Original

Tensioner neural mobilization performance utilization in the treatment of patients with radicular low back pain

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Abstract

Background: Low back pain (LBP) poses as one of the worldwide health problems which disrupts posture while reducing functional abilities. The condition develops because of faulty posture and tissue injuries as well as emotional factors. Chronic back pain patients mostly receive physiotherapy treatment at the initial stage using different therapeutic methods to relieve their symptoms and enhance their performance level. Research has focused on the tensioner approach within neural mobilization therapy because of its promising effects on managing LBP.

Aim: The purpose of this research was to evaluate the effectiveness of tensioner neural mobilization techniques applied with conventional physiotherapy practices against conventional physiotherapy exclusively for LBP patients.

Methodology: The study applied a prospective controlled experimental design with ten randomly assigned patients. Ten patients between 45 and 60 years old received random distribution into two separate groups. Two treatment groups were formed for the study: Group A received tensioner neurodynamic mobilization with conventional physiotherapy and Group B received conventional physiotherapy alone. Six treatment sessions delivered both interventions during two weeks of therapy. Three outcome measures consisted of the Numerical Pain Rating Scale (NPRS), the Oswestry Disability Index (ODI) and handheld dynamometry tests used to assess muscle strength.

Results: The NPRS scores decreased substantially from 7.6 to 1.2 and ROM measurements increased from 3.3 to 5.0 in patients assigned to Group A. Subjects undergoing therapy experienced measurable improvements throughout their various muscles. The participants in Group B experienced moderate pain reduction (NPRS: 8.0 to 4.6) along with improved ROM (2.7 to 3.7) and strength development although their progress was less significant than Group A.

Conclusion: LBP patients benefit more from incorporating tensioner neural mobilization techniques with standard physiotherapy treatments because these methods improve both pain reduction and strength recovery according to research findings.

Keywords: Low back pain, physiotherapy, tensioner neural mobilization, functional impairment.

Introduction

Low back pain (LBP) affects large numbers of the population and stands as the main reason why patients go to medical practitioners. Studies demonstrate that 80% of individuals will need to deal with LBP at one point in their lives and many of these individuals will struggle with persistent functional restrictions. LBP creates functional deficits in gait and postural alignment thereby leading people to need simultaneous pain treatments and functional recovery programs (1). LBP stands as the worldwide leading disability source that leads to disability-induced losses of healthy years (YLDs) (2). Research data reveals that LBP affected 619 million people throughout the world in year 2020 and scientists predict this number will expand to 843 million in 2050 (3).

Various factors lead to LBP development. It typically stems from postural errors including office worker seated positions that are incorrect or the improper mechanical actions required when picking up heavy loads. Biochemical events as well as spinal fractures and disc degeneration and infections and inflammation and trauma represent different reasons for low back pain (4). Several medical conditions including tumors as well as referred pain from kidney stones and specific body structural problems such as scoliosis can cause LBP. People who have osteoarthritis in their family background together with individuals who battle depression or anxiety face higher susceptibility toward LBP development (5).

LBP demonstrates itself through three main symptom groups consisting of dull aching pain together with sharp pain and the distinctive sciatica symptom that produces electric and shooting pain that travels down the legs. Weakness in muscles and functional reduction causes detrimental effects to health-related activities of daily living (ADL) as well as human walking capabilities and quality of sleep (6). The treatment approach relies on determining if the pain has a specific origin or non-specific origins. Healthcare providers started with treating specific LBP causes but treat nonspecific LBP through a combination of specialist care to help patients restore their functional abilities. Three professional groups including psychologists and nutrition specialists and physiotherapists collaborate to build patient recovery (7,8).

Therapeutic procedures called neural mobilization aim to create specific neural mechanical changes as they work towards symptom relief through edema reduction in nerves along with decreasing pain sensitivity and enhancing blood flow in the skin (9). Research demonstrated that neural mobilization brings positive improvements for both patients suffering from nerve-related LBP and patients presenting with neck and arm pain (8,10,11).

The tensioner neurodynamic mobilization technique stretches neural tissue below its elastic limits producing benefits for nerve elasticity. The treatment method consists of extending the nerve until its maximum length and maintaining the position temporarily before fully removing the applied tension (12). The researchers evaluated how tensioner neural mobilization together with conventional physiotherapy affects pain levels and lumbar flexibility while testing lower limb muscle strength compared to standard physiotherapy for treating low back pain patients with radicular leg pain.

Methodology

This prospective, controlled experimental study was designed to assess whether tensioner neurodynamic mobilization demonstrates more efficacy than typical physiotherapy methods for decreasing low back pain symptoms and increasing both lumbar flexibility and lower limb muscle strength among patients suffering from back pain.

The research included ten patients with low back pain. The orthopedic and neurologist surgeons chose patients independently for both study groups. Group A included five patients who participated in tensioner neurodynamic mobilization and conventional physiotherapy for 12 sessions conducted over four weeks with three sessions per week. The five patients in Group B underwent conventional physiotherapy as their sole treatment for four weeks at the same three times per week throughout. Physicians assigned similar participants between the groups based on age, gender and weight distribution and height levels and BMI measurements.

The research selected patients who were between 45 and 60 years old and of any gender with positive Straight Leg Raise test results and between 12 weeks to one year duration of low back pain and radicular pain. Study participants were required to be pain-free during the past four weeks yet report numeric pain rates above 4/10 on the NPRS scale. Patients with SLR test negative and those suffering from vertebral fractures or trauma, as well as individuals who missed the criteria due to the specified pathologies excluded from this study. The research study included a requirement for exclusion of pregnant women along with other criteria.

This research employed the Numerical Pain Rating Scale (NPRS) as its assessment tool for pain measurements through a scale from 0 (no pain) to 10 (worst pain) (13). Lumber flexibility was evaluated using the Schober test which calculated the forward flexion range of motion by measuring distance changes at two lower back points (14). A hand-held dynamometer measured lower limb muscle strength by recording maximal voluntary contractions of hip flexors as well as knee extensors and ankle dorsiflexors and more (15).

Group A patients received tensioner neurodynamic mobilization through the slump position using a sequence between trunk extension with dorsiflexed ankles and flexed knees and trunk flexion with plantarflexed ankles and extended knees. The rehabilitation program used five sets with expanding repetition quantities that were executed in sequential patterns separated by brief resting moments between each set. Conventional physiotherapy included the application of moist heat as well as the use of transcutaneous electrical nerve stimulation (TENS) and back-strengthening exercises for therapy. The patients in Group B received conventional physiotherapy alone while those in Group A participated in standard therapy with the exclusion of neurodynamic mobilization.

Our study consisted of pre-treatment assessments for every participant who received both consent approval and underwent NPRS pain measurement combined with Schober test flexion examination and hand-held dynamometer muscle strength evaluation. The

researchers conducted the same assessment protocols after the completion of 12 sessions to establish changes between the baseline measurements and post-intervention test results.

Data analysis

For data analysis, the quantitative data were analyzed using computer-aided design (CAD) software: SPSS 24.0 and Microsoft Excel. AMOS allowed us to compare the differences within and between groups; data were processed in Microsoft Excel. Descriptive and frequency statistics were employed in this study to identify the basic characteristics of the sample, and the results are displayed as means and percentages for continuous and categorical variables, respectively.

We used the independent samples t-test to compare demographic data between two groups, and we used the paired t-test to compare the data before and after treatment. These tests are useful to use when comparing means in different contexts.

Intrusive growth and efficacy within groups were compared using the paired sample test, while for comparing the effectiveness between groups, we used the independent sample t-test provided the assumption of normality was met.

Ethical approval

All Participants in the current study were properly informed of the goals and purpose of the study, the processes to be undertaken, likely adverse effects, and the benefits of the study; voluntary consent was obtained from all Participants. Participants received assurances that their identities would be kept anonymous throughout the research exercise, and they had the right to withdraw from the study at any time.

Results

This study included 10 participants, divided into two groups: Group A and Group B, each with 5 participants. Group A received tensioner neurodynamic mobilization combined with conventional physiotherapy, while Group B received conventional physiotherapy alone. The demographic distribution was 30% male and 70% female.

The demographic characteristics of both groups, presented in Table 1, showed no significant differences, ensuring comparability between the groups. The mean ages for Group A and Group B were 59.2 and 55.6 years, respectively ($p = 0.22$). There were no significant differences in weight (Group A: 84.0 kg, Group B: 89.0 kg, $p = 0.46$), height (Group A: 165.8 cm, Group B: 164.6 cm, $p = 0.73$), or BMI (Group A: 30.49, Group B: 32.79, $p = 0.20$). Independent sample t-tests showed that all p-values for age, weight, height, and BMI were greater than 0.05, indicating no significant differences between the groups.

Table 1: Comparison of Demographic Characteristics between Groups.

Variable	Group	Mean	SD	Test statistics	p-value
age	A	59.200	4.7645	1.3	0.22
	B	55.600	3.8471		
weight	A	84.000	9.7980	-0.76	0.46
	B	89.000	10.9316		
height	A	165.800	6.3403	0.35	0.73
	B	164.600	4.3932		
BMI	A	30.4920	2.22083	-1.38	0.20
	B	32.7860	2.98302		

*p<0.01; SD: standard deviation

Table 2 shows significant improvements in Group A following treatment with tensioner neurodynamic mobilization combined with conventional physiotherapy. Pain, measured by the Numeric Pain Scale (NPS), decreased significantly from 7.6 to 1.2 ($p < 0.001$). Range of motion (ROM) improved from 3.3 to 5.0 ($p = 0.005$), and strength improved in dorsiflexors ($p = 0.03$), knee flexors ($p = 0.011$), hip flexors ($p = 0.031$), hip extensors ($p = 0.001$), and hip abductors ($p = 0.019$). However, increases in plantar flexor and knee extensor strength were not statistically significant ($p = 0.098$ and $p = 0.068$, respectively) fig (1). This combined treatment proved effective in reducing pain and improving physical function.

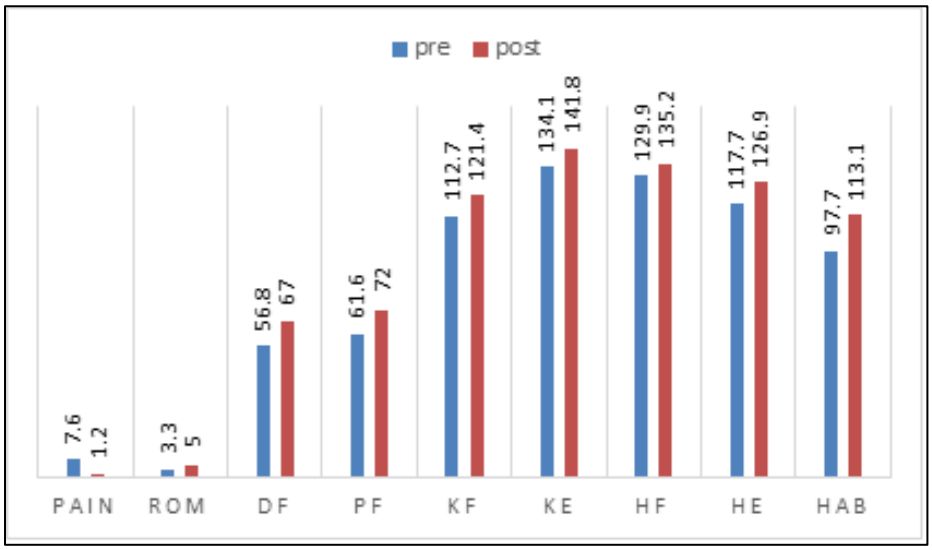
Table 2: Comparison of Group A Sample Before and After the Tensioner Neurodynamic Mobilization Combined with Conventional Physiotherapy.

Group A		Mean	Std. Deviation	Test statistics	p-value
numeric pain scale	NPS (Pre)	7.600	.5477	26.13	0.00
	NPS (post	1.200	.8367		
range of motion	ROM (pre)	3.300	.6708	-5.67	0.005

	ROM (post)	5.000	.0000		
Dorsiflexor	DF (pre)	56.8180	13.67660	-3.30	0.030
	DF (post)	67.0500	9.56333		
Planter flexor	PF (pre)	61.6120	11.45124	-2.15	0.098
	PF (post)	72.0720	21.95744		
knee flexor	KF (pre)	112.7640	9.99804	-4.48	0.011
	KF (post)	121.4700	7.34017		
knee extensor	KE (pre)	134.1180	45.65185	-2.48	0.068
	KE (post)	141.8140	44.06549		
hip flexor	HF (pre)	129.9020	15.84410	-3.27	0.031
	HF (post)	135.2080	15.09424		
hip extensor	HE (pre)	117.6980	11.90218	-9.77	0.001
	HE (post)2	126.9200	12.17849		
hip abductor	Hab(pre)	97.6800	8.19433	-3.81	0.019
	Hab(post)	113.1240	2.78109		

*p<0.05

Figure 1: Means for pre- and post-applying the tensioner neurodynamic mobilization combined with conventional physiotherapy.



Group B, as detailed in Table 3, exhibited enhancements solely by traditional physiotherapy. Pain levels, assessed by the NPS, dramatically diminished from 8.0 to 4.6 ($p < 0.001$). Range of motion (ROM) rose from 2.7 to 3.7 ($p = 0.003$), while strength metrics exhibited small yet statistically significant enhancements for dorsiflexors ($p = 0.002$), plantar flexors ($p = 0.013$), knee extensors ($p = 0.047$), hip flexors ($p = 0.021$), hip extensors ($p = 0.042$), and hip abductors ($p = 0.041$). Nevertheless, knee flexor strength showed only negligible, non-significant enhancement ($p = 0.090$). fig (2). The findings indicate that traditional physiotherapy significantly alleviates pain and improves function but to a lesser degree than the combination treatment.

Table 3: Comparison of Group B Sample Before and After Conventional Physiotherapy

Group B		Mean	Std. Deviation	Test statistics	p-value
numeric pain scale	NPS (Pre)	8.000	.7071	13.88	0.00
	NPS (post	4.600	.5477		
range of motion	ROM (pre)	2.700	.4472	-6.32	0.003
	ROM(post)	3.700	.6708		
Dorsiflexor	DF (pre)	116.4820	5.10178	-7.23	0.002
	DF (post)	117.4380	5.01535		
planter flexor	PF (pre)	116.4740	5.92050	-4.29	0.013
	PF (post)	117.0200	6.06317		
knee flexor	KF (pre)	114.7700	4.51824	-2.22	0.090
	KF (post)	115.4200	4.40817		
knee extensor	KE (pre)	116.7040	11.22464	-2.83	0.047
	KE (post)	118.2600	11.70397		
hip flexor	HF (pre)	121.7120	12.84289	-3.67	0.021
	HF (post)	122.5800	12.63456		
hip extensor	HE (pre)	123.4500	9.35212	-2.94	0.042
	HE (post)2	125.1800	10.25558		
hip abductor	Hab(pre)	116.5860	9.06905	-2.98	0.041
	Hab(post)	117.7600	9.63680		

*$p<0.05$

Figure 2: Means values for pre- and post-applying Conventional physiotherapy

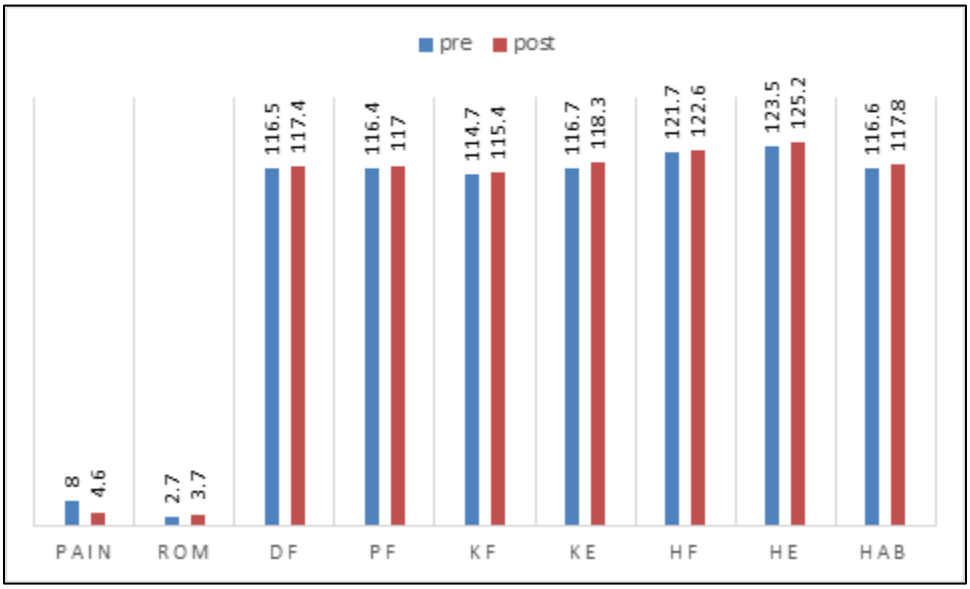


Table 4 compares the two groups, showing the superiority of the combination treatment in Group A over conventional physiotherapy in Group B. Group A demonstrated a larger reduction in pain (6.4 vs. 3.4, $p < 0.001$) and greater improvements in ROM (-1.7 vs. -1.0, $p = 0.073$), though the latter was not statistically significant. Strength improvements in Group A were significantly greater for dorsiflexors (-10.23 vs. -0.95, $p = 0.017$), knee extensors (-7.7 vs. -1.6, $p = 0.003$), hip extensors (-9.2 vs. -1.7, $p < 0.001$), and hip abductors (-15.4 vs. -1.1, $p = 0.008$). While improvements in plantar flexor and hip flexor strength were more noticeable in Group A, they were not statistically significant. These findings suggest that tensioner neurodynamic mobilization combined with conventional physiotherapy is more effective than conventional physiotherapy alone in reducing pain and improving functional rehabilitation.

Table 4: Comparison between group A and group B before and after the two exercises

	GROUP A		GROUP B			
VARIABLE	Mean difference	Std. Deviation	Mean difference	Std. Deviation	Test statistics	p-value
numeric pain scale	6.4	0.54	3.4	0.58	8.60	0.00

range of motion	-1.7	0.67	-1.0	0.35	-2.06	0.073
Dorsi flexor	-10.23	6.9	-0.95	0.29	-3.00	0.017
Planter flexor	-10.46	10.9	-0.54	0.28	-2.04	0.076
knee flexor	-8.7	4.3	-0.65	0.65	-4.1	0.22
knee extensor	-7.7	7.01	-1.6	1.2	-1.95	0.003
hip flexor	-5.3	3.6	-0.8	0.53	-2.7	0.087
hip extensor	-9.2	2.1	-1.7	1.3	-6.7	0.00
hip abductor	-15.4	9.1	-1.1	0.89	-3.5	0.008

*$p<0.05$

Discussion

The research evaluated the treatment results between using tensioner neurodynamic mobilization alongside conventional physiotherapy and employing conventional physiotherapy by itself for patients who experienced CLBP with radicular features. A combination of tensioner neurodynamic mobilization reduced pain more than routine physiotherapy and increased ROM and muscle strength better than sole routine physiotherapy use.

Group A patients who received combined treatments experienced better pain reduction according to the study results than patients in group B who received only conventional methods. Group A patients recorded scores changing from 7.6 to 1.2 on the NPRS whereas group B patients reported a score change from 8.0 to 4.6 on the NPS. The findings show that using neurodynamic techniques together effectively minimized pain across neurological complaints. This treatment approach has the dual purpose of improving nervous system functions while making it less prone to irritation in patients with radicular pain (9). Research has proven that neurodynamic mobilization achieves notable pain relief for patients whose pain stems from nerves to demonstrate its effectiveness in treating nervous tissue mechanosensitivity (16).

Group A participants gained higher ROM outcomes in our study from 3.3 to 5.0 ($p = 0.005$) and Group B participants obtained results from 2.7 to 3.7 ($p = 0.003$). Group A experienced

relatively larger changes compared to Group B in spite of significant findings between both groups. Multiple previous research articles agree that neurodynamic mobilization increases ROM by lessening neural strain and enhancing soft tissue pliability (8, 10). The research reveals that combining conventional therapy with neural approaches would provide higher impacts for improving movement recovery in CLBP patients.

The subjects in Group A who received tensioner neurodynamic mobilization demonstrated a substantial increase in strength for their hip extensor and dorsiflexor along with their hip abductor muscles. The combined treatment approach enhanced neuromuscular traction according to these performance outcomes. The strength of dorsiflexors improved equally in patients from Group A while the gain in patients from Group B remained minimal. The techniques enhance muscle strength because they improve neural conduction along with muscle contraction (17,18).

The combination therapy led to better results for plantar flexor and knee extensor strength but the enhancements lacked statistical significance thus indicating a need for better adjustments to maximize the exercise-extension training outcome in these muscle regions. The study results correspond with Coppieters et al. (2008) who explained that neurodynamic movements generate different effects between different muscles based on nerve duration and involvement (19).

The outcomes suggest better results emerge from the combination of treatments when we compare Group 1 to Group 2. When compared to Group B subjects Group A patients demonstrated superior results based on their pain scores and their enhanced strength in their key ments including their hip extensors. The study results indicate possible performance improvements through multimodal treatment that combines traditional methods with neurodynamic mobilization for optimizing recovery outcomes. Research by Basson et al. (2017) indicates that patients achieve better pain and functional results through neurodynamic interventions (8).

The underlying reason for observed changes in tensioner neurodynamic mobilization effects can be explained through reduced nerve tension alongside improved blood circulation and decreased peripheral nerve sensitization. The technique achieves its effects in cases of nerve stiffness primarily due to neurological immobility which leads to worse symptoms of both pain and reduced movement. Rodríguez et al. (2018) mentioned that neurodynamic techniques demonstrate potential for reducing nerve movement while decreasing symptom intensity so this study achieved improved pain and ROM results (20).

Limitations

This particular study contains certain built-in obstacles that future research must address. The analysis dependent on a low participant count reduces the study's ability to be generalized to other conditions. An increased number of participants would improve both

the statistical data and overall result generalization. Since the experimental interventions only lasted for brief periods it is challenging to identify their complete effects which might be difficult to understand since treatment occurs over extended time. Subsequent research needs to monitor durability by extending follow-up assessments of the achieved effects. The study lacked blinding procedures so this may introduce unwanted bias which makes the researchers suggest performing trials with blinding methods.

Conclusion

The method of utilizing tensioner neurodynamic mobilization in combination with conventional physiotherapy effectively decreased pain while strengthening back mobility and muscle strength capacity. Physical treatment methods on their own reduced pain intensity and improved flexibility and strength but to a lesser extent than when combined with tensioner neurodynamic mobilization. Persons in Group A who received the combined treatment demonstrated stronger gains in dorsiflexors as well as knee extensors and hip extensors and abductors when compared to Group B. The strength improvements for plantar flexors along with hip flexors from Group A were statistically significant though many researchers did not demonstrate this finding. The inclusion of tensioner neurodynamic mobilization with conventional physiotherapy led to superior pain relief together with functional improvement when compared to traditional physiotherapy treatment.

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