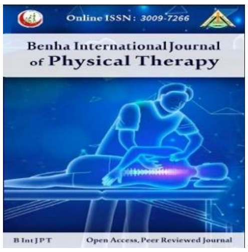
Benha International Journal of Physical Therapy

Online ISSN: 3009-7266 **Home page:** https://bijpt.journals.ekb.eg/



Original research

Effect of thoracic spine mobilization on pain and lumbar mobility in patients with lumbosacral radiculopathy.

Aya A E Salah Eldeen[1,]*, Nagwa I Rehab[2], Ebtesam M Fahmy [3], Wael S Shendy[2], Hossam M Alsaid[4]

1. Bachelor of physical therapy, Cairo University, Egypt.
2. Department of Physical Therapy for Neurology and Neurosurgery, Faculty of Physical Therapy Cairo University, Egypt.
3. Department of Neurology, Faculty of Medicine, Cairo University, Egypt.
4.Lecturer Department of Physical Therapy for Neurology and Neurosurgery, Faculty of Physical Therapy Cairo University, Egypt.

***Correspondene to:**
Dr. Aya Abd Elmohsen Salah Eldeen
Bachelor of physical therapy Cairo university Egypt.
E-mail: ayamohsen214@gmail.com

Article history:
Submitted: 10-07-2024
Revised: 20-07-2024
Accepted: 28-07-2024

Abstract

Background: Leg pain combined with low back pain (LBP) refers to lumbosacral radiculopathy (LR). It is a common complaint causing global disability. Studies about effect of mobilization of the thoracic spine in treatment of LR are still insufficient.

Purpose: to study the impact of thoracic spine mobilization on pain and lumbar mobility in lumbosacral radiculopathy (LR) patients.

Methods: Thirty-four male and female patients with unilateral chronic LR, aged from 30 to 45 years were divided equally and randomly to two groups (study and control). Both groups received conventional physiotherapy program. In addition to that, the study group received thoracic spine mobilization as well. The treatment session was lasted 45 to 60 minutes, performed thrice weekly for six weeks. Measurement of back pain and radiated pain were measured with visual analogue scale, whereas lumbar flexion range of motion was measured using Schober test pre and post treatment.

Results: There were statistically marked improvements in back and leg pain, and lumbar mobility in both groups after treatment (p-value<0.05), in favor of the study group.

Conclusion: Thoracic spine mobilization adds a valuable effect to the conventional physiotherapy program in improving back and leg pain, and lumbar mobility in chronic LR patients.

Keywords: Back pain**,** Sciatica, Posteroanterior mobilization, Visual analogue scale.

Introduction:

Lumbosacral radiculopathy (LR) is a common health disorder associated with disc herniation and low back pain (LBP). LR induces pain in the lower back, and gluteal areas which radiates to the posterior surface of the thigh and leg. LR affects up to 5% of the general population

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and affects men more than women[1]. LR is commonly caused by intervertebral disc herniation which compresses and irritates a nerve root. The discs commonly herniate at levels L4,5 and L5, S1 which lead to radiculopathy in L5 or S1 nerve root**.** This radiculopathy leads to paresthesia (sensory deficits) and pain in the involved dermatome.

The pain may be dull, sharp, piercing, stabbing, throbbing, burning or shooting in nature [2]. This pain is chronic (continues for > 3 months) in a quarter of the patients [3]. In addition, patients with LR have changes in the reflexes and muscle activities [3]. Pain of LR may sustain for more than three months in a quarter of the patients [3]**,** due to spinal nerve irritation [4]. At the end of the day, function, life quality, and working capability all are reduced [5].

Based on the "biomechanical impairment-based model", thoracic spine hypo-mobility increases the mechanical loading on the lumbar spine. The thoracic spine hypo-mobility may be due to overactivation of the erector spinae muscles that attach to thoracolumbar fascia and thoracic spine. This overactivation is muscle guarding which aims to protect the lower back due to pain and local lumbar muscle weakness. As a result, the thoracic spine tends to stiffen and flex more. Mobilization of the spinal joints can improve joint mobility and thus may strengthen the unstable joints which may improve muscle activity and function. More specifically, mobilization of the thoracic spine can improve mobility and thus reflexively can relax the overactive muscles and reduce lumbar spine loading [6].

Given that there is not sufficient research on the effects of mobilization of the thoracic spine in LR, therefore this research was conducted to study the impact of mobilizing the thoracic spine on pain and lumbar mobility in patients with LR.

Methods

This randomized controlled trial was performed at the out-patient clinic-Faculty of Physical Therapy-Cairo University-Egypt in the period between June 2023 and December 2023. Study approval was given by the Ethics Committee at the Faculty of Physical Therapy-Cairo University (P.T.REC/012/004608.). The study had been registered on ClinicalTrials.gov (NCT06167044). All patients signed consent form before the study.

Study population

Thirty-four patients with unilateral chronic LR of both sexes due to disc prolapse were included. The patients were diagnosed as having LR based on careful clinical examination and magnetic resonance imaging by a neurologist. Patients were included if they had age between 30 and 45 years, unilateral chronic LR due to disc herniation at L4,5 and/or L5, S1 levels, positive straight leg raising (SLR) test, average pain >5 on the Visual Analogue Scale (VAS), leg pain > 3 months, Patients with good concentration and memory function and body mass index (BMI) less than 30 kg/m^2.

While, patients were excluded, if they had ankylosing spondylitis, cauda equina syndrome, fractures, spina bifida, inflammation, diabetes, spinal tumor or surgery, neuropathy and pregnancy.

Randomization

Eligible participants (N=34) were randomly and equally divided to two groups (study and control of 17 patients each) using sealed envelope. Both groups received selected physical therapy program; in addition to that the study group also received thoracic mobilization.

Procedures:

For all patients in both groups, the subsequent evaluations were completed pre and post intervention.

Assessment Procedures:

A- Confirming presence of radicular pain via SLR test:

SLR can be done passively or actively but in the study, it was an active test. Both legs were assessed starting with the unaffected[7]. The patient assumed supine position with no pillow under the head, keeping the knee in extension and the hip in adduction and internal rotation. The physiotherapist grasped around the patient's

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heel and distal thigh (anterior) to keep the knee extended.

The patient was asked to lift the leg keeping the knee straight until feeling discomfort or tension in the back of the leg or lower back[7]. Then the patient slowly lowered the leg until the feeling resolved, at which point he/she put the ankle in dorsiflexion and were asked to flex the neck [8]. If the pain stilled present or increased, this indicated that the test was positive for sciatica.

B- Assessment of back pain and radiated pain intensity using VAS:

The VAS is a 100 mm line which has two ends; one is "no pain" (score of 0) and the other end is "worst imaginable pain" (score of 10). Patient was instructed to mark at the suitable point representing their average back and leg pain intensity separately [9].

C- Assessment of sagittal lumbar mobility using Schober Test:

The patient was standing. The physiotherapist made markings at L5 spinous process, and 5 cm below and 10 cm above this point using tape measurement. Patients were instructed to touch their toes without flexing the to measure lumbar mobility in flexion. Normally this distance increases by at least 5 cm [10].

Interventions:

Patients in both groups received the following conventional physiotherapy program which included:

1-Transcutaneous electric Nerve Stimulation (TENS)

Patient was prone lying with a pillow under the pelvis and under the chest to keep the back in a horizontal level. Electrodes were placed paraspinally (corresponding to L4-L5 or L5-S1 levels) and on the course of sciatic nerve. 4 Hz frequency and 0.1 seconds pulse duration were used. The intensity level of the electrical stimulation was carefully adjusted to each patient's maximum tolerance threshold, for 20 minutes[11].

2-Ultrasound:

It was applied to paraspinal muscles with a frequency of 1 MHz with a continuous mode and 0.5 W/Cm2 for 5 minutes using moving sound head technique [12].

***3- Lumbar stabilization exercises*:** was performed according to Mohgadam et [13]. Kostadinovic et al. [10].

Exercise 1.

Patients were in crook-lying position. Draw the lower abdomen in and hold for 10 seconds and repeat 10 times with 10 seconds rest interval.

Exercise 2.

Same as exercise 1 but performed while the patient stayed on hands and knees and neutral lumbar spine.

Exercise 3. Bridging

Patient was in crook lying position; draw the lower abdomen in while lifting buttocks off the floor. Hold for 10 seconds and repeat 10 times with 10 seconds rest interval.

Exercise 4. Bridge with Knee Extension

As exercise 3 but the patient extends one knee while remaining at bridge position. Hold for 10 seconds and repeat 10 times with10 seconds rest interval.

Exercise 5. Curl up (raising the head and shoulders)

Patients were asked to be in crook lying maintaining feet rested on the bed and hands across the chest. Patients were instructed to raise the head and shoulders only from the bed. Hold for 10 seconds and repeat 10 times with 10 seconds rest interval.

Exercise 6. Quadruped (Bird dog position)

Patient started on all fours, with knees directly underneath hips and hands underneath the shoulders. Aiming for a neutral position in the spine. Patients draw the abdomen in and contract the lumbar paraspinal muscles keeping the back neutral, lifting one leg behind and lifting opposite arm in front. Hold for 10 seconds and repeat 10 times 10 seconds rest interval.

Patients in the study group received thoracic mobilization technique in addition to the conventional physiotherapy program.

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Thoracic mobilization:

Patients were instructed to lie in a prone position, then therapist applied grade 2–3 central postero-anterior glide mobilization to the T5–T12 spinous processes after their localization and palpation. Mobilization performed for 60 seconds then relax for 15 s and repeated for 5 minutes after confirming the comfort of the patients during the procedure [14].

Data analysis:

Independent t-test was used for testing differences between groups in demographic data except sex distribution was tested with Chi-squared test. Normality distribution and homogeneity of variance of the variables were confirmed with Shapiro-Wilk and Levene's tests, respectively. Mixed MANOVA (with Bonferroni correction for multiple comparisons) was performed to analyze differences within- and between-group in VAS for back pain, VAS for radiated pain and lumbar mobility. Alpha was set at 0.05. Analysis was done with Statistical Package for Social Studies (SPSS) version 25 for windows (IBM SPSS, Chicago, IL, USA).

Results

***Subject characteristics*:**

Table (1) shows baseline characteristics of patients of both groups. There were no significant differences between both groups in all demographic data ($p > 0.05$).

Table 1. Subject characteristics of study and control groups.

	Study group	Control group	p-value
	Mean ± SD	**Mean ± SD**	
Age (years)	36.76 ± 4.32	34.94 ± 4.71	0.24
Height (cm)	164.76 ± 5.55	166.17 ± 4.41	0.41
Weight (kg)	70.23 ± 8.28	71.47 ± 10.05	0.69
BMI (kg/m²)	25.89 ± 2. 95	25.81 ± 3.08	0.94
Duration of pain (month)	6.06 ± 1.64	5.71 ± 1.76	0.55
Sex, n (%)			
Females	12 (71%)	9 (53%)	0.29
Males	5 (29%)	8 (47%)	

SD, Standard deviation; p value, Level of significance.

Impact of intervention on back pain, radiated pain, and lumbar mobility:

There was a significant main effect of time ($F = 169.27$, $p = 0.001$), treatment ($F = 5.63$, $p = 0.003$), and interaction of treatment and time ($F = 19.53$, $p = 0.001$).

Within group comparison

There was a statistically significant decrease in the mean score of VAS for back pain and VAS for radiated pain in both groups post treatment ($p < 0.001$). The percent of change of in VAS score for back pain, and VAS score for radiated pain of study group were, 49.56 and 42.94 respectively; and that

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of control group were, 27.15 and 23.11 respectively (Table 2).

In addition, there was a statistically significant increase in the mean score of lumbar mobility of in both groups post treatment ($p < 0.001$). The percent of change in lumber mobility of study and control groups were 16.95% and 7.38% respectively.

Between group comparison

There was no statistically significant difference between both groups pretreatment ($p > 0.05$). There was a statistically significant difference in the mean score of VAS for back pain, and VAS for radiated pain and lumbar mobility between groups post-treatment in favor of the study group ($p < 0.01$). (Table 2)

Table 2. Comparison of back pain, radiated pain, and lumbar mobility pre and post treatment for both groups.

	Pre-treatment	Post -treatment			
	Mean ±SD	**Mean ±SD**	**MD**	**% of change**	**p value**
VAVAS score for back pain					
Study group	5.71 ± 1.21	2.88 ± 1.11	2.83	49.56	0.001
Control group	5.82 ± 0.81	4.24 ± 0.90	1.58	27.15	0.001
MD	-0.11	-1.36			
	p = 0.74	***p = 0.001***			
VAS score for radiated pain					
Study group	6.59 ± 1.18	3.76 ± 1.14	2.83	42.94	0.001
Control group	6.88 ± 0.92	5.29 ± 0.84	1.59	23.11	0.001
MD	-0.29	-1.53			
	p = 0.42	***p = 0.001***			
Lumber mobility flexion score (cm)					
Study group	17.35 ± 0.86	20.29 ± 1.16	-2.94	16.95	0.001
Control group	17.47 ± 0.62	18.76 ± 0.97	-1.29	7.38	0.001
MD	-0.12	1.53			
	p = 0.65	***p = 0.001***			

SD, Standard deviation; MD, Mean difference; p value, Probability value

Discussion

Patients with LR complain from LBP and leg pain. Low back pain causes significant disability globally. This research was undergone to study the effects of thoracic spine mobilization on pain and lumbar mobility LR patients.

Regarding VAS score for back pain, the result of this study showed that there was a marked reduction in back pain in both groups post treatment in favor of study group who received thoracic spine mobilization.

Results regarding VAS score for back pain in the study group were in accordance with the finding of Yang and Kim [15], who found that thoracic mobilization decrease pain in patients with chronic LBP.

The results of this study also agreed with Heo et al.[16] and Sung et al [14]. who found that thoracic mobilization decreases back pain and mentioned that significant reduction of back pain in patients received thoracic spine mobilization might be attributed to that reduction of the excessive movement of the relatively unstable

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lumbar segment by improvement of thoracic mobility which showed restricted movement.

Regarding lumbar mobility, there was a marked improvement in lumbar flexion range of movement in both groups post treatment in favor of study group that received thoracic spine mobilization.

Significant increase of lumbar mobility in both groups might be attributed to the significant reduction of pain. This explanation was supported by the fact that pain leads to limitation in range of motion. Alexander and LaPier [17] reported that LBP limits range of motion. Patients with LR avoid leaning forward for fear of increasing pain resulting from compression of disc on nerve root.

Thoracic kyphosis reduces thoracic mobility and increases the abnormal movement at the lumbar spine causing lumbar instability, and easily recurrence of LBP and symptoms of lumbar radiculopathy [18]. The significantly higher decrease of pain in the study group compared with the control group might be attributed to improved lumbar stability via improved local trunk muscle function and hence proprioception [19].

Physiotherapists are encouraged to include thoracic spine mobilization to the traditional program of treatment of patients with LR.

Limitations

This study has some limitations. Firstly, the way by which study sample was selected (convenient) sampling rather than random sample which may affect generalization of the results. Secondly, lack of follow up to determine long term effect of thoracic mobilization on pain and lumbar mobility in patients with LR. Thirdly, thoracic spine mobility was not measured in this study. Fourthly, the effect size in this study between groups were small (mean difference was less than the minimal clinical important difference), but increasing the dose and the treatment duration may improve this.

Conclusion:

Based on the result of this study, it was concluded that thoracic spine has a beneficial effect for reducing pain and improving lumbar mobility in patients with chronic LR.

Acknowledgment
None.

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