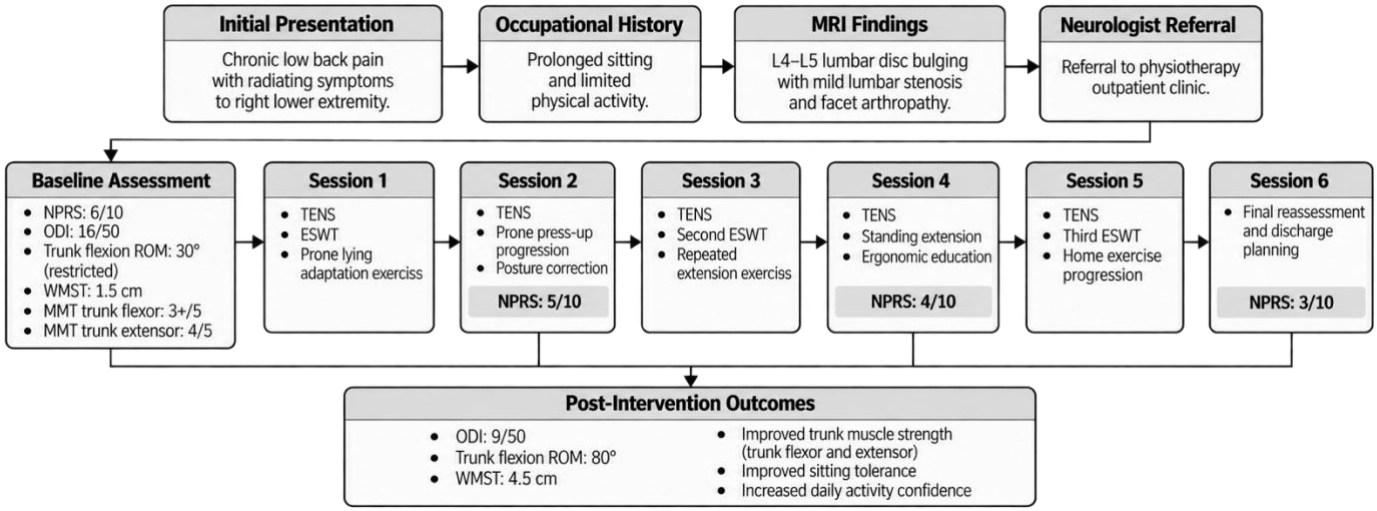

Figure 1. Clinical course and physiotherapy management of lumbar disc bulging.

Before presentation of post-intervention outcomes, baseline clinical findings are summarized in Table 1 to provide a clearer overview of the patient's initial impairments and functional limitations before rehabilitation.

Table 1. Baseline Clinical Findings

Outcome Measure	Baseline Findings
Numerical Pain Rating Scale (NPRS)	6/10 (moderate pain)
Oswestry Disability Index (ODI)	16/50 (moderate disability)
Trunk Flexor Strength (MMT)	3+/5
Trunk Extensor Strength (MMT)	4/5
Lumbar Flexion ROM	30°
Lumbar Extension ROM	30°
Lumbar Lateral Flexion ROM	50°
Wolfson-modified Schober test (WMST)	1.5 cm

At baseline, the patient demonstrated moderate pain intensity associated with functional limitations during prolonged sitting, standing, bending, and walking activities. Lumbar mobility was substantially restricted, particularly during trunk flexion, accompanied by decreased trunk muscle strength and mild antalgic movement patterns. Functional disability measured using the ODI indicated moderate disability affecting occupational activities and daily functional performance.

To facilitate interpretation of rehabilitation outcomes, comparative pre- and post-intervention findings are presented in Table 2. The table summarizes changes in pain intensity, lumbar mobility, trunk muscle strength, and functional disability after completion of the multimodal physiotherapy program.

Table 2. Changes in Clinical Outcomes Following Intervention

Outcome Measure	Pre-intervention	Post-intervention	Clinical Interpretation
NPRS	6/10	3/10	50% pain reduction
ODI	16/50	9/50	Moderate to minimal disability
Trunk Flexor Strength (MMT)	3+/5	4/5	Improved moderate resistance
Trunk Extensor Strength (MMT)	4/5	5/5	Restored normal strength
Lumbar Flexion ROM	30°	80°	Marked mobility improvement
Lumbar Extension ROM	30°	30°	No substantial change
Lumbar Lateral Flexion ROM	50°	50°	Maintained mobility
WMST	1.5 cm	4.5 cm	Increased lumbar mobility

Pain intensity measured using the NPRS decreased from 6/10 to 3/10, representing a 50% reduction and exceeding the reported Minimal Clinically Important Difference (MCID) threshold of approximately 2 points for chronic low back pain.[27] Functional disability measured using the ODI improved from 16/50 to 9/50, indicating transition from moderate disability to minimal disability and exceeding the reported MCID threshold of approximately 6–10 points for lumbar rehabilitation outcomes.[28]These findings suggest that the observed improvements were clinically meaningful rather than representing minor symptom fluctuation alone.

Objective functional outcomes also demonstrated progressive improvement following rehabilitation. Trunk flexion ROM increased substantially from 30° to 80°, indicating improved movement tolerance and lumbar flexibility during forward bending activities. In contrast, lumbar extension and lateral flexion demonstrated relatively stable values, suggesting that the intervention primarily improved movement restriction in trunk flexion rather than producing uniform changes across all planes of lumbar movement. Lumbar segmental mobility measured using the WMST improved from 1.5 cm to 4.5 cm, reflecting enhanced lumbar flexibility and spinal segmental motion.

Muscle strength assessment also demonstrated progressive recovery of trunk stabilizing musculature. Trunk flexor strength improved from 3+/5 to 4/5, whereas trunk extensor strength improved from 4/5 to 5/5, indicating restoration of normal resistance capacity during extension testing. Clinically, these improvements corresponded with reduced movement guarding, improved posture control, and better tolerance during occupational activities requiring prolonged sitting.

Serial observations during rehabilitation demonstrated gradual symptom centralization and improved confidence during exercise progression. Early treatment sessions primarily focused on pain modulation and adaptation to extension-based exercises, whereas later sessions emphasized functional integration, ergonomic correction, posture control, and self-management strategies. No worsening neurological symptoms, adverse effects, or post-treatment exacerbation were observed throughout the intervention period.

In addition to objective clinical improvements, the patient subjectively reported improved sitting tolerance, reduced fear of movement, and greater confidence during work-related and daily functional activities after completion of the rehabilitation program. The patient stated that prolonged sitting became “more comfortable and less painful” compared with the pre-intervention condition, suggesting improved functional participation and perceived quality of movement following rehabilitation.

Discussion

This CARE-compliant case report demonstrated clinically meaningful improvements in pain intensity, lumbar mobility, trunk muscle strength, and functional capacity following a three-week multimodal physiotherapy rehabilitation program integrating Transcutaneous Electrical Nerve Stimulation (TENS), the McKenzie method, posture correction, home exercises, and Extracorporeal Shock Wave Therapy (ESWT). Pain intensity measured using the Numerical Pain Rating Scale (NPRS) decreased from 6/10 to 3/10, exceeding the reported Minimal Clinically Important Difference (MCID) threshold for chronic low back pain.[29] Similarly, the Oswestry Disability Index (ODI) improved from 16/50 to 9/50, indicating transition from moderate disability to minimal disability and suggesting clinically meaningful functional recovery rather than isolated symptom reduction alone.[29]

The reduction in pain intensity observed in this study may be explained through complementary neurophysiological mechanisms associated with the multimodal rehabilitation approach. TENS is recognized for modulating nociceptive transmission through activation of large-diameter afferent fibers and endogenous opioid pathways based on the gate control theory.[7] Reduced pain sensitivity likely improved patient tolerance toward movement exposure and exercise participation during the early rehabilitation phase. Previous studies have demonstrated that TENS may facilitate exercise adherence and improve movement-related pain in patients with chronic lumbar disorders.[8,10] In the present case, early pain modulation appeared important for reducing movement guarding and facilitating progression toward active rehabilitation.

The McKenzie method also likely contributed substantially to improvement in lumbar mobility and symptom centralization. Mechanical Diagnosis and Therapy (MDT) emphasizes repeated directional loading exercises aimed at reducing mechanical derangement, restoring lumbar biomechanics, and improving movement efficiency.[9] Systematic reviews have reported that repeated lumbar extension exercises may improve pain intensity, functional disability, and spinal mobility in patients with chronic low back pain and lumbar radiculopathy.[10,11] In the present study, progressive transition from prone lying adaptation exercises toward standing lumbar extension exercises appeared to improve trunk flexion tolerance and movement confidence without provoking symptom exacerbation. The gradual reduction in NPRS scores during serial sessions also supports the role of progressive exercise exposure in facilitating functional recovery.

Improvement in lumbar flexibility and trunk muscle performance may additionally be associated with the therapeutic effects of ESWT. Extracorporeal Shock Wave Therapy has increasingly been investigated as a regenerative modality capable of stimulating neovascularization, tissue remodeling, modulation of inflammatory mediators, and reduction of nociceptive substance P activity within chronic musculoskeletal conditions.[12–14] Recent evidence also suggests that ESWT may improve tissue healing and reduce myofascial trigger point sensitivity in chronic low back pain and lumbar radiculopathy, thereby improving movement tolerance and facilitating active rehabilitation participation.[13,14] These mechanisms may explain the substantial improvement in trunk flexion ROM and Wolfson-modified Schober test (WMST) outcomes observed after intervention.

Interestingly, the most prominent mobility improvement occurred in trunk flexion rather than extension or lateral flexion. This finding suggests that the rehabilitation program primarily improved movement restriction and flexibility in previously painful movement patterns rather than producing uniform changes across all lumbar planes of motion. Reduced pain sensitivity, decreased muscle guarding, and improved confidence during forward bending activities may have contributed to restoration of functional trunk flexion capacity during occupational and daily activities.

The observed clinical improvements may also be interpreted using the International Classification of Functioning, Disability and Health (ICF) framework. At the body structure and function level, the intervention reduced pain intensity, improved lumbar mobility, and enhanced trunk muscle strength. These physiological improvements subsequently translated into better activity and participation domains, particularly prolonged sitting tolerance, occupational comfort, and daily functional performance. The patient’s subjective report regarding reduced fear of movement and improved work-related tolerance further supports the functional relevance of the rehabilitation outcomes.

Although the multimodal rehabilitation approach demonstrated favorable short-term outcomes, interpretation of these findings should remain cautious because this study involved only a single patient without a comparison group. Therefore, the present findings should not be interpreted as evidence that multimodal physiotherapy is superior to monotherapy or standard physiotherapy care. This clarification is important because overinterpretation and causal inference are common methodological limitations in single-case rehabilitation reports.[16,30] The current study instead provides descriptive clinical evidence regarding feasibility, safety, and short-term rehabilitation outcomes within an outpatient physiotherapy setting.

Another important consideration involves the possibility of natural recovery and co-intervention effects. Although the patient had experienced chronic symptoms for several years before rehabilitation initiation, spontaneous symptom fluctuation in chronic low back pain remains possible. In addition, the patient concurrently received analgesic, anti-inflammatory, anticonvulsant, and muscle relaxant medications prescribed by a neurologist throughout the intervention period. These pharmacological agents may have contributed partially to pain reduction and improved movement tolerance, thereby representing potential confounding factors during interpretation of treatment outcomes. Placebo responses and therapeutic interaction effects may also have influenced patient-reported improvement, particularly within repeated supervised rehabilitation sessions.[30]

Despite these limitations, the present study contributes clinically relevant information because it provides detailed rehabilitation progression, reproducible intervention parameters, serial symptom monitoring, and integrated functional assessment that are frequently absent in previous case reports involving chronic lumbar rehabilitation. Earlier studies commonly evaluated TENS,

McKenzie exercises, or ESWT separately and focused primarily on pain outcomes without comprehensive assessment of lumbar mobility, trunk muscle strength, functional disability, and patient perspective simultaneously.[11–15] The present report therefore expands existing literature by demonstrating the feasibility of integrating electrotherapy, directional exercise therapy, posture correction, ergonomic education, and acoustic-wave therapy within a structured outpatient rehabilitation program.

No adverse events, worsening neurological symptoms, or exercise intolerance were identified throughout the rehabilitation period, supporting the short-term safety of the intervention when administered progressively according to patient tolerance. Gradual exercise progression, interval-based ESWT administration, ergonomic education, and continuous symptom monitoring likely contributed to maintaining patient safety and rehabilitation adherence during treatment.

Nevertheless, several limitations should be acknowledged. The absence of long-term follow-up prevents evaluation of durability effects, recurrence prevention, and sustained functional improvement after discharge. Furthermore, findings derived from a single 35-year-old male patient cannot be generalized to broader populations with different ages, psychosocial factors, or severity of lumbar pathology. Future prospective studies and randomized controlled trials with larger sample sizes and extended follow-up periods are therefore recommended to further investigate the effectiveness, safety, and clinical applicability of multimodal physiotherapy protocols integrating TENS, the McKenzie method, and ESWT in patients with chronic lumbar disc disorders.

Conclusion

This CARE-compliant case report demonstrated that a multimodal physiotherapy rehabilitation program integrating Transcutaneous Electrical Nerve Stimulation (TENS), the McKenzie method, posture correction, home exercises, and Extracorporeal Shock Wave Therapy (ESWT) was associated with clinically meaningful improvements in pain intensity, lumbar mobility, trunk muscle strength, and functional capacity in a patient with chronic lumbar disc bulging. The intervention also contributed to reduced disability levels, improved movement tolerance, and better occupational sitting tolerance following a structured three-week rehabilitation program.

From a clinical perspective, the findings suggest that integrating electrotherapy, directional exercise therapy, ergonomic correction, and acoustic-wave intervention may provide a feasible and safe conservative rehabilitation strategy for patients with chronic lumbar disc bulging accompanied by functional limitations and radicular symptoms. Progressive symptom-guided rehabilitation may facilitate functional recovery and improve participation in occupational and daily activities.

However, these findings should be interpreted cautiously because of the single-case design, absence of long-term follow-up, and potential confounding influence of concurrent pharmacological therapy. Further prospective studies and randomized controlled trials with larger sample sizes, serial outcome monitoring, and extended follow-up periods are recommended to evaluate the long-term effectiveness, safety, and generalizability of multimodal physiotherapy protocols integrating TENS, the McKenzie method, and ESWT in chronic lumbar disc disorders.

Clinical Implications

The present case report highlights the potential clinical applicability of combining pain modulation, directional mechanical exercise, ergonomic correction, and regenerative physiotherapy modalities within an integrated outpatient rehabilitation protocol for chronic lumbar disc bulging. The structured progression of intervention parameters, symptom-guided exercise adaptation, and inclusion of self-management strategies may support individualized rehabilitation planning in musculoskeletal physiotherapy practice.

Study Limitations

Several limitations should be acknowledged when interpreting the present findings. First, the study involved only a single patient without a control or comparison group, thereby limiting causal interpretation and generalizability. Second, the absence of long-term follow-up prevented evaluation of durability effects and recurrence prevention after rehabilitation completion. Third, concurrent pharmacological therapy may have influenced pain reduction and functional improvement outcomes. Finally, serial quantitative assessment for all outcome variables at each treatment session was not available, limiting detailed evaluation of progressive recovery patterns during rehabilitation.

Author Contribution

Dipta Hiqmal Wirananta: Conceptualization, Methodology, Investigation, Data Curation, Formal Analysis, Writing Original Draft, Writing Review and Editing
Wahyuni: Conceptualization, Methodology, Supervision, Validation, Writing Review and Editing
Leo Muchamad Dahlan: Clinical Supervision, Investigation, Resources, Data Curation, Writing Review and Editing

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Conflict of Interest Statement

The authors declare that there are no conflicts of interest related to this study.

Funding Sources

This research received no external funding and was independently conducted by the authors.

Ethics Statement

This study received ethical approval from the Health Research Ethics Committee of the Faculty of Health Sciences, Universitas Muhammadiyah Surakarta, Indonesia (No. 2230/KEPK-FIK/V/2026). Written informed consent was obtained from the patient prior to participation and publication. All patient information was anonymized to ensure confidentiality and compliance with ethical research standards in accordance with the CARE guideline principles.

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