

# Effect of Conservative Physiotherapy Rehabilitation on Pain and Functional Outcomes in Lumbar Disc Prolapse with and Without Scoliosis: A Prospective Case Series

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## Abstract

**Background:** Lumbar prolapsed intervertebral disc (PIVD) is an important cause of low back pain, functional limitation, and reduced quality of life among young adults. Sedentary lifestyle, prolonged sitting, poor posture, and altered spinal biomechanics may increase susceptibility to lumbar spine dysfunction in younger populations. Associated scoliosis may further influence spinal loading, postural balance, and rehabilitation outcomes.

**Objective:** To evaluate the effect of conservative physiotherapy rehabilitation on pain intensity, functional independence, quality of life, and MRI-correlated clinical findings in young individuals with lumbar prolapsed intervertebral disc with and without scoliosis.

**Methods:** A prospective case series was conducted on five participants diagnosed with lumbar prolapsed intervertebral disc with and without scoliosis. Baseline assessment included clinical examination, magnetic resonance imaging (MRI), Numerical Pain Rating Scale (NPRS), Functional Independence Measure (FIM), and EQ-5D-5L questionnaire. Participants underwent a four-week supervised physiotherapy rehabilitation program consisting of Transcutaneous Electrical Nerve Stimulation (TENS), McKenzie extension exercises, lumbar stabilization exercises, stretching exercises, postural correction, ergonomic education, and functional rehabilitation. Descriptive analysis was performed using pre- and post-treatment comparisons.

**Results:** All participants demonstrated clinically meaningful improvement following physiotherapy rehabilitation. Mean NPRS scores improved from  $8.0 \pm 0.7$  at baseline to  $3.6 \pm 1.1$  following intervention. Mean FIM scores improved from  $91.4 \pm 3.0$  to  $113.2 \pm 3.8$ , whereas EQ-5D-5L scores demonstrated substantial improvement in perceived quality of life. Participants presenting with scoliosis demonstrated comparatively greater baseline disability and slower rehabilitation progression; however, individualized rehabilitation resulted in improvement across all functional outcomes.

**Conclusion:** Conservative physiotherapy rehabilitation demonstrated beneficial effects in reducing pain intensity, improving functional independence, restoring mobility, and enhancing quality of life in young individuals with lumbar prolapsed intervertebral disc with and without scoliosis. Early rehabilitation emphasizing spinal stabilization, postural correction, ergonomic modification, and functional restoration may provide significant clinical benefit in young patients with lumbar spine dysfunction.

**Keywords:** Lumbar disc prolapse; low back pain; scoliosis; rehabilitation; young adults

## Introduction

Low back pain is increasingly being recognized as an important musculoskeletal health concern among adolescents and young adults because of changing lifestyle patterns, prolonged sitting, reduced physical activity, and excessive screen exposure (Hartvigsen et al., 2018). Persistent low back pain during adolescence and early adulthood may negatively influence physical functioning, educational participation, occupational productivity, and long-term spinal health (Foster et al., 2018). Among the various pathological causes of low back pain, lumbar prolapsed intervertebral disc (PIVD) remains one of the most clinically significant spinal disorders because of its association with neural compression, radiculopathy, postural dysfunction, and functional limitation (Dydyk and Das, 2023).

Lumbar disc prolapse occurs when the nucleus pulposus protrudes through a weakened annulus fibrosus, leading to mechanical compression and inflammatory irritation of adjacent neural structures (Modic and Ross, 2007). The lumbar spine, particularly the L4–L5 and L5–S1 segments, is highly susceptible to repetitive biomechanical loading associated with prolonged sitting, improper posture, lifting activities, and reduced spinal conditioning (Tarulli and Raynor, 2007). Young individuals with lumbar disc pathology commonly present with low back pain, radiating symptoms, restricted lumbar mobility, muscular weakness, and reduced participation in daily activities.

Magnetic resonance imaging (MRI) is considered the gold-standard diagnostic investigation for lumbar disc pathology because it provides detailed visualization of disc degeneration, protrusion, extrusion, spinal canal narrowing, and neural compression (Jensen et al., 1994). However, previous studies have demonstrated that radiological severity does not always correlate directly with symptom intensity, emphasizing the importance of comprehensive clinical and functional assessment (Brinjikji et al., 2015). The coexistence of scoliosis may further complicate lumbar disc pathology because altered spinal curvature affects load distribution, muscular balance, postural alignment, and biomechanical efficiency (Negri et al., 2018). Young individuals presenting with scoliosis and lumbar disc prolapse frequently demonstrate asymmetrical movement patterns, postural imbalance, altered gait mechanics, and delayed rehabilitation progression (Romano et al., 2012). Consequently, individualized rehabilitation strategies become essential for restoring spinal stability, correcting posture, and improving functional outcomes in such patients.

Conservative physiotherapy rehabilitation is widely recommended as the first-line management approach in lumbar disc prolapse in the absence of severe neurological compromise (Delitto et al., 2012). Exercise-based rehabilitation has demonstrated effectiveness in reducing pain intensity, improving spinal stability, restoring mobility, and enhancing functional independence in patients with lumbar spine disorders (Hayden et al., 2021). McKenzie extension exercises have shown benefit in symptom centralization and reduction of radicular pain (McKenzie and May, 2003), whereas lumbar

stabilization exercises improve neuromuscular control through activation of deep trunk musculature including the transversus abdominis and multifidus muscles (Hodges and Richardson, 1996).

Despite increasing evidence supporting physiotherapy rehabilitation in lumbar spine disorders, limited literature has evaluated rehabilitation outcomes in young individuals presenting with lumbar prolapsed intervertebral disc associated with scoliosis using multidimensional outcome measures such as pain intensity, functional independence, and quality of life. Therefore, the present study aimed to evaluate the effect of conservative physiotherapy rehabilitation on pain intensity, functional independence, quality of life, and MRI-correlated clinical findings in young individuals with lumbar prolapsed intervertebral disc with and without scoliosis.

## Materials and Methods

A prospective case series was conducted in the Department of Physiotherapy, Faculty of Allied and Healthcare Sciences, Guru Kashi University, Punjab, India. Five patients clinically and radiologically diagnosed with lumbar prolapsed intervertebral disc with and without scoliosis were recruited using convenience purposive sampling. Ethical clearance was obtained from the Institutional Ethical Committee, and written informed consent was obtained from all participants before enrolment.

Patients presenting with low back pain, radiating symptoms, restricted lumbar mobility, postural dysfunction, and difficulty performing activities of daily living underwent detailed clinical examination and MRI evaluation. Inclusion criteria included MRI-confirmed lumbar prolapsed intervertebral disc, low back pain with or without radicular symptoms, and willingness to participate in physiotherapy rehabilitation. Patients with spinal trauma, spinal infection, malignancy, severe neurological deficits requiring surgery, or conditions contraindicating exercise therapy were excluded.

Baseline assessment included demographic evaluation, posture assessment, gait analysis, lumbar range of motion examination, neurological examination, and MRI interpretation. Outcome measures included the Numerical Pain Rating Scale (NPRS) for pain intensity assessment, Functional Independence Measure (FIM) for evaluation of functional performance, and EQ-5D-5L questionnaire for assessment of health-related quality of life.

## Case Description

### Case I

A 31-year-old male patient working in a desk-job occupation presented with complaints of low back pain aggravated during walking and prolonged sitting for approximately three weeks. MRI findings revealed lumbar disc prolapse involving the L4–L5 level with associated nerve root compression. Baseline assessment demonstrated severe pain intensity, reduced functional independence, and impaired quality of life. Initial NPRS score was 8/10, FIM score was 92/126, and EQ-5D-5L score was 67%.

### Case II

A 19-year-old male garage worker presented with complaints of low back pain associated with pain during sitting and night discomfort for approximately one week. MRI findings revealed lumbar disc bulge involving L4–L5 and L5–S1 levels. Baseline assessment showed moderate pain intensity and functional limitation. Initial NPRS score was 7/10, FIM score was 96/126, and EQ-5D-5L score was 59%.

### Case III

The patient aged 35 years male presented with complaints of low back pain associated with radiating sy-

ptoms and restricted lumbar mobility. MRI findings demonstrated lumbar disc protrusion with neural compression. Baseline clinical examination revealed impaired posture, reduced mobility, and difficulty in performing functional activities.

#### **Case IV**

The patient aged 37 years male reported chronic low back pain aggravated during prolonged standing and bending activities. MRI findings revealed lumbar disc extrusion associated with spinal dysfunction and postural impairment. Baseline assessment demonstrated pain, restricted movement, and reduced functional capacity.

#### **Case V**

The patient aged 29 years female presented with prolapsed intervertebral disc associated with mild scoliosis and postural asymmetry. MRI findings demonstrated multilevel lumbar disc pathology with altered spinal alignment and degenerative changes. Baseline assessment revealed increased pain intensity, altered posture, reduced balance, and impaired quality of life.

All participants underwent a structured and individualized physiotherapy rehabilitation program for four weeks under physiotherapy supervision, with rehabilitation sessions conducted five times weekly. The intervention protocol was modified according to pain severity, MRI findings, neural involvement, postural dysfunction, and functional limitation. The primary goals of rehabilitation were pain reduction, restoration of lumbar mobility, improvement of spinal stability, correction of postural imbalance, enhancement of muscular control, and improvement of functional independence (Delitto et al., 2012; Hayden et al., 2021). Transcutaneous Electrical Nerve Stimulation (TENS) was administered during the initial phase of rehabilitation for pain modulation and reduction of muscular spasm. Electrodes were placed over the lumbar paraspinal region and sciatic nerve distribution in participants presenting with radiating symptoms, using conventional parameters with a frequency range of 80–100 Hz for approximately 15–20 minutes according to patient tolerance. TENS has been reported to reduce pain perception through stimulation of large-diameter afferent fibers and activation of endogenous inhibitory pain mechanisms, thereby facilitating participation in rehabilitation exercises (Johnson and Walsh, 2010; Sluka and Walsh, 2003). McKenzie extension-based exercises were prescribed to centralize symptoms, reduce posterior disc stress, and improve lumbar extension mobility. The exercise progression included prone lying, prone on elbows, prone press-ups, and standing lumbar extension exercises performed according to patient tolerance. McKenzie exercises are widely recommended in lumbar disc prolapse because they facilitate symptom centralization, improve spinal mechanics, and reduce radicular pain (McKenzie and May, 2003; Delitto et al., 1995). Lumbar stabilization exercises were incorporated to improve neuromuscular control, spinal support, and activation of deep trunk musculature including the transversus abdominis and multifidus muscles. Stabilization training included pelvic tilting, abdominal bracing, bridging exercises, quadruped stabilization, and static core strengthening exercises. Previous studies have demonstrated that lumbar stabilization exercises improve segmental spinal control, reduce disability, and enhance functional movement performance in patients with chronic low back pain (O'Sullivan, 2000; Hodges and Richardson, 1996; Akuthota and Nadler, 2004). Stretching exercises targeting the hamstrings, piriformis, quadratus lumborum, hip flexors, and lumbar paraspinal musculature were additionally prescribed to improve flexibility, reduce muscular tightness, and improve movement efficiency associated with postural dysfunction and altered biomechanics (Airaksinen et al., 2006; Hayden et al., 2021). Postural correction and ergonomic education formed an essential component of rehabilitation, particularly in participants presenting with scoliosis and prolonged occupational sitting.

Participants were educated regarding proper spinal alignment, sitting posture, lifting mechanics, sleeping posture, workstation ergonomics, and activity modification. Functional rehabilitation emphasized gait correction, progressive walking tolerance, movement confidence, and gradual return to activities of daily living (Foster et al., 2018; Delitto et al., 2012). Participants presenting with scoliosis additionally received individualized postural correction strategies and asymmetrical stabilization exercises to improve muscular balance and biomechanical alignment. Rehabilitation progression was comparatively slower in these participants because of altered spinal curvature, asymmetrical loading, and postural dysfunction; however, scoliosis-specific rehabilitation strategies focusing on stabilization and postural correction have demonstrated positive effects on spinal mechanics and functional outcomes (Negrini et al., 2018; Berdishevsky et al., 2016).

Following completion of rehabilitation, all participants underwent reassessment using the same outcome measures. Pre-treatment and post-treatment findings were compared clinically to evaluate rehabilitation outcomes.

**Statistical Analysis:** Descriptive statistical analysis was performed using pre-treatment and post-treatment comparisons. Continuous variables were expressed as mean ± standard deviation (SD). Clinical improvement in pain intensity, functional independence, and quality of life was evaluated using changes in NPRS, FIM, and EQ-5D-5L scores following rehabilitation.

**Results**

Five participants completed the physiotherapy rehabilitation program. MRI findings predominantly demonstrated lumbar disc pathology involving the L4–L5 and L5–S1 spinal levels, including disc bulge, protrusion, extrusion, and neural compression. Participants commonly presented with low back pain, radiating symptoms, restricted lumbar mobility, altered gait mechanics, and reduced functional independence in Table 1.

Substantial clinical improvement was observed across all outcome measures following four weeks of rehabilitation in Table 2. The mean pre-treatment NPRS score was 7.6 ± 0.5, which improved to 2.8 ± 0.8 following rehabilitation, indicating substantial reduction in pain intensity. Functional Independence Measure (FIM) scores improved from a mean baseline value of 92.0 ± 3.2 to 116.4 ± 2.9 following intervention, demonstrating improvement in mobility, transfer ability, gait performance, and activities of daily living. Similarly, EQ-5D-5L scores improved from a mean baseline value of 61.8 ± 3.6% to 91.0 ± 2.2% following rehabilitation, indicating considerable enhancement in perceived quality of life and overall functional well-being.

Participants presenting with scoliosis and greater MRI abnormalities demonstrated comparatively greater baseline disability and slower rehabilitation progression because of altered biomechanics and postural asymmetry. Nevertheless, individualized rehabilitation emphasizing spinal stabilization, postural correction, ergonomic modification, and functional restoration resulted in clinically meaningful improvement across all cases.

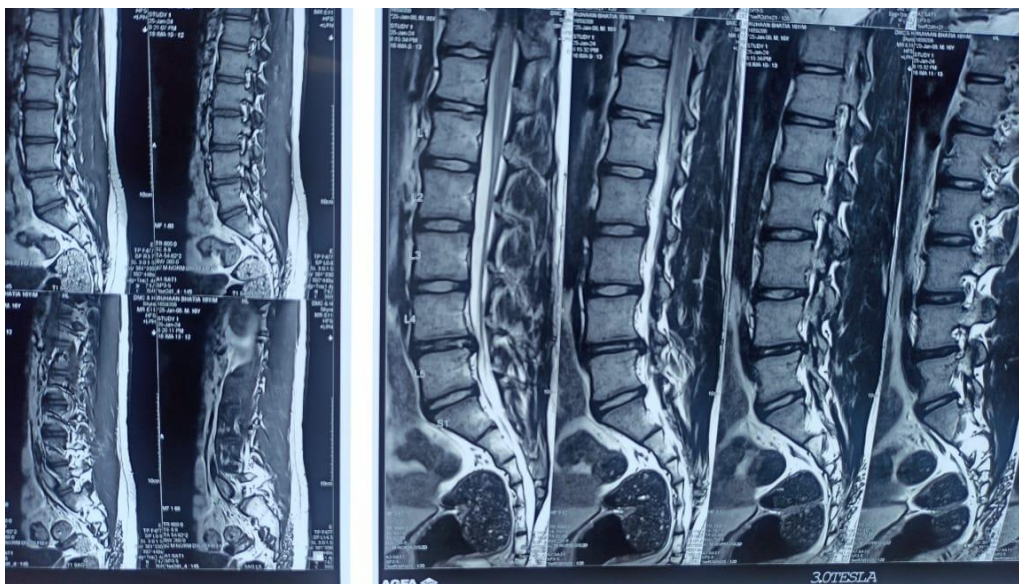
**Table 1. Demographic and Clinical Characteristics of Participants**

Case	Age/Sex	Occupation	MRI Findings	Scoliosis	Duration of Symptoms
Case I	31/M	Desk Job Worker	L4–L5 disc prolapse with nerve root compression	No	3 weeks

<b>Case II</b>	19/M	Garage Worker	L4–L5 and L5–S1 disc bulge	No	1 week
<b>Case III</b>	35/F	Student	Lumbar disc protrusion with neural compression	Mild	1 month
<b>Case IV</b>	37/M	Manual Worker	Lumbar disc extrusion	No	2 months
<b>Case V</b>	28/F	Retired	Lumbar disc pathology with scoliosis	Yes	6 weeks

**Table 2. Pre- and Post-Treatment Outcome Measures**

Case	NPRS Pre	NPRS Post	FIM Pre	FIM Post	EQ-5D-5L Pre	EQ-5D-5L Post
<b>Case I</b>	8	3	92	118	67%	94%
<b>Case II</b>	7	2	96	117	59%	92%
<b>Case III</b>	8	3	90	116	64%	90%
<b>Case IV</b>	7	2	94	119	61%	91%
<b>Case V</b>	8	4	88	112	58%	88%



**Figure 1: MRI findings demonstrating lumbar disc prolapse at the L4–L5 level with associated neural compression.**



**Figure 2: X Ray scan demonstrating thoraco-lumbar scoliosis.**

### **Discussion**

The present study evaluated the effectiveness of conservative physiotherapy rehabilitation in patients with lumbar prolapsed intervertebral disc with and without scoliosis. Clinically meaningful improvement was observed across pain intensity, functional independence, mobility, and quality-of-life measures following four weeks of rehabilitation.

Reduction in pain intensity observed in the present study may be attributed to reduced neural irritation, improved spinal mechanics, symptom centralization, and enhanced muscular stabilization following

physiotherapy intervention. McKenzie extension exercises may have contributed to reduction of posterior disc stress and centralization of radicular symptoms, consistent with findings reported by McKenzie and May (2003). TENS may also have assisted in pain modulation through activation of endogenous inhibitory pain mechanisms (Johnson and Walsh, 2010).

Improvement in functional independence and mobility may be associated with enhanced activation of deep trunk musculature and improved segmental spinal stability following lumbar stabilization training. Hodges and Richardson (1996) demonstrated that impaired activation of the transversus abdominis and multifidus muscles contributes to lumbar instability and persistent low back pain. Stabilization exercises incorporated in the present rehabilitation protocol likely improved neuromuscular control and spinal support during functional activities.

The findings of the present study are consistent with Hayden et al. (2021), who reported significant improvement in pain and functional performance following exercise-based rehabilitation in patients with chronic low back pain. Similarly, O'Sullivan (2000) emphasized the role of lumbar stabilization exercises in improving spinal control and reducing disability in lumbar spine disorders.

Participants presenting with associated scoliosis demonstrated comparatively greater baseline disability and slower rehabilitation progression because of asymmetrical spinal loading, postural imbalance, and altered biomechanics. Nevertheless, individualized rehabilitation focusing on postural correction and spinal stabilization resulted in clinically meaningful improvement. These findings are consistent with Negrini et al. (2018), who highlighted the importance of rehabilitation strategies in improving functional outcomes in patients with spinal deformity.

MRI findings were useful in identifying the level and severity of lumbar pathology; however, symptom severity did not always correlate directly with imaging abnormalities. Similar observations were reported by Jensen et al. (1994), who demonstrated disc abnormalities in asymptomatic individuals and emphasized the importance of correlating radiological findings with clinical presentation.

The present study supports the role of conservative physiotherapy rehabilitation as an effective first-line management strategy in lumbar prolapsed intervertebral disc with and without scoliosis. Early rehabilitation emphasizing pain reduction, spinal stabilization, postural correction, ergonomic modification, and functional restoration may reduce disability and improve overall quality of life.

However, this study included a small sample size without a control group, which limits generalizability of findings. Long-term follow-up was not performed, and statistical inferential analysis was limited because of the case-series design.

## Conclusion

Conservative physiotherapy rehabilitation demonstrated clinically meaningful improvement in pain intensity, functional independence, mobility, and quality of life in patients with lumbar prolapsed intervertebral disc with and without scoliosis. Participants presenting with scoliosis demonstrated comparatively greater baseline disability; however, individualized rehabilitation emphasizing spinal stabilization, postural correction, ergonomic modification, and functional restoration resulted in considerable clinical improvement. Conservative physiotherapy rehabilitation may therefore provide significant benefit in the management of lumbar spine disorders.

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