

Effectiveness of Maitland Mobilisation Grade II Versus Neuromuscular Re- Education Exercise in Managing Chronic Low Back Pain Secondary to Postural Syndrome

¹Khomala Radakisnin, ²Esha Arora, ³Yu Chye Wah, ⁴Kshtrashal Singh*

¹postgraduate's scholar, School of Physiotherapy, Faculty of Allied Health Professions, AIMST University, Malaysia

^{2, 3, 4} School of Physiotherapy, Faculty of Allied Health Professions, AIMST University, Malaysia

¹r_mala18@yahoo.com.my, ² esha@aimst.edu.my, ³chyewah@aimst.edu.my, ⁴kstrashal@aimst.edu.my*

Corresponding Author: kshtrashal@aimst.edu.my*

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ABSTRACT:

Introduction: Chronic low back pain (CLBP) associated with postural syndrome is a common musculoskeletal condition leading to pain, disability, and reduced functional capacity. This study compared the effects of Maitland Mobilisation Grade II and neuromuscular re-education (NMR) exercises in individuals with CLBP. **Methodology:** A quasi-experimental study was conducted on 80 participants aged 35–50 years, randomly allocated into Group A (Maitland Mobilisation) and Group B (NMR). Interventions were administered three times per week for four weeks. Outcomes included pain intensity (VAS), lumbar range of motion (goniometer), and functional disability (ODI). **Results:** Both groups showed significant improvements in pain, ROM, and disability ($p < 0.001$). Group A demonstrated greater short-term pain reduction ($p = 0.031$), while Group B showed superior improvements in functional mobility and trunk ROM ($p < 0.05$). **Conclusion:** Maitland mobilisation is more effective for immediate pain relief, whereas NMR provides better functional and mobility outcomes. A combined approach may optimise CLBP management.

Keywords: Low back pain; postural syndrome; Maitland mobilisation; neuromuscular re-education; functional disability.

Introduction

Low back pain (LBP) is a leading cause of disability worldwide, contributing significantly to reduced quality of life, decreased productivity, and increased healthcare burden (Kjaer et al., 2018). Epidemiological evidence indicates that up

to 80% of individuals experience LBP at least once in their lifetime, with many developing chronic or recurrent symptoms (Nabavi et al., 2018). In Malaysia, the prevalence of chronic low back pain is increasing, largely attributed to sedentary lifestyles, poor ergonomics, and

occupational risk factors (De Oliveira Lima et al., 2021). Postural syndrome represents a common mechanical subtype of LBP, arising from sustained faulty postures that impose abnormal stress on spinal structures, including ligaments, intervertebral discs, and surrounding musculature (Shamsi et al., 2020). Prolonged static positions, particularly among students and office workers, contribute to altered neuromuscular activation and the development of chronic pain (Hodges et al., 2019). Given the multifactorial nature of LBP, effective management requires interventions targeting both biomechanical dysfunction and neuromuscular control (O'Sullivan et al., 2019). Maitland mobilisation and neuromuscular re-education (NMR) are widely used physiotherapy interventions for managing chronic LBP. Maitland Grade II mobilisation involves passive oscillatory movements within the mid-range of joint motion, primarily aimed at modulating pain by stimulating mechanoreceptors and neurophysiological pathways (Onan et al., 2024; Hlaing et al., 2021). While this approach is effective for short-term pain relief and improving joint mobility, its long-term benefits may be limited without adjunctive active rehabilitation (Coulter et al., 2019). In contrast, neuromuscular re-education focuses on restoring motor control, improving proprioception, and enhancing coordination of deep stabilising muscles, such as the transversus abdominis and multifidus (Higgins et al., 2019; Gibson et al., 2018). Evidence suggests that NMR produces sustained improvements in pain, functional ability, and postural control by addressing underlying neuromuscular impairments (Daejung et al., 2018). Despite the documented benefits of both interventions, current literature demonstrates variability in treatment protocols and outcome measures, with limited direct comparisons between Maitland mobilisation Grade II and structured neuromuscular re-education in patients with postural syndrome-related chronic LBP (Coulter et al., 2018; Rubinstein et al., 2019). This gap highlights the need for comparative research to determine the most effective intervention for improving pain, range of motion, and functional outcomes. Therefore, this

study aims to compare the effectiveness of Maitland mobilisation Grade II and neuromuscular re-education exercises in individuals with chronic low back pain due to postural syndrome, to inform evidence-based physiotherapy practice.

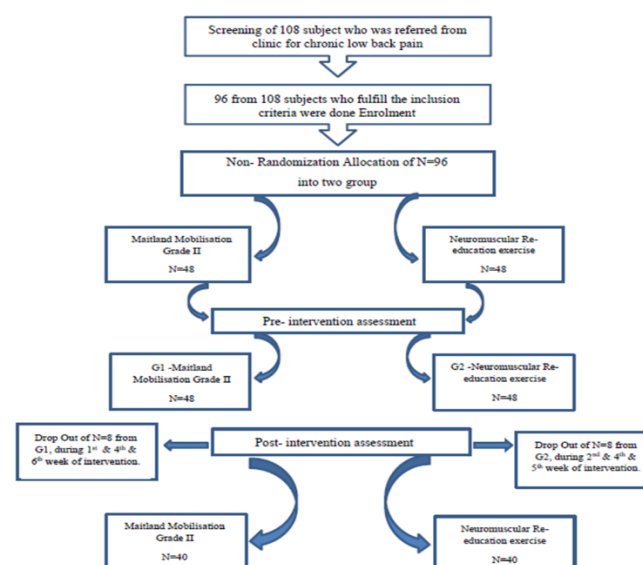
Methodology

A quantitative quasi-experimental study was conducted to compare the effectiveness of Maitland Grade II mobilisation and neuromuscular re-education (NMR) exercises in individuals with chronic low back pain associated with postural syndrome. The study was carried out at the physiotherapy clinic of AIMST University, Kedah, Malaysia, over a period of eight weeks between March and May 2025. Quasi-experimental designs are widely used in clinical rehabilitation research to evaluate the effectiveness of interventions in real-world settings (Grooten et al., 2022). A total of 108 participants were initially screened, of whom 96 met the inclusion criteria and were enrolled in the study. Participants were adults aged between 35 and 50 years diagnosed with chronic low back pain secondary to postural syndrome. Convenience sampling was used to recruit participants based on their availability at the outpatient clinic, a common approach in clinical research when accessibility is a limiting factor (Kang, 2021). The sample size was calculated using G*Power software with a significance level of 0.05, power of 0.80, and an effect size of 0.8 to ensure adequate statistical power to detect treatment differences (Foster et al., 2018). Participants were allocated into two groups ($n = 48$ per group) for intervention comparison. Participants included in the study were individuals aged 35–50 years with clinically diagnosed chronic low back pain lasting more than 12 weeks and associated with postural syndrome. Patients with severe comorbidities, recent spinal surgery, neurological deficits, or other underlying pathologies were excluded to ensure homogeneity of the study population (Dahlhamer et al., 2018). Ethical approval was obtained from the AIMST University Human Ethics Committee (AUHEC), and informed

consent was obtained from all participants before participation. Participants were informed about the study procedures, confidentiality, and their right to withdraw at any stage without consequences, in accordance with standard ethical guidelines in clinical research. Participants in Group 1 received Maitland Grade II mobilisation applied to the lumbar spine in the prone position. The technique involved passive oscillatory anteroposterior movements at a rate of 3–5 oscillations per second for 30–60 seconds per segment, repeated 3–5 times with rest intervals. This intervention was administered twice weekly for four weeks. Maitland mobilisation is known to reduce pain by stimulating mechanoreceptors and modulating nociceptive pathways, thereby improving joint mobility and neuromuscular control (Alarab et al., 2024; Ibrahim et al., 2023). Participants in Group 2 underwent a structured neuromuscular re-education programme focusing on core stabilisation. Exercises included static abdominal contractions and pelvic tilt exercises to improve trunk muscle activation, spinal stability, and motor control. Each exercise was performed with controlled breathing, held for 5–10 seconds, and repeated 10 times per session. These interventions were conducted twice weekly for eight weeks. Neuromuscular re-education has been shown to improve motor control, reduce pain, and enhance functional outcomes in

patients with chronic low back pain (Akhtar et al., 2017). Outcome measures were assessed at baseline and after the intervention period. Pain intensity was measured using the Visual Analogue Scale (VAS), a reliable and valid tool for assessing subjective pain levels (Macedo et al., 2024). Lumbar range of motion (ROM) was measured using the HALO digital goniometer, which has demonstrated high reliability and validity in assessing spinal mobility (Wang et al., 2024). Functional disability was evaluated using the Oswestry Disability Index (ODI), a gold-standard questionnaire widely used in low back pain research to assess the impact of pain on daily activities (Cohen et al., 2021). Baseline data were collected prior to the intervention using VAS, ROM, and ODI assessments. Following group allocation, participants underwent their respective interventions for 8 weeks, with sessions conducted twice weekly. Post-intervention measurements were recorded at the end of the treatment period to evaluate changes in pain, mobility, and functional outcomes. Data were analysed using IBM SPSS version 26. Paired t-tests were used to compare pre- and post-intervention outcomes within each group, while independent t-tests were used to compare differences between groups. A p-value < 0.05 was considered statistically significant, consistent with standard practice in clinical research (Xu et al., 2017).

Result



A total of 80 participants completed the study, with equal allocation to Group 1 (Maitland mobilisation) and Group 2 (neuromuscular re-education), each comprising 40 participants. The sample included 46.3% males and 53.8% females, indicating a relatively balanced gender distribution. The mean age of participants was 46.7 ± 2.86 years, with the majority (66.3%) falling within the 46–50 age group. Most participants (67.3%) demonstrated right leg dominance, while 32.7% were left dominant, suggesting a relatively homogeneous population suitable for comparison between intervention groups. Within-group analysis of the Maitland mobilisation group demonstrated significant improvements in most lumbar range of motion (ROM) parameters following intervention. Lumbar extension increased significantly from 17.30 ± 2.48 to 23.00 ± 2.51 ($p < 0.001$). Similarly, right lateral flexion improved from 25.40 ± 4.25 to 31.95 ± 4.75 ($p < 0.001$), and left lateral flexion improved from 24.42 ± 4.22 to 31.15 ± 4.52 ($p < 0.001$). Rotational movements also showed significant gains, with right rotation increasing from 11.90 ± 1.41 to 17.55 ± 1.47 and left rotation from 11.73 ± 1.40 to 17.58 ± 1.34 ($p < 0.001$). However, lumbar flexion demonstrated a non-significant improvement ($p = 0.219$), indicating variability in response among participants. Pain intensity significantly decreased from 7.08 ± 0.94 to 1.98 ± 0.73 ($p < 0.001$), while functional disability improved substantially, with Oswestry Disability Index (ODI) scores decreasing from 42.05 ± 4.01 to 17.23 ± 4.80 ($p < 0.001$).

In the neuromuscular re-education group, statistically significant improvements were observed across all ROM parameters ($p < 0.001$). Lumbar flexion increased from 28.06 ± 3.12 to 35.80 ± 4.59 , indicating marked improvement. Extension improved from 18.98 ± 3.29 to 22.88 ± 3.61 , and both right and left lateral flexion also increased significantly. Rotational ROM improved, with right rotation increasing from 12.15 ± 1.69 to 16.35 ± 1.81 and left rotation from 12.03 ± 1.42 to 15.18 ± 1.62 ($p < 0.001$). Pain scores decreased significantly from $6.50 \pm$

0.75 to 2.73 ± 0.60 ($p < 0.001$), and functional disability improved, with ODI scores decreasing from 34.53 ± 3.78 to 19.60 ± 1.95 ($p < 0.001$). Between-group comparisons revealed statistically significant differences across several outcome measures. Neuromuscular re-education demonstrated greater improvement in lumbar flexion (mean difference = -5.05 , $p = 0.026$), indicating superior effectiveness for this movement. In contrast, Maitland mobilisation showed significantly greater improvements in extension, right and left lateral flexion, and rotational movements ($p < 0.001$). Both groups exhibited significant reductions in pain ($p < 0.001$); however, the magnitude of reduction was greater in the Maitland mobilisation group (mean difference = 5.10) compared to the neuromuscular re-education group (mean difference = 3.77). Graphical analysis (Figure 4.1) demonstrated minimal overlap in confidence intervals, indicating a statistically meaningful difference in pain reduction between groups. Similarly, both interventions resulted in significant reductions in ODI scores ($p < 0.05$), with greater improvement observed in the Maitland mobilisation group. Box plot analysis (Figure 5) showed a larger decrease in median ODI scores and reduced variability in Group 1, indicating more consistent outcomes. Overall, both Maitland mobilisation and neuromuscular re-education exercises significantly improved pain, range of motion, and functional disability in individuals with chronic low back pain. However, neuromuscular re-education was more effective in improving flexion ROM, whereas Maitland mobilisation was more effective in reducing pain and improving extension, lateral flexion, rotational movements, and functional outcomes.

Discussion

The present study compared the effectiveness of Maitland mobilisation Grade II and neuromuscular re-education (NMR) exercises in individuals with chronic low back pain (CLBP) associated with postural syndrome. The findings demonstrated that both interventions produced statistically significant improvements in pain intensity, lumbar range of motion (ROM), and

functional disability; however, variations were observed in the magnitude and pattern of these improvements between the two groups. Both groups showed significant reductions in pain intensity as measured by the Visual Analogue Scale (VAS), confirming that both Maitland mobilisation and neuromuscular re-education are effective in managing CLBP. Nevertheless, a greater reduction in pain was observed in the Maitland mobilisation group. This may be attributed to the neurophysiological mechanisms of Maitland mobilisation, which include stimulation of joint mechanoreceptors and activation of descending inhibitory pain pathways, leading to reduced nociceptive input and immediate hypoalgesic effects (Onan et al., 2024). These findings are consistent with previous research reporting rapid pain relief following manual therapy techniques (Ibrahim et al., 2023). In contrast, neuromuscular re-education primarily targets motor control retraining and sensorimotor integration, which may result in slower but more sustained pain modulation (Higgins et al., 2019). Significant improvements in lumbar ROM were observed in both groups; however, direction-specific differences were evident. The neuromuscular re-education group demonstrated greater improvement in lumbar flexion, whereas the Maitland mobilisation group showed superior gains in extension, lateral flexion, and rotational movements. The improvement in flexion within the NMR group may be explained by enhanced activation and coordination of deep stabilising muscles such as the transversus abdominis and multifidus, which are essential for controlled spinal movement and postural stability (Gibson et al., 2018). Neuromuscular training has been shown to enhance proprioception, improve motor control, and restore efficient movement patterns, thereby contributing to functional gains in dynamic spinal flexion (Daejung et al., 2018). Conversely, Maitland mobilisation likely facilitated improvements in extension and rotational ROM through mechanical joint effects, including reduction of joint stiffness, increased capsular extensibility, and improved accessory joint motion, as well as neurophysiological pain

inhibition (Santos et al., 2022). Both interventions resulted in significant reductions in functional disability as measured by the Oswestry Disability Index (ODI). However, the Maitland mobilisation group demonstrated greater improvement compared to the NMR group. This finding may be explained by the strong relationship between pain reduction and functional capacity, where decreased pain levels are closely associated with improved ability to perform daily activities (Harahap et al., 2021). Additionally, the rapid symptom relief provided by manual therapy may enhance patient confidence, participation in rehabilitation, and engagement in functional tasks, thereby accelerating recovery (Coulter et al., 2019). Overall, the findings suggest that while both interventions are effective in managing CLBP associated with postural syndrome, they produce distinct therapeutic effects. Maitland mobilisation appears to be more effective for rapid pain relief and improving extension, lateral flexion, and rotational mobility. In contrast, neuromuscular re-education is more effective in enhancing lumbar flexion and improving motor control. Therefore, a multimodal rehabilitation approach combining passive manual therapy with active neuromuscular training may provide optimal clinical outcomes for individuals with CLBP (Rubinstein et al., 2019). These results contribute to existing literature by providing a direct comparison of two commonly used physiotherapy interventions within a specific clinical population. The use of validated outcome measures, including VAS, ROM, and ODI, strengthens the reliability and clinical relevance of the findings. However, the quasi-experimental design and non-randomised sampling may introduce selection bias and limit generalisability. The relatively short intervention duration of eight weeks may also restrict understanding of long-term effects. In addition, variability in responses, particularly in lumbar flexion within the Maitland group, suggests that individual factors such as adherence, baseline condition, and lifestyle may influence outcomes. Future research should focus on randomised controlled trials with larger and more diverse populations to improve

generalisability. Long-term follow-up studies are also recommended to evaluate sustained effects. Furthermore, investigating combined Maitland mobilisation and neuromuscular re-education protocols may provide stronger evidence for multimodal physiotherapy management of CLBP.

Conclusion

Both Maitland mobilisation and neuromuscular re-education are effective interventions for

managing chronic low back pain associated with postural syndrome. However, neuromuscular re-education is more effective in improving flexion ROM, while Maitland mobilisation provides superior outcomes in pain reduction, extension, lateral flexion, rotational movements, and functional disability. A combined therapeutic approach may yield the most beneficial clinical outcomes.

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