

Research article

Effect of Mckenzie lumbar extension exercise with TENS on lumbar radiculopathySenthil Kumar B.¹, Divyasree S.¹, Kumaresan A.², Surya Vishnuram²¹UCA College of Paramedical Sciences, College of Physiotherapy, Chennai, Tamil Nadu, India²Saveetha College of Physiotherapy, Saveetha Institute of Medical and Technical Sciences, Chennai, Tamil Nadu, India

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Corresponding author: **B. Senthil Kumar**. Email: senthilkumar79@yahoo.com**ABSTRACT**

Introduction and Aim: This study was aimed to investigate the impact of TENS (Transcutaneous Electrical Nerve Stimulation) along with Mckenzie lumbar extension exercise on patients with lumbar radiculopathy. The objective is to compare the effect of TENS with Mckenzie exercise and control group. The study assessed pain levels, radicular pain through SLR (Straight Leg Raise) test, disability using RMDQ (Roland Morris Disability Questionnaire), and spine range of motion (ROM) using MMST (Modified Modified Schober Test). Pre-test and post-test measurements were collected and compared to determine any differences.

Methodology: The study included a total of 50 male and female patients aged between 31 and 40 years, all of whom experienced disabling pain for a duration of 6-12 weeks. The materials used for the assessment included an inch tape for measuring lumbar spine ROM, a goniometer for SLR, and a belt.

Results: After the 6-week program, the findings revealed a significant reduction in pain levels, improved SLR, enhanced lumbar spine ROM, and decreased disability among the participants. Paired t-test showed significant differences in post-test values and independent t-test revealed significant post-test values in the experimental group than the control group at $p < 0.05$.

Conclusion: The group of patients with lumbar radiculopathy who received TENS combined with Mckenzie exercise demonstrated superior outcomes in terms of pain reduction, SLR improvement, MODI (Modified Oswestry Disability Index) scores, and RMQ (Roland Morris Questionnaire) scores compared to the group treated with general exercise and TENS.

Keywords: Mckenzie exercise; TENS (transcutaneous electrical nerve stimulation); MMST (modified-modified Schober's test); SLR (straight leg raise).

INTRODUCTION

Lumbar radiculopathy is characterized by pain that originates from the compression or irritation of the sciatic nerve, often caused by disk herniation. This condition commonly occurs in individuals in their forties, and the pain tends to worsen during activities involving flexion, straining, coughing, sneezing, or sitting (1). If the pain persists for more than three months, it is considered chronic. The pain typically begins at low-back and radiates to the sacroiliac and gluteal regions, extending into the back of the thigh. Radicular pain associated with lumbar radiculopathy usually extends beyond the knee (1). Poor posture contributes significantly to the development of low back pain (2). It is estimated that around 80% of the population will experience low back pain at some point in their lives, with the highest incidence occurring in individuals in their forties (3,4).

The intervertebral disk, which is sandwiched between the anterior and posterior longitudinal ligaments, is primarily composed of the nucleus pulposus in the center and the annulus fibrosus around it. The posterior longitudinal ligament is relatively weak compared to the anterior ligament. The fibrocartilaginous tissue is thicker at the front and

thinner in the posterolateral aspect. Narrowing of the intervertebral foramen, leading to root entrapment, can occur due to osteophytic impingement and posterior articular closure (5,6).

Changes in the cartilage end plate may contribute to disk degeneration. Intervertebral disks in adults lack a direct blood supply, and the cells within the disk rely on nutrient diffusion through pores in the vertebral bodies (7). The MCKENZIE lumbar extension exercise is known to help centralize radiating leg pain, reduce or eliminate pain, and increase the range of motion through extension (8-10). Transcutaneous electrical nerve stimulation (TENS) is a pain modulation technique that involves applying electrical stimulation through the skin. TENS can be delivered with various electrical parameters and waveforms (11).

This study was aimed to investigate the impact of TENS (Transcutaneous Electrical Nerve Stimulation) along with Mckenzie lumbar extension exercise on patients with lumbar radiculopathy. The objective is to compare the effect of TENS with Mckenzie exercise to a control group with conventional treatment.

MATERIALS AND METHODS

Material used

Inch tape for lumbar spine ROM, goniometer for SLR and Belt.

Methodology

Inclusion criteria

Both genders with Disabling pain for past 6-12 weeks of the age group 31-40 years. Sample size was 50 patients and the duration was: 6 weeks [5 days a week]

Exclusion criteria

Patients with spinal fracture, infection, malignancy, pregnancy and cauda equina syndrome were excluded from the study.

Tool or tests

- Numerical pain rating scale (12)
- Roland Morris disability questionnaire (13)
- Straight leg raise (14)
- Modified Schober's test (15)

Intervention

Subjects and group allocation

Fifty patients were randomly allocated to two groups. Group A received TENS and MCKENZIE exercise, while Group B received general exercise and TENS.

Mckenzie exercise

The Mckenzie exercise approach focused on addressing posterior derangement, which is a common occurrence. The reductive force used in this approach was extension. The expected response to Mckenzie exercise included centralization of symptoms, reduction or elimination of pain, a possible temporary increase in centralized pain, increased range of motion in extension, and reduction of derangement (8-10,16).

Lying prone

The lying prone position should be performed when symptoms are present and can be omitted if symptoms are absent. This position is crucial when considering the time factor in the development of symptoms. Initially, pain may be present, but it tends to reduce or disappear within four to five minutes.

Lying Prone in Extension: Lying prone in extension can be recommended as a position of rest, such as for reading or watching television, as an alternative to lounging on the sofa. Again, this position is significant when considering the time factor, as pain may initially be present but reduces or disappears over a period of four to five minutes.

Extension in lying

Maintaining lordosis (natural curve) is important during the extension in lying exercise as the patient regains an upright posture.

Extension in lying (with belt fixation)

For this exercise, a belt or towel is placed around the pelvis, and an assistant stands on either side of the towel, straddling the patient.

Extension in standing

During this exercise, the patient stands with feet shoulder-width apart and knees straight, ensuring a stable base of support. The hands are placed in the small area of the back across the belt line with fingers pointing downwards. The patient then leans backward as far as possible, letting the head tip back (caution should be exercised if the patient has cervical spine problems as well). The hands are used to apply pressure on the spine, acting as a fulcrum.

Posture correction

Instruction in posture correction, the use of a lumbar roll, interrupting prolonged sitting, and avoiding repetitive flexion are essential for maintaining reduction and managing symptoms. Maintaining good sitting posture can be challenging on sofas or settees due to the shape of the chair causing posterior rotation of the pelvis, reducing lordosis. It is easier to maintain good posture on a dining room-type chair. Using a lumbar roll on a lounge chair can provide beneficial support, and cushions should be used to prevent the support from being absorbed by the upholstery¹⁷.

Modification of lying posture

If the patient experiences issues while sleeping with legs extended on a hard surface, lack of lumbar support may be the problem. In such cases, a lumbar support roll, made by folding and rolling a beach or bath towel, can be helpful. If the mattress or bed base allows the spine to sag during sleep, pillows placed at both ends of the bed under the mattress can create a sagging effect. Some individuals may require a sagging mattress to address this issue.

Exercise regimen

The recommended exercise regimen consists of performing the extension in lying exercise ten times, twice a day. Once function and pain improve, patients should be advised to continue with ten repetitions of extension in lying, 1-2 times per day, for maintenance (18).

Progressions

If progress is slow, specific progressions can be adopted in the following order: introduce one new procedure per session, wait at least twenty-four hours to evaluate the response before considering further force progress.

Control group (19)

- Prone on elbows
- Cat and camel
- Pelvic rotation

- Lumbar rotation
- Hip flexor stretch
- Hamstring stretch
- Piriformis stretch

RESULTS

The statistical analysis using independent t-test was performed to analyse the between the group comparison and paired t-test was performed to analyse within the group comparisons at $p < 0.05$ (Table 1).

The independent t-test revealed that there is no significant difference between the groups before the intervention and there is significant difference after the

intervention, stating that the experimental group was more effective than the control group. Paired -test revealed that there is significant effect in both the groups, however the mean post-test values of the experimental group were shown to be more effective than the control group.

From the data analysis it is shown that after 6 weeks of McKenzie lumbar extension exercise with TENS for 15 minutes for 5 days in week showed significant improvement when compared to the control group in Numerical pain rating scale, Roland Morris disability questionnaire, Straight leg raise, and Modified Schober's test

Table 1: Data comparison between the groups

Outcome	Experimental group (Mean)		Control group (Mean)		t-value	p-value
	Pre	Post	Pre	Post		
NPRS	7.64	1.8	7.24	2.8	2.58	P<0.05
RMDQ	13.28	3.8	13.68	5.32	7.10	
SLR	51.6	104.7	49.1	94.2	4.87	
MST	4.52	7.1	4.86	6.25	7.42	

DISCUSSION

The results of this study provide evidence supporting the effectiveness of McKenzie lumbar extension exercise combined with Transcutaneous Electrical Nerve Stimulation (TENS) in reducing pain, disability, and improving range of motion in patients with lumbar radiculopathy. The principle of using extension exercises is based on the fact that posterior derangements are commonly observed in these patients. By applying extension forces, derangement reduction can be achieved, leading to the alleviation of nerve root deformation and associated signs and symptoms (8-10).

One notable phenomenon observed in this study is centralisation, which refers to the progressive reduction and elimination of distal pain through therapeutic loading strategies. Centralisation occurs specifically in derangement syndrome cases where peripheral or radiating pain is permanently abolished. Centralisation has shown positive outcomes in patients with both mild and severe back pain. The findings suggest that the McKenzie lumbar extension exercise with TENS promotes centralisation, leading to improved clinical outcomes and enhanced pain management in patients with lumbar radiculopathy (20-22).

Regarding the TENS intervention, it is important to note that conventional TENS is typically administered for 15 minutes, utilizing pulses of 50 to 80 ms duration and a frequency of 100 to 150 pulses per second. The intensity is adjusted to produce a comfortable sensation for the patient. Further research could explore variations in TENS parameters, such as pulse

duration, frequency, and intensity, to determine the optimal settings for pain reduction and functional improvement in patients with lumbar radiculopathy (23,24).

The limitations of the study include relatively small sample size, which may limit the generalizability of the results. Future research with larger and more diverse participant groups would enhance the statistical power and applicability of the findings. Additionally, the duration of the intervention was limited to six weeks. Longer-term follow-up assessments would provide a better understanding of the sustained benefits of the McKenzie lumbar extension exercise with TENS in the management of lumbar radiculopathy.

Future studies could also explore the underlying mechanisms of centralisation and further investigate its relationship with treatment outcomes. Understanding the specific factors that contribute to centralisation would help refine therapeutic approaches and optimize patient outcomes. Moreover, it would be valuable to compare the effectiveness of McKenzie exercise with TENS to other treatment modalities, allowing for a comprehensive evaluation of different interventions and their respective benefits for patients with lumbar radiculopathy.

CONCLUSION

In conclusion, this study provides evidence supporting the effectiveness of the McKenzie lumbar extension exercise with TENS in reducing pain, disability, and improving range of motion in patients with lumbar radiculopathy. Centralisation emerges as an important concept in the context of derangement syndrome,

showing positive outcomes in various levels of back pain severity. However, larger-scale studies, long-term follow-ups, exploration of underlying mechanisms, and comparative investigations of different treatment modalities are needed to strengthen the evidence base and guide clinical decision-making for the management of lumbar radiculopathy.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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