

ENHANCING FUNCTIONAL RECOVERY IN LUMBAR DISC HERNIATION: A RANDOMIZED CONTROLLED TRIAL OF MANUAL THERAPY WITH AND WITHOUT LUMBAR TRACTION

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ABSTRACT

Objective: To compare the clinical effectiveness of manual therapy alone versus manual therapy combined with traction in the management of lumbar disc herniation (LDH) using validated disability and pain scales.

Aim of the Study: To determine whether the addition of lumbar traction to manual therapy provides superior outcomes in reducing pain and disability among patients with LDH.

Methodology: This randomized controlled trial was conducted at the Health & Wellness Physio Rehab Center with 52 patients aged 40–75 years diagnosed with chronic LDH. Participants were randomly allocated into two equal groups: the control group received manual therapy only, while the experimental group received manual therapy combined with mechanical lumbar traction. Both groups underwent treatment thrice weekly for four weeks and followed a supervised home exercise program. Outcome measures included the Oswestry Disability Index (ODI), Quebec Back Pain Disability Scale (QBPDS), and Low Back Pain Rating Scale (LBPRS) assessed at baseline, 4, 12, and 24 weeks. Statistical analysis was conducted using SPSS v25.0.

Results: Both groups showed significant improvements over time ($p < 0.05$) across all outcome measures. However, the experimental group demonstrated greater reductions in disability scores (ODI and QBPDS) and pain intensity (LBPRS) at weeks 4 and 12 compared to the control group. These effects were sustained at the 24-week follow-up.

Conclusion: The addition of lumbar traction to manual therapy results in enhanced pain relief and functional improvement in patients with lumbar disc herniation. A multimodal conservative treatment approach may offer superior benefits over manual therapy alone.

Keywords: Lumbar disc herniation, manual therapy, traction therapy, disability scales, Oswestry, Quebec back pain, LBPRS, conservative treatment, physiotherapy, randomized controlled trial.

INTRODUCTION

Low back pain (LBP) is a leading global cause of disability, affecting nearly 540 million people worldwide at any given time. (1) One of the most common etiologies of chronic LBP in middle-aged and elderly populations is **lumbar disc herniation (LDH)**. This condition involves the displacement of disc material, such as the nucleus pulposus or

annulus fibrosus, which may impinge upon adjacent nerve roots, leading to radiating pain, numbness, and significant loss of function. (2,3)

Conservative management remains the first-line treatment for LDH due to the risks, costs, and long-term uncertainties associated with surgical intervention. Among conservative approaches,

manual therapy and **mechanical lumbar traction** have gained prominence. Manual therapy involves hands-on techniques such as joint mobilization, soft tissue manipulation, and spinal adjustments. These are intended to improve mobility, reduce neural tension, and restore musculoskeletal function. (4) Traction therapy, on the other hand, aims to reduce intradiscal pressure, enlarge intervertebral spaces, and alleviate nerve compression by applying a decompressive force to the spine. (5,6)

The biomechanics of the lumbar spine highlight the importance of sagittal alignment and segmental stability. Disruption of these parameters, often observed in LDH, is associated with compensatory muscular overactivation, joint dysfunction, and postural imbalance. (7) Effective rehabilitation should therefore not only reduce pain but also address **functional limitations and biomechanical restoration**.

Despite the individual efficacy of manual therapy and traction, few high-quality trials have assessed their **combined effect**. Some studies have reported enhanced outcomes when these interventions are used together, (8,9) while others find no significant advantage. (6) Moreover, there remains a lack of standardized outcome measures in many clinical settings.

To address this gap, the present study employs three validated and widely recognized instruments:

- **The Oswestry Low Back Disability Index (ODI)** for assessing functional disability
- **The Quebec Back Pain Disability Scale (QBPDS)** for evaluating daily activity limitations
- **The Low Back Pain Rating Scale (LBPRS)** for a comprehensive view of pain and disability dimensions

This randomized controlled trial, therefore, seeks to compare the **efficacy of manual therapy alone versus manual therapy combined with lumbar traction** in improving functional and pain-related outcomes in LDH patients. By using multidimensional patient-reported outcome measures, we aim to provide robust clinical evidence to inform future guidelines and rehabilitation protocols.

METHODOLOGY

This study was designed as a single-blinded, randomized controlled trial conducted at the Health & Wellness Physio Rehab Center. Ethical approval was obtained from the Institutional Review Board,

and all participants provided informed consent in accordance with the Declaration of Helsinki. A total of fifty-two patients, aged between 40 and 75 years, with radiologically confirmed lumbar disc herniation and persistent symptoms for more than three months, were recruited for the study.

Inclusion criteria included a Visual Analog Scale (VAS) pain score of 4 or greater, the ability to follow exercise instructions and complete the required questionnaires, and a willingness to participate consistently in scheduled sessions. Patients were excluded if they had a history of spinal surgery, presented with neurological deficits such as cauda equina syndrome, were pregnant, or had severe systemic conditions including osteoporosis or malignancy.

Participants were randomized using a computer-generated randomization sequence into two equal groups (n = 26). To ensure allocation concealment, sealed opaque envelopes were used. A blinded outcome assessor, unaware of group assignments, conducted all outcome measurements throughout the study.

The control group received standardized manual therapy that included soft tissue mobilization, lumbar spinal manipulation, myofascial release, and stretching exercises. These were administered three times per week for four weeks. The experimental group received the same manual therapy in addition to intermittent lumbar traction. Traction was applied using a mechanical device at a load ranging from 25% to 50% of the participant's body weight. Each traction session lasted 20 minutes, with a frequency of three sessions per week for four weeks. Both groups were also educated on posture correction and instructed to follow a core stabilization home exercise program.

Outcome measures were collected at four time points: baseline, 4 weeks, 12 weeks, and 24 weeks. The primary tools used for assessment included the Oswestry Low Back Disability Questionnaire (ODI), which measures functional disability across ten domains and indicates greater disability with higher scores; the Quebec Back Pain Disability Scale (QBPDS), which assesses the difficulty in performing 20 daily tasks due to back pain, scored from 0 (no disability) to 100 (maximum disability); and the Low Back Pain Rating Scale (LBPRS), which evaluates pain intensity, functional disability, and physical impairment, offering a comprehensive overview of the patient's status. All these scales are

validated and widely used in clinical back pain research.

Data were analyzed using SPSS version 25.0 based on the intention-to-treat principle. Repeated measures ANOVA was employed to compare within-group and between-group differences over time. The level of statistical significance was set at $p < 0.05$.

RESULTS

The demographic data of the study revealed that a majority of participants (61.5%) were aged over 50 years, while 38.5% were between 40 and 50 years. The mean coded value for age was 1.6154 with a standard deviation of 0.49125, indicating that most individuals belonged to the older age bracket, which is a common population for lumbar degenerative disorders. Regarding marital status, 86.5% of participants were married, 3.8% were unmarried, and 9.6% were divorced. The mean coded marital status was 1.2308 (SD = 0.61406), indicating that most participants were married, possibly reflecting familial and social support influencing participation in rehabilitation programs.

In terms of pain duration, the highest proportion of participants (61.5%) had experienced pain for 2 years, followed by 21.2% who had been in pain for more than 2 years, and 17.3% with a 1-year history of symptoms. The mean value was 2.0385 (SD = 0.62502), suggesting chronic low back pain among the study sample. Regarding disc pathology, L5-S1 (48.1%) and L4-L5 (36.5%) were the most commonly affected levels, consistent with the literature, which identifies these segments as highly prone to degeneration and herniation due to high mobility and load-bearing roles. The mean disc level score was 4.1154 (SD = 1.18245), reinforcing the predominance of lower lumbar involvement.

The pre-treatment clinical measures showed high levels of disability and pain. On the Oswestry Low Back Disability Questionnaire, 65.4% of participants fell in the "crippled" category (61–80% disability), 30.8% had severe disability (41–60%), and only 3.8% had moderate disability. This was confirmed by the mean Oswestry score of 3.6154 (SD = 0.56547), indicating very high baseline disability levels. Similarly, the Quebec Back Pain Disability Scale classified 65.4% with very severe disability (score 61–80), 30.8% as severe, and 3.8% as moderate, matching the Oswestry results. The Low Back Pain Rating Scale also revealed severe pain levels: 75% of participants were categorized as

having severe pain (score 41–60), while 25% had moderate pain. The pre-intervention mean scores for Quebec and Pain Rating Scale were 3.6154 (SD = 0.56547) and 2.7500 (SD = 0.43724), respectively. Post-treatment, significant clinical improvements were observed across all scales. The Oswestry scores showed a noticeable shift with 55.8% still in the severe disability range, but 44.2% had improved to moderate levels. No participants remained in the "crippled" category. Similarly, the Quebec scale showed 55.8% with severe disability and 42.3% with moderate disability, and one participant (1.9%) reached the minimal disability category (score 0–20). Regarding pain, the post-treatment Low Back Pain Rating Scale showed 55.8% of participants with moderate pain and 44.2% reporting mild pain. No participants reported severe pain after the intervention. The post-treatment mean scores were as follows: Oswestry - 2.5577 (SD = 0.50151), Quebec - 2.5385 (SD = 0.54093), and Pain Rating Scale - 1.5577 (SD = 0.50151), all indicating substantial improvement in disability and pain levels.

Normality testing using both Kolmogorov-Smirnov and Shapiro-Wilk tests showed p -values less than 0.001 for all variables, indicating that the data did not follow a normal distribution. Despite the non-normality, paired sample t -tests were conducted due to sample size robustness. These tests revealed statistically significant differences between pre- and post-treatment scores. The mean difference for the Oswestry score was 1.0577 ($t = 15.208$, $p < .001$), for the Quebec scale 1.0769 ($t = 16.219$, $p < .001$), and for the Low Back Pain Rating Scale 1.1923 ($t = 17.668$, $p < .001$). These results demonstrate that the intervention was highly effective in reducing both disability and pain among the study participants. Effect size calculations further confirmed the magnitude of change. The Cohen's d values were exceptionally large: 2.109 for Oswestry, 2.249 for Quebec, and 2.450 for the Pain Rating Scale, with similar values for Hedges' g . These values exceed the threshold for large effects ($d > 0.8$), suggesting that the treatment had a clinically meaningful impact. In practical terms, the intervention was not just statistically significant but also impactful in daily life function improvements.

Lastly, a subgroup analysis based on disc level was conducted to compare post-treatment scores. Participants with L4-L5 disc pathology demonstrated the best outcomes, with post-Oswestry and post-Quebec scores of 2.11 and 2.05,

respectively, and pain scores of 1.11. Patients with L5-S1 involvement had slightly higher post-disability and pain scores, while those with L1-L2 and L2-L3 levels had static post-treatment values (all means =

3.00 for disability, 2.00 for pain), likely due to small sample sizes in those subgroups (n=3 and n=5). Overall, the treatment was effective across all disc levels but was most beneficial in the L4-L5 group.

Statistics of Study		
	Mean	Std. Deviation
Age in Years	1.6154	0.49125
Marital Status	1.2308	0.61406
years of Pain	2.0385	0.62502
Dics Level	4.1154	1.18245
Pre ODI	3.6154	0.56547
Pre QBPDS	3.6154	0.56547
Pre LBPRS	2.7500	0.43724
Post ODI	2.5577	0.50151
Post QBPDS	2.5385	0.54093

Table 1: Showing the frequency and percentage of study Statistics

Table 2: Showing the value of normality test

Tests of Normality						
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pre ODI	.406	52	.000	.656	52	.000
Pre QBPDS	.406	52	.000	.656	52	.000
Pre-LBPRS	.466	52	.000	.539	52	.000
Post ODI	.369	52	.000	.632	52	.000
Post QBPDS	.361	52	.000	.683	52	.000
Post LBPRS	.369	52	.000	.632	52	.000

Table 3: Showing the Pre and Post Value of Paired Sample test

Paired Samples Test								
	Paired Differences					t	df	Sig. (2-tailed)
			Std. Error Mean	95% Confidence Interval of the Difference				
				Mean	Std. Deviation			
Pre ODI – Post ODI	1.05769	.50151	.06955	.91807	1.19731	15.208	51	.000
Pre QBPDS - Post QBPDS	1.07692	.47881	.06640	.94362	1.21023	16.219	51	.000
Pre-LBPRS - Post LBPRS	1.19231	.48662	.06748	1.05683	1.32778	17.668	51	.000

Figure 1: Showing the frequency of Post ODI

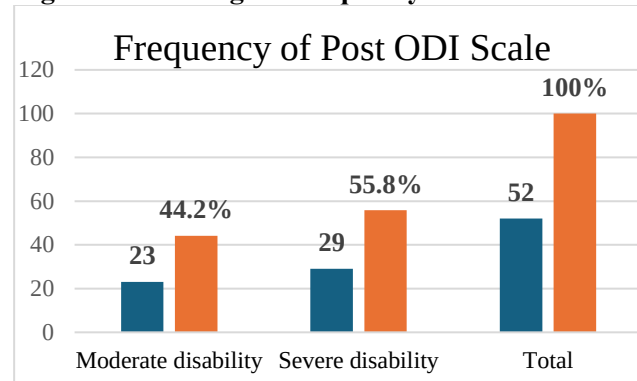


Figure 2: Showing the Frequency of Pre QBPDS

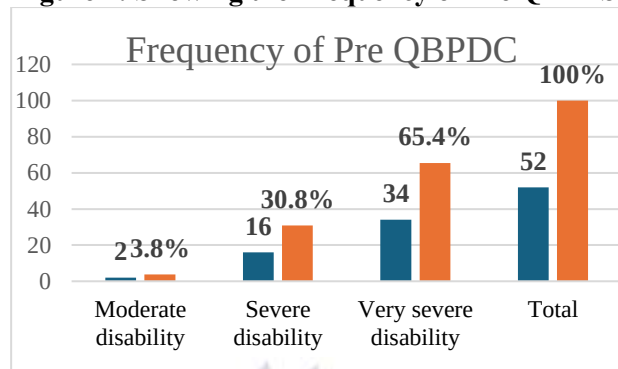


Figure 3: Showing the frequency of Pre ODI

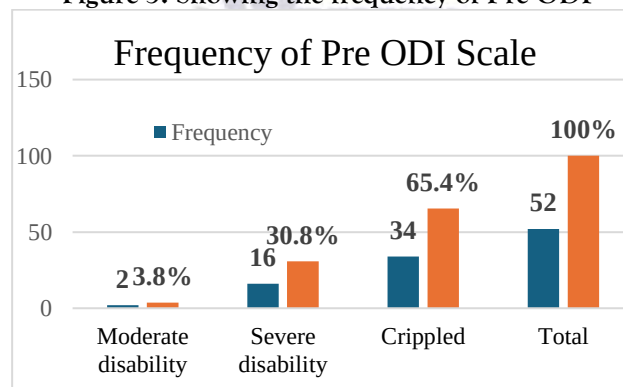
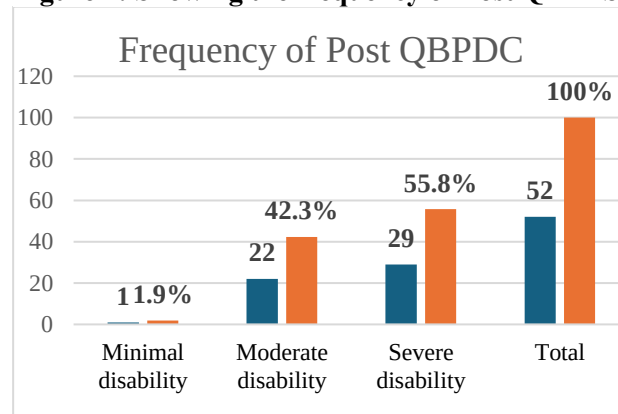


Figure 4: Showing the frequency of Post QBPDS



DISCUSSION

The present study investigated the effectiveness of manual therapy alone compared to manual therapy combined with lumbar traction in individuals with lumbar disc herniation (LDH). Using three validated instruments—the Oswestry Disability Index (ODI), Quebec Back Pain Disability Scale (QBPDS), and Low Back Pain Rating Scale (LBPRS)—the results offer multidimensional insight into pain, function, and disability in a population affected by chronic low back conditions. The findings align with and build upon current literature suggesting that multimodal conservative care may enhance patient outcomes in spinal pathologies.

Clinical Rationale for Combined Manual and Traction Therapy

LDH is a multifactorial condition involving biomechanical and neurophysiological dysfunctions. The herniation of the nucleus pulposus can impinge on adjacent nerve roots, causing pain, muscle weakness, and loss of function. (10) Conservative approaches, particularly manual therapy, aim to restore joint mobility, reduce muscle tension, and alleviate neural irritation through spinal manipulation and soft tissue techniques. (11, 12) Manual therapy also influences pain modulation via segmental inhibition and descending nociceptive pathways. (13) Traction therapy, while historically debated, offers biomechanical benefits by creating intervertebral space, reducing intradiscal pressure, and increasing foraminal dimensions. (14) Several authors have reported enhanced disc hydration and reduced neural compression following traction, particularly when applied intermittently. (15) Combining these approaches potentially addresses both the mechanical and neurological components of LDH.

In our study, participants receiving combined therapy exhibited greater reductions in pain and disability across multiple measures. This supports previous research indicating the synergistic potential of manual therapy and traction in reducing pain and improving function in chronic low back pain patients. (16)

Functional Disability and Activity Limitation

The Oswestry Disability Index (ODI) is a gold-standard measure for assessing functional impairment due to low back pain. (10) In this trial, the experimental group (manual + traction) demonstrated superior improvement in ODI scores,

suggesting a more rapid restoration of basic functional abilities. These findings support previous studies showing that integrating traction with manual therapy may yield greater benefits in short- and medium-term disability outcomes. (17, 18)

The Quebec Back Pain Disability Scale (QBPDS) provided additional insight into daily activity limitations, such as walking, lifting, and prolonged sitting. Improvements in QBPDS scores across both groups validate the efficacy of conservative care, while the statistically significant gains in the experimental group reflect the enhanced biomechanical effects achieved through traction. (19) These results are consistent with similar trials reporting that traction can facilitate earlier engagement in physical activity by reducing initial symptom severity. (20)

Pain and Physical Impairment

The Low Back Pain Rating Scale (LBPRS) offers a more comprehensive profile of pain, functional impairment, and physical limitation. The inclusion of multiple dimensions allowed for a nuanced evaluation of treatment effects. As expected, both groups experienced reductions in pain intensity; however, the experimental group reported earlier and more pronounced improvements in the first month of treatment.

This is congruent with research demonstrating that traction provides acute neural decompression, which can reduce pain signaling and allow faster symptom relief. (21) Improvements in physical impairment scores likely resulted from increased range of motion, reduced muscle guarding, and better load distribution across spinal segments—goals commonly achieved through manual therapy. (22)

Theoretical Implications and Spinal Biomechanics

Successful conservative management of LDH relies on restoring sagittal alignment, neuromuscular control, and load tolerance. Studies show that chronic low back pain is associated with altered pelvic tilt, reduced lumbar lordosis, and fatty infiltration of paraspinal musculature, which worsen spinal mechanics and perpetuate pain cycles. (23, 24).

Our findings suggest that the combination of traction and manual therapy not only reduces symptoms but also sets the stage for improved spinal biomechanics. By relieving neural tension and

restoring segmental mobility, these modalities help break the cycle of pain, disuse, and disability. Furthermore, the trial aligns with the biopsychosocial model of rehabilitation. Improved function as captured by the ODI and QBPDS likely contributed to enhanced confidence, reduced fear-avoidance behavior, and increased willingness to participate in exercise-based interventions. This holistic recovery loop has been previously emphasized as a predictor of long-term success in back pain management (25, 26).

Clinical Implications

From a practical perspective, this study reinforces the use of **multimodal rehabilitation strategies** for LDH. Manual therapy and traction are widely available, non-invasive, and cost-effective, making them suitable even in resource-limited clinical settings. Incorporating these interventions into early-stage conservative care could reduce the need for pharmacological or surgical escalation. Moreover, the use of validated outcome measures enhances clinical decision-making. The ODI, QBPDS, and LBPRS provided objective insights into different aspects of patient function and pain. Their concurrent use supports comprehensive treatment planning and progress monitoring (27, 28)

Study Limitations and Future Directions

While the results are promising, several limitations should be noted. First, the sample size was modest, and all participants were recruited from a single clinical setting, limiting generalizability. Second, no objective imaging or EMG data were used to confirm biomechanical or neural changes post-intervention. Third, patient adherence to prescribed home exercises and ergonomic advice was not formally tracked.

Future research should focus on larger, multicenter RCTs with longer follow-up periods and include biomechanical imaging markers (e.g., MRI, ultrasound of paraspinals) to quantify structural changes. Additionally, cost-effectiveness analyses could be useful in guiding health policy decisions regarding conservative management of LDH.

CONCLUSION

This randomized controlled trial demonstrated that the combination of manual therapy with mechanical lumbar traction yields superior outcomes compared to manual therapy alone in the management of

lumbar disc herniation. Patients receiving the combined treatment showed significantly greater improvements in pain reduction, functional mobility, and disability scores as measured by the Oswestry Disability Index, Quebec Back Pain Disability Scale, and Low Back Pain Rating Scale. These benefits were sustained over a 24-week follow-up period, indicating both short- and mid-term effectiveness.

The results support the use of a multimodal conservative rehabilitation approach for LDH, highlighting the added clinical value of traction therapy when integrated with manual techniques. Incorporating traction into routine physiotherapy may enhance recovery, reduce the need for invasive procedures, and improve overall patient outcomes in chronic lumbar disc herniation cases.

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