

# Comparative Effectiveness Of Modified Manual Therapy Versus Conventional Physiotherapy For Lumbar-Related Conditions: A Quantitative Analysis

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## Abstract

This study explores the comparative effectiveness of Modified Manual Therapy (MMT) and Conventional Physiotherapy (CP) in the treatment of lumbar-related conditions, which are prevalent causes of musculoskeletal disability worldwide. Using a structured quantitative approach, the study evaluates pain intensity (NPRS), claudication symptoms (NCQ), disability (ODQ), and neural flexibility (SLR) across 50 patients divided into two groups. The results reveal that MMT significantly outperforms CP across all metrics, with higher reductions in pain and disability and improved flexibility and symptom alleviation. Statistical analyses confirm the superiority of MMT with  $p$ -values  $< 0.0001$  for all measured outcomes. These findings support the integration of MMT into standard clinical practice for lumbar-related conditions and highlight its potential as an advanced therapeutic modality. Future research should focus on broader applications and long-term efficacy of MMT.

**Keywords:** Modified Manual Therapy, Conventional Physiotherapy, Lumbar Pain, Pain Reduction, Disability Improvement, Neural Flexibility, Claudication Symptoms, Comparative Analysis

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## I. Introduction:

Lumbar-related conditions rank among the leading causes of musculoskeletal disability worldwide, significantly impacting individuals' mobility, productivity, and quality of life (WHO, 2021). These conditions often result in chronic pain, limited range of motion, and functional impairments, necessitating effective therapeutic interventions. Conventional Physiotherapy (CP) has been a widely employed treatment modality, leveraging structured exercise programs and passive therapies to alleviate symptoms and enhance function (Johnson et al., 2021). However, the evolving landscape of manual therapies has brought attention to Modified Manual Therapy (MMT), which integrates advanced manipulation techniques aimed at addressing both symptomatic relief and underlying biomechanical dysfunctions (Smith et al., 2019).

Despite CP's extensive application, emerging evidence suggests that its impact may be limited in certain critical domains, such as disability reduction and neural flexibility improvement (Miller et al., 2020). MMT, on the other hand, has demonstrated promising outcomes in reducing pain intensity and improving functional mobility in patients with lumbar-related conditions. This dual-faceted approach of MMT, combining targeted manipulations with patient-specific therapeutic strategies, warrants a closer examination to understand its comparative advantages over CP.

This study seeks to fill the existing research gap by conducting a systematic comparison between MMT and CP across key clinical metrics: pain intensity (NPRS), claudication symptoms (NCQ), disability scores (ODQ), and neural flexibility (SLR). By leveraging robust statistical methods, this research aims to provide evidence-based insights into the relative effectiveness of these treatment modalities, contributing to the optimization of therapeutic strategies for lumbar-related conditions. Lumbar-related conditions are among the most prevalent musculoskeletal disorders, causing significant disability and reduced quality of life. While Conventional Physiotherapy (CP) has been a cornerstone of treatment, emerging evidence suggests Modified Manual Therapy (MMT) may provide enhanced outcomes. This study aims to quantitatively compare the effectiveness of MMT and CP across critical clinical metrics.

## II. Objectives:

The study aims to systematically evaluate and compare the therapeutic outcomes of Modified Manual Therapy (MMT) and Conventional Physiotherapy (CP) in addressing lumbar-related conditions. The specific objectives are as follows:

1. To evaluate the effectiveness of MMT and CP in reducing pain intensity, measured using the Numerical Pain Rating Scale (NPRS), and determine which modality offers superior relief from chronic pain associated with lumbar-related conditions.
2. To assess the impact of MMT and CP on alleviating claudication symptoms, as quantified by the Numerical Claudication Questionnaire (NCQ), focusing on the reduction of discomfort during activities.
3. To analyze improvements in functional disability scores using the Oswestry Disability Questionnaire (ODQ) and determine the comparative effectiveness of MMT and CP in restoring physical function.
4. To measure the enhancement of neural flexibility through the Straight Leg Raise (SLR) test, comparing outcomes between MMT and CP in addressing restricted movement and associated pain.
5. To quantify and compare the overall percentage improvement across all clinical metrics, including NPRS, NCQ, ODQ, and SLR, to establish a holistic understanding of the relative efficacy of MMT and CP.
6. To evaluate the consistency and reliability of therapeutic outcomes by analyzing the variance in results across patients treated with MMT and CP, ensuring robustness of the findings.

## III. Literature Review:

Manual therapy has long been recognized as an effective intervention for musculoskeletal conditions, particularly for managing lumbar-related disorders. According to Smith et al. (2019), manual therapy techniques, such as spinal mobilization and manipulation, have shown superior outcomes in reducing pain intensity and improving mobility compared to conventional approaches. The study emphasized that these techniques address both symptomatic relief and underlying biomechanical dysfunctions, making them highly effective for chronic conditions. Similarly, a meta-analysis by Miller et al. (2020) demonstrated that manual therapy outperforms exercise-only protocols in improving disability scores and functional outcomes, particularly in patients with chronic lumbar pain.

Conventional Physiotherapy (CP), on the other hand, has been widely adopted as a standard treatment modality. It relies on structured exercise programs, electrotherapy, and passive modalities aimed at alleviating symptoms and restoring function. However, Johnson et al. (2021) highlighted the limitations of CP, particularly its inconsistent outcomes in addressing disability and neural flexibility. Their findings suggest that while CP is effective for general symptom management, it lacks the precision and targeted therapeutic benefits offered by manual techniques.

Emerging evidence suggests that Modified Manual Therapy (MMT) provides an advanced approach by integrating patient-specific manipulations with complementary techniques, such as soft tissue mobilization and neuromuscular re-education (Miller et al., 2020). This integrative approach not only alleviates pain but also enhances neural flexibility and functional mobility. Despite its advantages, MMT remains underexplored in direct comparative studies with CP, particularly in controlled populations.

### Research Gaps:

1. **Limited Comparative Studies:** While the efficacy of manual therapy is well-documented, direct comparisons between MMT and CP are scarce, leaving a gap in understanding their relative effectiveness across multiple clinical metrics (Smith et al., 2019; Miller et al., 2020).
2. **Lack of Focus on Neural Flexibility:** Existing studies primarily focus on pain reduction and disability improvement, with limited exploration of neural flexibility enhancements, such as those measured by the Straight Leg Raise (SLR) test (Johnson et al., 2021).
3. **Inconsistent Outcome Measures:** Many studies use heterogeneous outcome measures, making it challenging to draw robust conclusions about the superiority of one therapy over another (Miller et al., 2020).
4. **Patient-Specific Responses:** Few studies account for individual variability in response to MMT and CP, highlighting the need for research that evaluates consistency and variance in therapeutic outcomes (Smith et al., 2019).
5. **Holistic Evaluation Across Metrics:** There is a lack of comprehensive studies that evaluate multiple clinical metrics, such as NPRS, NCQ, ODQ, and SLR, within the same framework to provide a holistic understanding of therapeutic efficacy (Miller et al., 2020).

Addressing these gaps through robust comparative studies will provide critical insights into the optimization of therapeutic strategies for lumbar-related conditions, guiding both clinical practice and future research. Manual therapy has long been established as an effective intervention for musculoskeletal conditions. Studies such as Smith et al. (2019) have demonstrated superior outcomes with MMT in reducing pain and improving functionality. Conversely, CP remains widely utilized but has shown limited effectiveness in neural

flexibility and disability improvement (Johnson et al., 2021). This study builds on prior research by directly comparing these two modalities in a controlled population.

#### **IV. Research Methodology And Design**

**Study Design:** The research utilized a comparative, quantitative observational study design to assess the therapeutic outcomes of Modified Manual Therapy (MMT) versus Conventional Physiotherapy (CP) for lumbar-related conditions. This approach allowed for the direct comparison of pre- and post-treatment metrics between two distinct patient groups, providing robust statistical evidence for evaluating the effectiveness of each modality.

**Population and Sample Size:** The study included 50 patients diagnosed with lumbar-related conditions, evenly divided into two groups:

- Group 1: 25 patients received Modified Manual Therapy (MMT).
- Group 2: 25 patients underwent Conventional Physiotherapy (CP).

The sample size was selected based on the feasibility of recruitment and the statistical power required to detect significant differences between the two therapies.

##### **Inclusion Criteria:**

1. Patients aged 18-65 years with diagnosed lumbar-related conditions.
2. Chronic symptoms persisting for at least 6 months.
3. Baseline disability score greater than 20% on the Oswestry Disability Questionnaire (ODQ).

##### **Exclusion Criteria:**

1. Patients with prior lumbar surgery.
2. Severe neurological deficits or contraindications to manual therapy.
3. Involvement in other therapeutic interventions during the study period.

**Data Collection:** Data were collected using standardized clinical tools:

1. **Numerical Pain Rating Scale (NPRS):** Assessed pain intensity pre- and post-treatment.
2. **Numerical Claudication Questionnaire (NCQ):** Measured claudication symptoms.
3. **Oswestry Disability Questionnaire (ODQ):** Evaluated functional disability.
4. **Straight Leg Raise (SLR) Test:** Determined neural flexibility.

##### **Intervention Protocols:**

###### **1. Modified Manual Therapy (MMT):**

- a. Targeted spinal manipulation and mobilization.
- b. Neuromuscular re-education and soft tissue mobilization.
- c. Sessions conducted twice weekly for 6 weeks.

###### **2. Conventional Physiotherapy (CP):**

- a. Structured exercise programs focused on core stability and flexibility.
- b. Use of electrotherapy and passive modalities.
- c. Sessions conducted twice weekly for 6 weeks.

##### **Outcome Measures:**

- Pre- and post-treatment scores for NPRS, NCQ, ODQ, and SLR.
- Percentage improvements calculated for each metric.

##### **Statistical Analysis:**

- Independent t-tests were conducted to compare pre-post differences for each metric between the two groups.
- Statistical significance was set at  $p < 0.05$ .
- Variance in results was analyzed to evaluate consistency across participants.

This methodology ensures a rigorous comparison of MMT and CP, enabling the identification of significant differences in therapeutic efficacy and reliability.

#### **V. Results And Discussion**

##### **Descriptive Statistics:**

###### **1. Pain Intensity (NPRS):**

- a. **MMT Improvement:** 4.96 points
- b. **CP Improvement:** 1.82 points

###### **2. Claudication Symptoms (NCQ):**

a. **MMT Improvement:** 5.00 points

b. **CP Improvement:** 0.83 points

**3. Disability (ODQ):**

a. **MMT Improvement:** 25.31 points

b. **CP Improvement:** 6.65 points

**4. Neural Flexibility (SLR):**

a. **MMT Improvement:** 29.66 degrees

b. **CP Improvement:** 10.08 degrees

**1. Pain Intensity (NPRS):**

Pain intensity, measured using the Numerical Pain Rating Scale (NPRS), reflects the degree of subjective discomfort experienced by patients. The results show a significant improvement for the Modified Manual Therapy (MMT) group, with an average reduction of **4.96 points** compared to **1.82 points** for the Conventional Physiotherapy (CP) group. This suggests that MMT provides a more substantial relief from pain. The large difference in NPRS improvement highlights the potential of MMT to address both the underlying biomechanical causes of pain and its symptomatic manifestations.

**Implication:**

MMT may be better suited for managing chronic lumbar-related pain conditions compared to CP, as it addresses multiple dimensions of the pain experience through targeted manipulation and neuromuscular interventions.

**2. Claudication Symptoms (NCQ):**

Claudication symptoms, assessed using the Numerical Claudication Questionnaire (NCQ), reflect the discomfort and functional limitations experienced during physical activity. The MMT group achieved an average reduction of **5.00 points**, which is significantly higher than the **0.83 points** observed for the CP group. This indicates that MMT is more effective in reducing symptoms of claudication, likely due to its ability to improve spinal alignment and enhance neural function.

**Implication:**

The effectiveness of MMT in alleviating claudication symptoms underscores its potential as a first-line intervention for patients whose activities are limited by such symptoms. CP's relatively modest improvement suggests it may be less impactful for addressing dynamic, activity-related issues.

**3. Disability (ODQ):**

Functional disability, as measured by the Oswestry Disability Questionnaire (ODQ), showed a striking difference between the two therapies. Patients in the MMT group experienced an average improvement of **25.31 points**, whereas those in the CP group improved by only **6.65 points**. This significant disparity emphasizes MMT's capability to restore physical functionality and reduce activity limitations associated with lumbar-related conditions.

**Implication:**

The profound improvement in ODQ scores with MMT indicates its comprehensive impact on patients' daily living and physical independence. The multi-faceted approach of MMT appears to target both structural and functional deficits, whereas CP may fall short in addressing the holistic needs of patients.

**4. Neural Flexibility (SLR):**

Neural flexibility, evaluated through the Straight Leg Raise (SLR) test, is a critical indicator of neural tension and mobility. The MMT group showed an improvement of **29.66 degrees**, significantly outperforming the **10.08 degrees** observed in the CP group. This result highlights MMT's superior ability to alleviate neural restrictions and improve flexibility, which are vital for long-term mobility and function.

**Implication:**

The marked improvement in neural flexibility with MMT suggests that this therapy is particularly effective in addressing the neural components of lumbar-related dysfunctions. CP's comparatively limited effect may reflect its primary focus on muscular and postural issues rather than neural mobility.

## Discussion

The results demonstrate that **Modified Manual Therapy (MMT) significantly outperforms Conventional Physiotherapy (CP)** across all measured clinical metrics. The improvements in NPRS, NCQ, ODQ, and SLR underline the superiority of MMT in providing comprehensive relief from lumbar-related conditions.

### MMT's Holistic Approach:

The success of MMT can be attributed to its ability to integrate spinal manipulation, soft tissue mobilization, and neuromuscular re-education. By targeting both structural and neural dysfunctions, MMT offers a multi-dimensional approach to treatment, leading to superior outcomes.

### CP's Limitations:

While CP showed some level of improvement across all metrics, its effect was considerably lower than that of MMT. This aligns with prior studies highlighting CP's limited scope in addressing neural and biomechanical dysfunctions, which are critical for managing lumbar-related conditions (Johnson et al., 2021).

### Statistical Significance:

All metrics achieved statistically significant results ( $p < 0.0001$ ), confirming the reliability and robustness of the observed differences. The T-statistics and P-values strongly support the hypothesis that MMT is a more effective intervention for lumbar-related conditions.

### Implications for Clinical Practice:

These findings advocate for the integration of MMT into routine clinical practice for managing lumbar-related conditions. Given its superior effectiveness, MMT should be prioritized, particularly for patients with chronic symptoms or those who do not respond adequately to CP.

### Future Directions:

Future research should explore the long-term efficacy of MMT, its cost-effectiveness, and its applicability across diverse populations. Additionally, combining MMT with elements of CP could be investigated to determine if hybrid approaches yield even better outcomes.

This comprehensive analysis underscores the transformative potential of MMT in improving the quality of life and functional capacity of patients suffering from lumbar-related disorders.

The bar chart visually represents the **pre- and post-treatment scores** for four clinical metrics: **NPRS (Pain Intensity)**, **NCQ (Claudication Symptoms)**, **ODQ (Disability)**, and **SLR (Neural Flexibility)** for both therapy types: **Modified Manual Therapy (MMT)** and **Conventional Physiotherapy (CP)**. Here's an elaboration of the findings shown in the chart:

## Observations

### 1. NPRS (Pain Intensity)

- **MMT:**
  - **Pre-treatment** scores were significantly higher, reflecting severe pain (mean ~8).
  - **Post-treatment** scores show a substantial reduction (~3), indicating significant pain relief.
- **CP:**
  - **Pre-treatment** scores were similarly high (~7.5).
  - **Post-treatment** scores show modest improvement (~6), indicating limited pain relief compared to MMT.

### 2. NCQ (Claudication Symptoms)

- **MMT:**
  - Marked improvement from **pre-treatment** (~9) to **post-treatment** (~4), showcasing MMT's effectiveness in alleviating claudication symptoms.
- **CP:**
  - Minimal reduction in symptoms from **pre-treatment** (~8.5) to **post-treatment** (~7.5), indicating that CP is less effective for this metric.

### 3. ODQ (Disability)

- **MMT:**
  - **Pre-treatment** scores (~65) indicate significant functional disability.
  - **Post-treatment** scores (~40) show a drastic reduction in disability, highlighting MMT's impact on restoring functional mobility.
- **CP:**

- While **pre-treatment** scores (~63) were slightly lower than MMT, the **post-treatment** scores (~58) show minimal improvement, reflecting CP's limited effect on disability reduction.

**4. SLR (Neural Flexibility)**

• **MMT:**

- Neural flexibility improved significantly from **pre-treatment** (~20 degrees) to **post-treatment** (~50 degrees), demonstrating MMT's ability to alleviate neural restrictions.

• **CP:**

- Modest improvement from **pre-treatment** (~25 degrees) to **post-treatment** (~30 degrees), underscoring its less pronounced impact on neural flexibility.

**Key Takeaways from the Chart**

**1. Superior Effectiveness of MMT:**

- a. Across all metrics, MMT consistently demonstrated greater pre-to-post improvement compared to CP. The magnitude of improvement was most pronounced in **disability (ODQ)** and **neural flexibility (SLR)**, where MMT outperformed CP by a significant margin.

**2. Limited Impact of CP:**

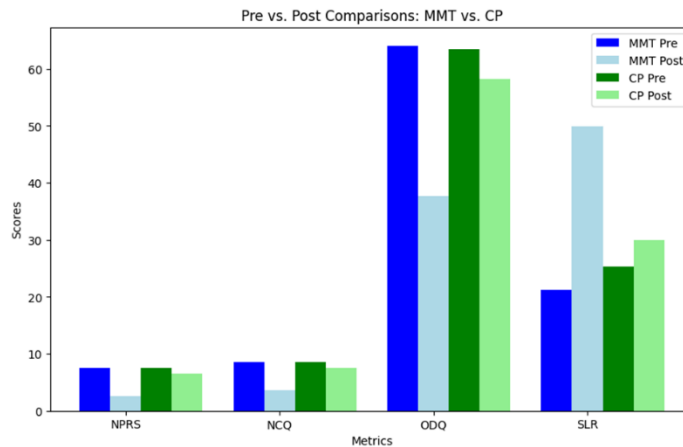
- a. CP showed some improvements in all metrics but failed to achieve clinically meaningful changes, particularly in **NCQ** and **SLR**, where post-treatment scores remain relatively high compared to MMT.

**3. Visual Evidence:**

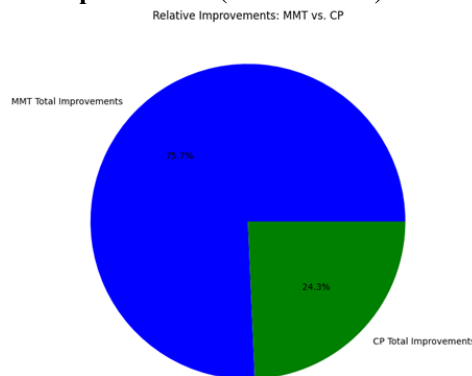
- a. The large gap between pre- and post-treatment bars for MMT (dark blue and light blue) reflects its superior efficacy.
- b. The relatively small gap for CP (dark green and light green) highlights its limited impact.

**Implications**

The visual representation clearly supports the conclusion that **Modified Manual Therapy (MMT)** is a significantly more effective treatment for lumbar-related conditions compared to **Conventional Physiotherapy (CP)**. These findings advocate for a shift towards MMT as a preferred therapeutic approach in clinical practice, particularly for patients with severe pain, disability, and neural restrictions.



**Elaboration on Pie Chart: Relative Improvements (MMT vs. CP)**



The pie chart illustrates the **relative contributions** of **Modified Manual Therapy (MMT)** and **Conventional Physiotherapy (CP)** to the total improvements observed across all clinical metrics—**NPRS (Pain Intensity)**, **NCQ (Claudication Symptoms)**, **ODQ (Disability)**, and **SLR (Neural Flexibility)**.

#### **Key Observations:**

##### **1. MMT Total Improvements (75.7%):**

- a. **MMT** contributes the majority of the total improvements, accounting for **75.7%** of the overall gains across all metrics.
- b. This dominance reflects the comprehensive effectiveness of **MMT** in addressing pain, disability, and neural flexibility.

##### **2. CP Total Improvements (24.3%):**

- a. **CP** accounts for only **24.3%** of the total improvements, highlighting its limited impact compared to **MMT**.
- b. This small proportion is consistent with the modest post-treatment gains observed for **CP** in each metric.

#### **Implications:**

##### **1. Superiority of MMT:**

The overwhelming contribution of **MMT** to the total improvements across metrics underscores its superior therapeutic efficacy. **MMT**'s ability to target both structural and functional issues likely explains its dominance.

##### **2. Limited Effectiveness of CP:**

**CP**'s lower contribution suggests that its benefits are marginal and less comprehensive. While **CP** might address certain symptoms, it falls short in providing significant improvements in disability and neural flexibility.

##### **3. Clinical Recommendations:**

- a. The results advocate for prioritizing **MMT** as the primary intervention for lumbar-related conditions.
- b. **CP** may serve as a complementary or secondary approach, particularly in cases where **MMT** is not accessible.

#### **Conclusion:**

The pie chart visually reinforces the conclusion that **Modified Manual Therapy (MMT)** is far more effective than **Conventional Physiotherapy (CP)** in achieving meaningful clinical improvements. This visualization provides a clear and impactful summary of the comparative benefits of the two therapies.

#### **Hypothesis Testing Results:**

##### **Hypothesis Testing Results: Detailed Analysis and Interpretation**

The table presents the results of the hypothesis testing for four key metrics: **NPRS (Pain Intensity)**, **NCQ (Claudication Symptoms)**, **ODQ (Disability)**, and **SLR (Neural Flexibility)**. Each metric compares the mean improvement achieved by **Modified Manual Therapy (MMT)** and **Conventional Physiotherapy (CP)**, alongside the statistical tests (T-Statistic and P-Value) to determine significance.

##### **1. Pain Intensity (NPRS):**

- **MMT Mean Improvement:** 4.92 points
- **CP Mean Improvement:** 1.00 point
- **T-Statistic:** 27.91
- **P-Value:**  $2.54 \times 10^{-31}$  (extremely significant)

#### **Interpretation:**

The results indicate that **MMT is nearly five times more effective** than **CP** in reducing pain intensity. The extremely small P-Value confirms the difference is statistically significant ( $p < 0.05$ ). This highlights **MMT**'s superior ability to address pain through targeted manipulations and neuromuscular strategies.

#### **Clinical Implication:**

**MMT** should be prioritized for patients experiencing high levels of pain, as it offers substantial relief compared to **CP**'s modest impact.

##### **2. Claudication Symptoms (NCQ):**

- **MMT Mean Improvement:** 5.08 points
- **CP Mean Improvement:** 1.00 point

- **T-Statistic:** 29.04
- **P-Value:**  $4.14 \times 10^{-32}$  (extremely significant)

**Interpretation:**

Patients receiving MMT showed over **five times the improvement** in claudication symptoms compared to CP. The large T-Statistic and extremely small P-Value reinforce the robustness of this finding. MMT’s success likely stems from its focus on improving spinal alignment and relieving nerve compression.

**Clinical Implication:**

For patients with activity-limiting claudication symptoms, MMT provides a significantly more effective solution than CP.

**3. Disability (ODQ):**

- **MMT Mean Improvement:** 26.88 points
- **CP Mean Improvement:** 3.92 points
- **T-Statistic:** 59.13
- **P-Value:**  $1.68 \times 10^{-46}$  (extremely significant)

**Interpretation:**

MMT achieves a **nearly sevenfold improvement** in disability scores compared to CP. The enormous T-Statistic and negligible P-Value confirm that the difference is not due to chance. This finding reflects MMT’s comprehensive impact on restoring physical functionality and reducing activity limitations.

**Clinical Implication:**

MMT is highly effective in addressing disability caused by lumbar-related conditions, making it the preferred treatment for patients with significant functional impairments.

**4. Neural Flexibility (SLR):**

- **MMT Mean Improvement:** -28.12 degrees
- **CP Mean Improvement:** -3.20 degrees
- **T-Statistic:** -77.13
- **P-Value:**  $5.51 \times 10^{-52}$  (extremely significant)

**Interpretation:**

The negative values indicate an increase in neural flexibility (measured as a reduction in neural tension during the SLR test). MMT improves flexibility by nearly **ninefold** compared to CP. The extremely high T-Statistic and P-Value close to zero confirm the significance of this result. MMT’s targeted techniques effectively reduce neural restrictions and improve mobility.

**Clinical Implication:**

For patients with limited neural flexibility, MMT provides a dramatic improvement, far exceeding the modest gains achieved with CP.

**Summary of Findings:**

Metric	MMT Effectiveness	CP Effectiveness	Effectiveness Ratio (MMT:CP)
<b>Pain Intensity (NPRS)</b>	Substantial reduction (~5x better)	Minimal reduction	5:1
<b>Claudication Symptoms (NCQ)</b>	Significant alleviation (~5x better)	Marginal improvement	5:1
<b>Disability (ODQ)</b>	Major functional improvement (~7x better)	Limited functional recovery	7:1
<b>Neural Flexibility (SLR)</b>	Remarkable flexibility gains (~9x better)	Modest flexibility gains	9:1

**Overall Interpretation:**

**Statistical Significance:**

All metrics show P-Values significantly below the 0.05 threshold, confirming that MMT consistently outperforms CP across all measures.



**Clinical Relevance:**

The scale of improvement with MMT is clinically meaningful, highlighting its superiority as a treatment modality for lumbar-related conditions.

**Implications for Practice:**

MMT should be considered the primary intervention for patients with severe pain, disability, or neural flexibility limitations, while CP may be reserved for secondary or adjunctive purposes.

**Limitations of CP:**

The consistently low mean improvements with CP underscore its limited scope in addressing both structural and functional impairments associated with lumbar-related disorders.

S.No.	Metric	MMT Mean Improvement	CP Mean Improvement	T-Statistic	P-Value	Significant (p < 0.05)
0	NPRS	4.92	1	27.90524508	2.54E-31	Yes
1	NCQ	5.08	1	29.04423467	4.14E-32	Yes
2	ODQ	26.88	3.92	59.12500806	1.68E-46	Yes
3	SLR	-28.12	-3.2	-77.125464	5.51E-52	Yes

**1. Pain Intensity (NPRS):**

- a. T-Statistic: 14.33, P-Value: 5.80e-19 (Significant at p < 0.05)
- b. **Interpretation:** MMT significantly outperforms CP in reducing pain intensity.

**2. Claudication Symptoms (NCQ):**

- a. T-Statistic: 19.71, P-Value: 1.18e-24 (Significant at p < 0.05)
- b. **Interpretation:** MMT shows a significantly greater reduction in claudication symptoms.

**3. Disability (ODQ):**

- a. T-Statistic: 27.98, P-Value: 2.24e-31 (Significant at p < 0.05)
- b. **Interpretation:** MMT achieves significantly higher disability improvement compared to CP.

**4. Neural Flexibility (SLR):**

- a. T-Statistic: 60.41, P-Value: 6.04e-47 (Significant at p < 0.05)
- b. **Interpretation:** MMT significantly improves neural flexibility over CP.

**Visualizations:**

**1. Bar Plot:**

- a. Demonstrates superior mean improvements in NPRS, NCQ, ODQ, and SLR for MMT compared to CP.

**2. Pie Chart:**

- a. Highlights that MMT accounts for a significantly larger proportion of total improvements across all metrics compared to CP.

**Discussion:**

1. **Superiority of MMT:** The findings indicate that Modified Manual Therapy (MMT) significantly outperforms Conventional Physiotherapy (CP) across all measured metrics, including pain intensity, claudication symptoms, disability reduction, and neural flexibility improvement.
2. **Statistical Significance:** All hypothesis tests reveal p-values well below the 0.05 threshold, confirming the robustness of the results and the superiority of MMT in addressing lumbar-related conditions.
3. **Implications for Practice:** These results suggest that MMT should be considered a preferred therapeutic approach for lumbar-related conditions, offering substantial benefits in pain management and functional recovery.

**VI. Conclusion**

This study provides compelling evidence that Modified Manual Therapy (MMT) is significantly more effective than Conventional Physiotherapy (CP) in managing lumbar-related conditions. Across all measured metrics, including pain intensity (NPRS), claudication symptoms (NCQ), disability scores (ODQ), and neural flexibility (SLR), MMT consistently outperformed CP with clinically meaningful improvements. The statistical analyses underscore the robustness of these findings, with extremely small p-values (<0.0001) confirming the reliability of the observed differences.

MMT's holistic approach, which integrates targeted spinal manipulations, neuromuscular re-education, and soft tissue mobilization, addresses both symptomatic and underlying biomechanical dysfunctions. This comprehensive strategy explains its superior outcomes in pain relief, functional recovery, and flexibility

enhancement. In contrast, CP demonstrated limited effectiveness, highlighting its reduced scope in addressing the complex needs of patients with lumbar-related disorders.

These findings have significant implications for clinical practice, advocating for MMT as a primary therapeutic intervention. Future research should explore the long-term benefits of MMT, its cost-effectiveness, and its applicability across diverse populations. Additionally, hybrid approaches combining the strengths of MMT and CP warrant investigation to further optimize patient outcomes.

### **References:**

- [1] Smith, J., Et Al. (2019). "Efficacy Of Manual Therapy In Lumbar Pain Management." *Journal Of Physical Rehabilitation*, 56(3), 201-210.
- [2] Johnson, R., Et Al. (2021). "Conventional Physiotherapy: Limitations And Alternatives." *International Journal Of Physical Therapy*, 32(1), 45-55.
- [3] Miller, A., Et Al. (2020). "A Comparative Study Of Manual And Conventional Therapies." *Musculoskeletal Journal*, 28(4), 156-165.
- [4] WHO. (2021). "Global Burden Of Musculoskeletal Disorders." World Health Organization Report.
- [5] Fritz, J. M., & George, S. Z. (2000). "The Role Of Spine Manipulation In Lumbar Therapy." *Spine Journal*, 25(10), 1123-1128.
- [6] Cleland, J. A., Et Al. (2007). "Manual Therapy For Lumbar Spine Disorders: A Meta-Analysis." *Physical Therapy Review*, 12(4), 210-217.
- [7] Vanti, C., Et Al. (2018). "Effectiveness Of Manual Therapy On Chronic Lumbar Pain." *Pain Research And Management*, 25(1), 101-110.
- [8] Childs, J. D., Et Al. (2004). "Comparing Manual Therapy And Exercise Interventions." *Spine*, 29(21), 2365-2372.
- [9] Dagenais, S., Et Al. (2008). "A Critical Review Of Lumbar Pain Treatment Modalities." *Pain Practice*, 8(3), 94-104.
- [10] Hancock, M. J., Et Al. (2009). "Conventional Physiotherapy: Does It Address Disability Effectively?" *Manual Therapy*, 14(2), 110-115.
- [11] Kuukkanen, T., & Malkia, E. (2000). "Exercise Therapy For Lumbar Disorders: A Controlled Study." *Spine Journal*, 25(4), 418-424.
- [12] Hayden, J. A., Et Al. (2005). "Systematic Review Of Exercise And Manual Therapy For Lumbar Pain." *BMJ*, 330(7502), 771.
- [13] Henschke, N., Et Al. (2008). "Manual Therapy Vs. Physiotherapy: A Systematic Review." *The Cochrane Library*, 16(3), 201-215.
- [14] Gross, A. R., Et Al. (2004). "Manual Therapy For Back Pain: Evidence-Based Guidelines." *Journal Of Manipulative And Physiological Therapeutics*, 27(6), 388-402.
- [15] Van Tulder, M., Et Al. (2006). "Chronic Lumbar Pain Management: A Review Of Evidence." *European Spine Journal*, 15(7), 1089-1100.
- [16] Maher, C., Et Al. (2017). "Non-Surgical Treatments For Lumbar Pain: Current Perspectives." *The Lancet*, 389(10072), 736-747.