

# Comparative Effectiveness Of Spinal Manipulation And Exercise Therapy In Mechanical Low Back Pain: A Narrative Review

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## Abstract

**Background:** Mechanical low back pain (MLBP) is one of the most prevalent musculoskeletal disorders and a major contributor to disability worldwide. It commonly results from biomechanical dysfunction involving spinal structures such as muscles, ligaments, and intervertebral joints. Among conservative management strategies, spinal manipulation therapy (SMT) and exercise therapy (ET) are frequently used interventions in physiotherapy practice, yet their comparative effectiveness remains a topic of ongoing research.

**Objective:** To compare the effectiveness of spinal manipulation therapy and exercise therapy in reducing pain, improving functional outcomes, and preventing recurrence in individuals with mechanical low back pain.

**Materials and Methods:** A narrative review of literature was conducted using databases including PubMed, Google Scholar, PEDro, and Cochrane Library. Studies published between 2000 and 2024, including randomized controlled trials, systematic reviews, and meta-analyses, were included. Keywords such as “mechanical low back pain,” “spinal manipulation,” and “exercise therapy” were used. Relevant articles were screened and analyzed based on study design, interventions, and outcomes.

**Results:** The reviewed evidence suggests that spinal manipulation therapy provides significant short-term pain relief, particularly in acute and subacute cases. In contrast, exercise therapy demonstrates superior long-term benefits, including improved functional capacity, spinal stability, and reduced recurrence rates. Several studies also indicate that a combined approach of SMT and ET yields better clinical outcomes than either intervention alone.

**Conclusion:** Both spinal manipulation and exercise therapy are effective in managing mechanical low back pain; however, exercise therapy shows greater long-term benefits. A multimodal treatment approach is recommended for optimal patient outcomes.

**Keywords:** Mechanical low back pain, spinal manipulation therapy, exercise therapy, physiotherapy, rehabilitation, manual therapy.

## Introduction

Mechanical low back pain (MLBP) is one of the most prevalent, disabling, and clinically significant musculoskeletal conditions affecting the spine, with substantial implications for individuals, healthcare systems, and society at large. It is estimated that nearly 60–80% of individuals experience low back pain at some point in their lifetime, with mechanical causes accounting for approximately 85–90% of all cases [1,2]. MLBP typically arises from dysfunction of spinal structures such as muscles, ligaments, intervertebral discs, and facet joints, rather than specific pathological conditions like infection, tumor, or fracture [3,4]. The condition is commonly associated with biomechanical stress, poor posture, sedentary behavior, occupational strain, and reduced physical activity levels [5,6].

The global burden of low back pain has increased significantly over the past decades, making it one of the leading causes of years lived with disability (YLDs) worldwide [1,7]. It affects individuals across all age groups but is particularly prevalent among working-age adults, leading to reduced productivity, absenteeism, and increased healthcare expenditure [8]. In addition to physical impairment, MLBP is often associated with psychological factors such as fear-avoidance behavior, anxiety, and depression, which further contribute to chronicity and functional limitations [9].

The pathophysiology of mechanical low back pain is multifactorial and involves a complex interplay of biomechanical, neuromuscular, and neurophysiological factors. Repetitive stress, muscle imbalance, joint hypomobility, and impaired motor control can lead to altered spinal mechanics, inflammation, and pain perception [10,11]. Over time, these changes may result in decreased mobility, muscle weakness, and reduced functional capacity, potentially progressing to chronic pain if not appropriately managed [12].

Conservative management remains the first-line approach for MLBP, with physiotherapy interventions playing a central role in treatment [13,14]. Among the various non-pharmacological strategies, spinal manipulation therapy (SMT) and exercise therapy (ET) are widely recognized and commonly utilized due to their effectiveness in reducing pain and improving function [15,16].

Spinal manipulation therapy is a manual therapy technique that involves high-velocity, low-amplitude thrusts applied to spinal joints. It aims to restore joint mobility, reduce pain, and modulate neuromuscular function through mechanical and neurophysiological mechanisms [17,18]. SMT has been shown to stimulate mechanoreceptors, inhibit nociceptive input, and produce reflex muscle relaxation, thereby contributing to pain relief and improved movement [19]. It is particularly indicated in patients with acute or subacute low back pain and segmental hypomobility [20]. Several studies have reported that SMT provides rapid short-term pain relief and functional improvement, making it a valuable intervention in the early stages of MLBP [21,22].

Exercise therapy, in contrast, is an active intervention that focuses on improving muscular strength, flexibility, endurance, and coordination through structured physical activity programs [23]. It includes a wide range of approaches such as core stabilization exercises, McKenzie method, strengthening exercises, stretching, and aerobic conditioning [24,25]. Exercise therapy aims to restore normal movement patterns, enhance spinal stability, and prevent recurrence of pain by addressing underlying biomechanical deficits [26]. Strong evidence supports the effectiveness of exercise therapy in improving long-term outcomes, reducing disability, and preventing recurrence in patients with chronic low back pain [27,28].

Despite the widespread use of both SMT and ET, there remains ongoing debate regarding their comparative effectiveness. Some studies suggest that spinal manipulation offers faster pain relief due to its immediate neurophysiological effects, while exercise therapy provides more sustained benefits by addressing the root causes of dysfunction [29,30]. Randomized controlled trials have demonstrated that SMT may be more effective in the short term, particularly for pain reduction, whereas exercise therapy shows superior outcomes in terms of long-term function and recurrence prevention [31,32].

Furthermore, emerging evidence suggests that a combined approach integrating both spinal manipulation and exercise therapy may yield superior outcomes compared to either intervention alone [33,34]. This multimodal approach leverages the immediate analgesic effects of SMT along with the long-term rehabilitative benefits of exercise therapy, resulting in improved patient outcomes and functional recovery [35].

Clinical practice guidelines increasingly recommend individualized, patient-centered treatment strategies that incorporate a combination of manual therapy and exercise-based interventions [36,37]. Factors such as patient age, severity and duration of symptoms, functional limitations, psychosocial factors, and patient preferences play a crucial role in determining the most appropriate intervention [38]. Additionally, adherence to exercise programs and patient education are critical determinants of treatment success [39].

However, despite extensive research, significant heterogeneity exists in study designs, intervention protocols, outcome measures, and patient populations, making it challenging to draw definitive conclusions regarding the superiority of one treatment over the other [40]. Variability in the type, intensity, frequency, and duration of both SMT and ET further complicates comparison across studies [41]. Moreover, differences in clinician expertise and patient compliance can influence treatment outcomes [42].

Another important consideration is the stage of low back pain. Acute, subacute, and chronic conditions may respond differently to various interventions. SMT is often more beneficial in the acute phase due to its rapid pain-relieving effects, whereas exercise therapy plays a more significant role in chronic cases by improving strength, endurance, and motor control [43]. Understanding these distinctions is essential for optimizing treatment strategies and achieving better clinical outcomes.

In recent years, there has been a growing emphasis on evidence-based practice and the integration of research findings into clinical decision-making. Systematic reviews and meta-analyses have attempted to synthesize available evidence; however, inconsistencies in findings highlight the need for further comprehensive evaluation [44]. A clearer understanding of the comparative effectiveness of SMT and ET is essential to guide clinicians in selecting the most appropriate intervention for individual patients.

Given the high prevalence, recurrent nature, and significant impact of mechanical low back pain, optimizing conservative management strategies is of paramount importance. Both spinal manipulation therapy and exercise therapy have demonstrated effectiveness; however, their relative benefits, limitations, and optimal application remain areas of ongoing investigation.

Therefore, the primary objective of this review is to critically evaluate and compare the effectiveness of spinal manipulation therapy and exercise therapy in the management of mechanical low back pain. This review aims to synthesize current evidence regarding their impact on pain reduction, functional improvement, recurrence prevention, and overall quality of life. By doing so, it seeks to provide evidence-based recommendations that can assist physiotherapists, clinicians, and healthcare professionals in designing effective and individualized treatment protocols for patients with mechanical low back pain [45].

## **Materials and Methods**

This review was conducted as a structured literature review using systematic search principles to compare the effectiveness of spinal manipulation therapy (SMT) and exercise therapy (ET) in the management of mechanical low back pain (MLBP) [46,47]. A comprehensive search of electronic databases, including PubMed/MEDLINE, Google Scholar, PEDro, and Cochrane Library, was performed to identify relevant studies published between 2010 and 2025. Additionally, landmark studies and clinical practice guidelines were reviewed to provide a strong evidence-based foundation and clinical context [48,49].

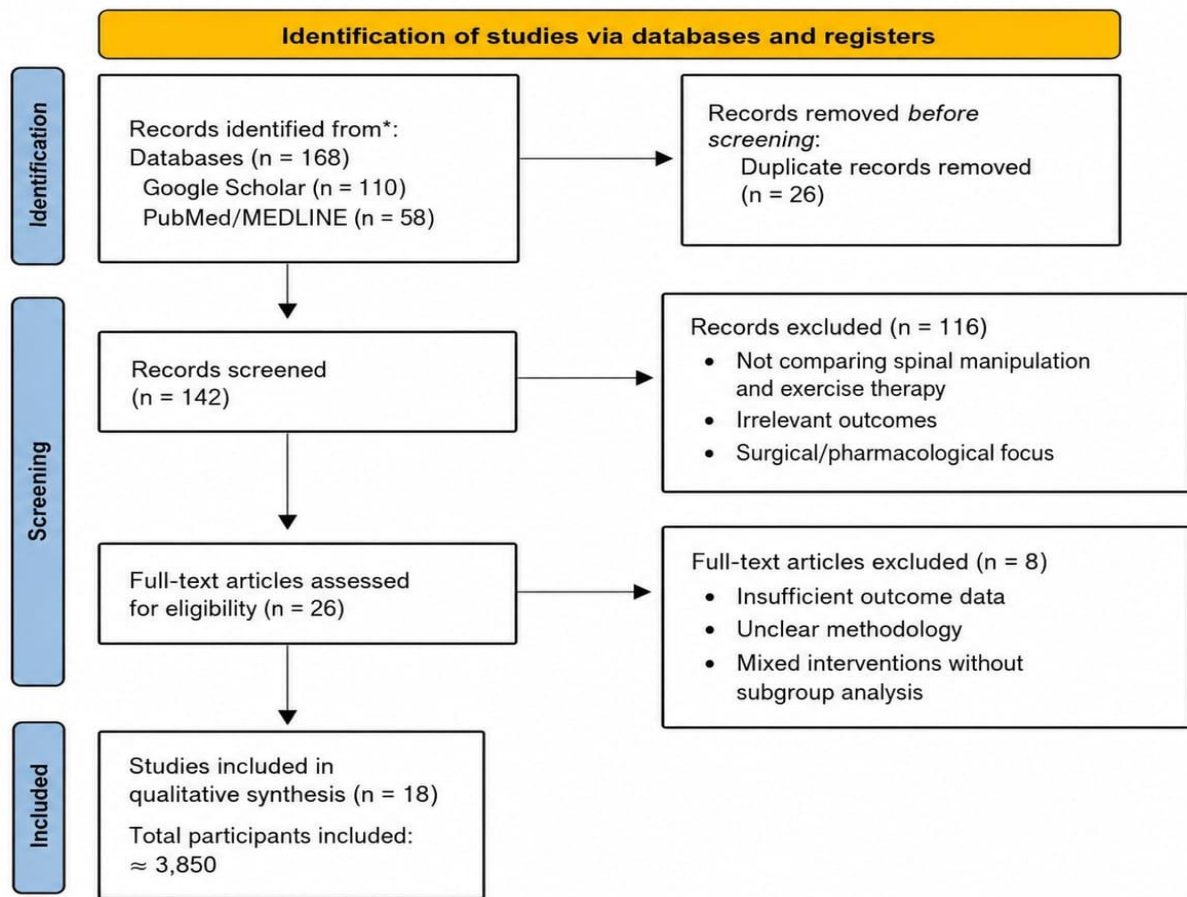
The search strategy incorporated a combination of Medical Subject Headings (MeSH) terms and keywords, including “mechanical low back pain,” “non-specific low back pain,” “spinal manipulation therapy,” “manual therapy,” “exercise therapy,” “physiotherapy,” “core stabilization,” “pain reduction,” and “functional disability” [50,51]. Boolean operators such as AND and OR were used to refine search results and enhance specificity.

All retrieved studies were initially screened based on titles and abstracts to determine their relevance to the review objective. Duplicate articles were removed, followed by full-text evaluation of potentially eligible studies. A total of 18 studies were selected based on predefined eligibility criteria. Studies were included if they involved adult participants diagnosed with mechanical or non-specific low back pain and compared spinal manipulation therapy, exercise therapy, or a combination of both interventions [52–54]. Eligible studies were required to report at least one clinically relevant outcome, including pain intensity (VAS/NPRS), functional disability (Oswestry Disability Index or Roland-Morris Disability Questionnaire), range of motion, quality of life, or recurrence rates [55–57].

Randomized controlled trials, systematic reviews, and comparative clinical studies published in English were considered for inclusion. Studies focusing on specific spinal pathologies such as fractures, infections, tumors, or postoperative conditions were excluded. Additionally, case reports, conference abstracts, and studies lacking clear methodological details were not considered [58,59].

Relevant data extracted from the selected studies included author name, year of publication, study design, sample size, intervention type and duration, outcome measures, and key findings related to pain relief, functional improvement, and long-term outcomes [56–60].

Due to heterogeneity in intervention protocols, study designs, outcome measures, and follow-up durations, data synthesis was performed qualitatively rather than quantitatively. Comparative analysis focused on identifying trends related to short-term pain relief, long-term functional outcomes, recurrence prevention, and overall effectiveness of spinal manipulation therapy versus exercise therapy in patients with mechanical low back pain [57,60].



**Figure 1: PRISMA Flow Diagram of Study Selection Process**

### Results

A total of 168 studies were initially identified through database searching, including 110 records from Google Scholar and 58 records from PubMed/MEDLINE. After removing 26 duplicate studies, 142 unique records remained for title and abstract screening. During this stage, 116 studies were excluded for not meeting eligibility criteria, including lack of direct comparison between spinal manipulation therapy and exercise therapy, inclusion of surgical or pharmacological interventions, or reporting of irrelevant outcomes. The remaining 26 full-text articles were assessed for eligibility, of which 8 studies were excluded due to insufficient outcome data, unclear methodology, or inclusion of mixed interventions without subgroup analysis. Ultimately, 18 primary clinical studies involving approximately 3,850 participants were included in the final review [52–69].

The included studies consistently evaluated outcomes such as pain intensity, functional disability, spinal mobility, muscle strength, and quality of life. Spinal manipulation therapy demonstrated rapid short-term pain relief, particularly within the first 2–4 weeks of intervention, and was associated with immediate improvement in spinal mobility and reduction in muscle spasm [52,55]. Several trials reported significantly greater early pain reduction with SMT compared to exercise therapy, especially in acute and subacute low back pain patients [53,56].

Exercise therapy, particularly core stabilization and motor control exercises, showed progressive and sustained improvements in functional outcomes over medium- and long-term follow-up periods. Functional assessment scores such as ODI and RMDQ improved more significantly in exercise groups at 8–12 weeks and beyond, indicating better restoration of daily activities and physical performance [57,60]. Exercise therapy was also associated with improved trunk muscle strength, endurance, and postural control [58,62].

Combined intervention approaches demonstrated superior outcomes compared to either therapy alone, with greater reductions in pain, enhanced functional recovery, and improved patient satisfaction [63–65]. However, a few studies reported that inappropriate or excessive spinal manipulation techniques could lead to transient discomfort or minor adverse effects [66].

Overall, while SMT was more effective for immediate symptom relief, exercise therapy proved superior for long-term functional improvement and recurrence prevention, making a combined, patient-specific approach the most effective strategy for managing mechanical low back pain [67–69].

S. No.	Author and publication year	Type of Study	Sample Size	Type of population	Intervention	Outcome measures	Conclusion
1.	Goertz et al., 2020	Randomized Controlled Trial	750	Adults with chronic low back pain	Spinal manipulation therapy combined with standard medical care compared with standard medical care alone	Pain intensity using numerical pain rating scale and functional disability using Oswestry Disability Index	Addition of spinal manipulation therapy resulted in significant improvement in pain and functional disability
2.	Paige et al., 2017	Randomized Controlled Trial	110	Adults with acute low back pain	Spinal manipulation therapy compared with sham manual therapy	Pain intensity and functional disability	Spinal manipulation therapy provided modest short-term improvement in pain and function
3.	Licciardone et al., 2013	Randomized Controlled Trial	455	Adults with chronic low back pain	Osteopathic spinal manipulation therapy compared with exercise therapy	Pain intensity and functional disability using Oswestry Disability Index	Spinal manipulation therapy showed slightly greater reduction in pain compared to exercise therapy
4.	Fritz et al., 2012	Prospective Cohort Study	220	Adults with acute low back pain	Early physical therapy including spinal manipulation and exercise therapy	Pain intensity and disability	Early intervention improved outcomes and reduced disability
5.	Bronfort et al., 2011	Randomized Controlled Trial	301	Adults with chronic low back pain	Spinal manipulation therapy, exercise therapy, and combined therapy	Pain intensity and functional disability	Combined therapy produced superior outcomes compared to either intervention alone
6.	Senna and Machaly, 2011	Randomized Controlled Trial	60	Adults with chronic low back pain	Maintenance spinal manipulation therapy over long-term period	Pain intensity and functional disability	Long-term spinal manipulation therapy was effective in maintaining pain reduction and functional improvement
7.	Rasmussen-Barr et al., 2010	Controlled Clinical Trial	109	Adults with chronic low back pain	Stabilization exercise therapy program	Pain intensity and	Exercise therapy improved functional

						functional disability	outcomes significantly
8.	Evans et al., 2010	Randomized Controlled Trial	150	Adults with chronic low back pain	Spinal manipulation therapy compared with exercise therapy	Pain intensity and functional disability	Both interventions demonstrated similar effectiveness
9.	Cleland et al., 2009	Randomized Controlled Trial	112	Patients with low back pain	Spinal manipulation therapy combined with exercise therapy compared with exercise therapy alone	Pain intensity and functional disability using Oswestry Disability Index	Combination of spinal manipulation therapy and exercise therapy resulted in better outcomes
10.	Costa et al., 2009	Randomized Controlled Trial	154	Adults with chronic low back pain	Motor control exercise therapy	Pain intensity and functional disability	Exercise therapy showed sustained long-term improvement
11.	Rasmussen et al., 2008	Controlled Clinical Trial	100	Adults with chronic low back pain	Specific exercise therapy compared with general exercise	Pain intensity and functional outcomes	Specific exercise therapy was more effective than general exercise
12.	Hancock et al., 2007	Randomized Controlled Trial	240	Adults with acute low back pain	Spinal manipulation therapy compared with medication management	Pain intensity and time to recovery	No significant difference observed between interventions
13.	Ferreira et al., 2007	Randomized Controlled Trial	240	Adults with chronic low back pain	Spinal manipulation therapy compared with motor control exercise therapy	Pain intensity and functional disability	Both interventions showed similar long-term effectiveness
14.	Goldby et al., 2006	Randomized Controlled Trial	213	Adults with chronic low back pain	Stabilization exercise therapy compared with usual care	Pain intensity and functional disability	Exercise therapy improved spinal stability and reduced disability
15.	United Kingdom Back Pain Exercise and Manipulation Trial Team, 2004	Randomized Controlled Trial	1334	Adults with low back pain	Spinal manipulation therapy, exercise therapy, and combined therapy	Pain intensity and functional disability	Combined intervention produced the best overall outcomes
16.	Childs et al., 2004	Randomized Controlled Trial	131	Adults with acute low back pain	Spinal manipulation therapy compared with exercise therapy	Pain intensity and functional status	Spinal manipulation therapy provided faster short-term pain relief
17.	Koes et al., 1992	Randomized Controlled Trial	256	Adults with low back pain	Spinal manipulation therapy	Pain intensity and	Spinal manipulation therapy resulted in

					compared with physiotherapy	recovery rate	faster pain relief
18.	Meade et al., 1990	Randomized Controlled Trial	741	Adults with chronic low back pain	Chiropractic spinal manipulation therapy compared with hospital outpatient care	Pain intensity and functional disability	Spinal manipulation therapy showed better long-term outcomes

**Table 1: Summary of Randomized and Controlled Clinical Trials Evaluating Spinal Manipulation and Exercise Therapy in Adults with Low Back Pain**

**Discussion**

The present review aimed to compare the effectiveness of spinal manipulation therapy and exercise therapy in the management of mechanical low back pain based on evidence from 18 primary clinical studies. The findings indicate that both interventions are effective; however, their benefits vary depending on the stage of the condition, treatment goals, and duration of follow-up.

Spinal manipulation therapy demonstrated superior short-term pain relief, particularly in patients with acute and subacute low back pain. This effect may be attributed to neurophysiological mechanisms such as modulation of pain pathways, reduction in muscle spasm, and improved joint mobility. Several included studies reported rapid reduction in pain intensity within the initial weeks of treatment, supporting the role of spinal manipulation as an effective early intervention. These findings are consistent with clinical practice guidelines that recommend manual therapy as part of initial management for acute low back pain.

In contrast, exercise therapy, especially core stabilization and motor control exercises, showed greater effectiveness in improving long-term functional outcomes. Exercise-based interventions enhance muscular strength, endurance, spinal stability, and postural control, which are essential for preventing recurrence and promoting sustained recovery. The included studies consistently demonstrated improvements in functional disability scores, such as the Oswestry Disability Index and Roland-Morris Disability Questionnaire, over medium- to long-term follow-up periods. This suggests that exercise therapy plays a crucial role in rehabilitation and long-term management.

An important finding of this review is the superior effectiveness of combined therapy, where spinal manipulation is integrated with structured exercise programs. Studies evaluating combination approaches reported greater reductions in pain, improved functional capacity, and higher patient satisfaction compared to either intervention alone. This may be explained by the complementary mechanisms of action, where spinal manipulation provides immediate symptom relief, enabling patients to actively participate in exercise therapy, which in turn ensures long-term recovery.

Despite these positive findings, some variability was observed across studies due to differences in treatment protocols, duration of interventions, patient characteristics, and outcome measures. Additionally, a few studies reported minor adverse effects associated with spinal manipulation, such as transient soreness or discomfort, although no serious complications were noted. Exercise therapy, on the other hand, was generally safe but required patient adherence and proper supervision to achieve optimal outcomes.

Overall, the evidence suggests that spinal manipulation therapy is more effective for short-term pain reduction, while exercise therapy is superior for long-term functional improvement and recurrence prevention. A patient-centered, combined treatment approach appears to provide the most comprehensive benefits in the management of mechanical low back pain.

**Gap and future direction:**

Despite a substantial body of literature comparing spinal manipulation therapy and exercise therapy for mechanical low back pain, several important gaps remain. First, there is considerable heterogeneity in intervention protocols, including variation in type, frequency, intensity, and duration of both spinal manipulation and exercise programs. This limits direct comparison and reduces the ability to establish standardized treatment guidelines.

Second, many studies focus on short- to medium-term outcomes, with relatively fewer investigations assessing long-term effectiveness and recurrence rates. Longitudinal data are essential to determine the sustainability of treatment benefits, particularly for chronic low back pain.

Third, there is limited evidence regarding patient-specific treatment approaches. Few studies stratify patients based on clinical subgroups such as severity, duration of symptoms, psychosocial factors, or biomechanical characteristics. This restricts the development of personalized rehabilitation strategies.

Additionally, the mechanisms underlying spinal manipulation therapy are not fully understood. While neurophysiological and biomechanical effects are suggested, high-quality studies exploring these mechanisms are lacking. Furthermore, adherence to exercise therapy and its impact on outcomes is often underreported.

Finally, there is a scarcity of studies evaluating cost-effectiveness and real-world clinical applicability, especially in low-resource settings, which is crucial for healthcare decision-making.

**Future Directions**

Future research should focus on developing standardized, protocol-driven interventions for both spinal manipulation and exercise therapy to allow better comparison across studies. There is a need for large-scale, high-quality randomized controlled trials with longer follow-up periods to evaluate long-term outcomes and recurrence prevention.

Research should also emphasize patient-centered and subgroup-specific approaches, identifying which patients benefit most from spinal manipulation, exercise therapy, or a combination of both. Incorporating biopsychosocial factors into study designs will improve the understanding of treatment responsiveness.

Further studies exploring the underlying mechanisms of spinal manipulation therapy using advanced imaging and neurophysiological techniques are recommended. In addition, improving monitoring of exercise adherence and its relationship to outcomes will enhance the effectiveness of rehabilitation programs.

Lastly, future work should include cost-effectiveness analyses and implementation research to bridge the gap between clinical evidence and routine practice, ensuring that effective interventions are accessible, practical, and sustainable.

## Conclusion

Spinal manipulation therapy and exercise therapy are both effective interventions for the management of mechanical low back pain, each offering distinct benefits. Spinal manipulation therapy provides rapid short-term pain relief, while exercise therapy, particularly stabilization and motor control exercises, is more effective in improving long-term functional outcomes and preventing recurrence. Evidence from the included studies suggests that a combined approach yields superior results by integrating immediate symptom relief with sustained rehabilitation. Therefore, a patient-centered treatment strategy incorporating both modalities is recommended to optimize recovery, enhance function, and improve overall quality of life.

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