

A case study on prolapsed intervertebral disc L4-L5

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Abstract: Prolapsed intervertebral disc is shift of nucleus pulposus outside the space of the intervertebral disc. Prolapsed intervertebral disc is one of the widespread and expensive health conditions in India. Heavy lifting, twisting and trauma were the most common causes of prolapsed intervertebral disc, in which 52-60% are work related. It may occur at any level, but in 95% of the cases it occurs at L4/5 or L5/S1. Repetitive activities such as bending, turning, twisting may cause tears in the annulus. Obesity, smoking, and improper posture while sitting or standing to make the disks more vulnerable to injuries resulting in PIVD. There are various complications of lumbar disc herniation such as foot drop, sciatic nerve injuries, and lumbar-plexopathies. Foot drop can be caused by L4 L5 radiculopathy. Four stages of PIVD are as follows– 1) Bulging disc 2) Protrusion 3) extrusion 4) sequestrization. Herniation and inflammation of the disc put pressure on the traversing spinal nerve which can cause radicular symptoms. Soft tissue massage, joint mobilisation, extension exercises were executed to relieve nerve root irritation and pain. Electrotherapy modalities are useful in the treatment of prolapsed intervertebral disc. TENS is a method of electrical stimulation which primarily aims to provide a degree of symptomatic pain relief by exciting sensory nerves and thereby stimulating either the pain gate mechanism and/or the opioid system. QL stretches can help improve flexibility and relieve aches and pains while preventing new ones. This study aims to find out the combined effect of transcutaneous electrical nerve stimulator and exercise therapy included with upper body extension along with release of quadratus lumborum muscle. This study results shows that in case of prolapsed disc conditions, TENS therapy, upper extension and supine rotational stretch along with QL-release exercise could be applicable to get the better therapeutic results to make the patients functional.

Keywords: prolapsed/herniated disc, Low back pain, quadratus lumborum, extension exercises.

INTRODUCTION:

Prolapsed intervertebral disc is shift of nucleus pulposus outside the space of the intervertebral disc [1]. Prolapsed intervertebral disc is one of the widespread and expensive health conditions in India. Heavy lifting, twisting and trauma were the most common causes of prolapsed intervertebral disc, in which 52-60% are work related. Prolapsed intervertebral disc is the most prevalent condition between the ages of 30 and 50, with male to female ratio of 2:1, and related to repetitive mechanical forces [2]. It may occur at any level, but in 95% of the cases it occurs at L4/5 or L5/S1 [3]. The clinical characteristics of the prolapsed intervertebral disc are pain and numbness radiating due to nerve root compression radiating to the buttocks and lower extremities [1].

The patients between 25-55 years old have an approximately 95 percent chance of herniated discs occurring either at L4-L5 or L5-S1. Disc disease is the underlying aetiology in less than five percent of patients with back pain [3]. Repetitive activities such as bending, turning, twisting may cause tears in the annulus. Obesity, smoking,

and improper posture while sitting or standing to make the disks more vulnerable to injuries resulting in PIVD. Lifting weights and traumatic injuries frequently result in PIVD[4]. One of the prevalent musculoskeletal disorders is prolapsed intervertebral disc and it is closely linked with functional disability of trunk muscles, such as back extensors and abdominal muscles. Disc herniation, as the key contributor to back pain, has a significant effect on the work, everyday life and quality of life of people, even persistent neurological disorders and incontinence for a lifetime due to syndrome of cauda equina [5]. There are various complications of lumbar disc herniation such as foot drop, sciatic nerve injuries, and lumbarplexopathies [6]. Foot drop can be caused by L4 L5 radiculopathy [7].

Four stages of PIVD –1) Bulging disc 2) Protrusion 3) extrusion 4) sequestrization.

Herniation and inflammation of the disc put pressure on the traversing spinal nerve which can cause radicular symptoms. The degree of alternative disc degeneration increases the chance of lower back pain [8,9]. Poor posture, prolonged sitting, poor lifting technique, obesity, pregnancy, and falls from height are the predisposing factors of PIVD. Due to the consequence of PIVD, there may be a chance of poor balance and a higher chance of dependency in the geriatric population [10,11].

The choice of investigation for suspect the intervertebral disc prolapsed are:

Plain X-rays- These are usually taken to rule out any fracture or malalignment. Plain X-rays don't give any information on nerve root or spinal cord compression. CT L-spine- it gives some information on bony alignment and occasionally, it is combined with myelogram to demonstrate any functional compression or obstruction. MRI lumbar spine- this is a gold standard in looking for lumbar disc prolapsed and to delineate the degree of nerve root or cauda equina compression [12].

Physiotherapy treatment for a disc-prolapse:

soft tissue massage, joint mobilisation, extension exercises to relieve nerve root irritation and pain, lower back exercises and techniques to help restore normal pain-free mobility and stability of the spine, Acupuncture, electrical stimulation such as TENS to help with pain. Electrotherapy modalities are useful in the treatment of prolapsed intervertebral disc.

Transcutaneous electrical nerve stimulation (TENS) : It is the One of the most common forms of electrical stimulation used for pain management, which provides short term pain relief. Electrical nerve stimulation is used to relieve pain associated with various conditions, including back pain. TENS is a method of electrical stimulation which primarily aims to provide a degree of symptomatic pain relief by exciting sensory nerves and thereby stimulating either the pain gate mechanism and/or the opioid system. The different methods of applying TENS relate to these different physiological mechanisms. The effectiveness of TENS varies with the clinical pain being treated, but research would suggest that when used 'well' it provides significantly greater pain relief than a placebo intervention.

Release of quadratus lumborum muscle: In this we perform supine rotation stretch. QL stretches can help improve flexibility and relieve aches and pains while preventing new ones. The quadratus lumborum (QL) is a deep core muscle located at back, which runs from the top of pelvis to bottom rib on either side of spine.

Upper body extension:- It can strengthen lower back muscles. This includes the erector spinae, which supports the lower spine. Back extensions also work the muscles in buttock, hips, and shoulders. Back extension exercises might provide relief in case of low back pain.

This study aims to find out the combined effect of transcutaneous electrical nerve stimulator and exercise therapy included with upper body extension along with release of quadratus lumborum muscle.

MATERIALS AND METHODS:

Case History: in this current study, patient (female) had severe low back pain following the consequences of prolapsed intervertebral disc. She was unable to bend forward even a bit. When she straight his spine, usually felt a great amount of comfort. My client had radiating pain which was up to left knee level. While sneezing or coughing, she felt current like pain. She used to feel pain usually during standing rather taking a walk. Client felt also tingling like sensation her right leg. She came to physiotherapy department of Rama University to resolve the issues due to her PIVD leading to low back pain. After 3 weeks of treatment patient got a lot of relief in terms of pain.

Numeric pain rating scale (NPRS): To continue the treatment and to know the intensity of pain we need to use NPRS (Numeric pain rating scale) A pain scale measures a patient's pain intensity or other features. Pain scales are a common communication tool in medical contexts, and are used in a variety of medical settings. Pain scales are a necessity to assist with better assessment of pain and patient screening.



Pain score for the patient:

Patient’s pain intensity before and after the treatment on NMRS is as follows:

Pre Treatment: 9 (severe pain)

Post Treatment: 0 (no pain)

Treatment:

S/N		1 st week	2 nd week	3 rd week
1	Treatment	TENS	TENS+ upper body extension exs + Lumbar extension exs and release of quadrates lumborum	TENS+ upper body extension exs + Lumbar extension exs and release of quadrates lumborum
2	Duration	30 minutes TENS	20 minutes TENS & above described exs	20 minutes TENS & above described exs
3	Frequency	3 times a day for TENS	2 times a day for TENS, 6 repetitions for exs	1 times a day for TENS, 10 repetitions for exs

4	Holding time		3 seconds for each exercise	6 seconds for each exercise
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PROCEDURE:-

1st week:

In the first week, our main goal was to reduce pain and prevent the recurrence of symptoms, so for that, we started symptomatic management of the same. For pain reduction, Conventional Transcutaneous Electrical Nerve Stimulation (TENS) was given for 30mins, 3 times in a day.

2nd week:

In second week we will apply tens for 20 minutes, two times in a day and perform lumbar extension exercises on patient such as upper body extension in prone position and will do release of quadratus muscle such as supine rotation stretch. We will do these exercises with 6 repetitions with 3 seconds holding time in each session. It will help in reducing lower back pain and will helpful in speedy recovery.

Upper body extension: lay on the stomach and keep' a pillow underneath. Hold both hands on the back bending the hands at the elbows. Lift the region above the stomach slowly.

At the same time, bring the chin near the chest.

Supine Rotation Stretch:

- Lie on your back, bending your knees and putting your feet flat on the floor. Rest your arms next to your sides.
- Keep your shoulder blades on the ground and your knees together. Slowly lower your knees to one side until you feel a stretch in your lower back.
- Hold this position for 20 to 30 seconds, and then return your knees to the starting position. Switch sides to stretch opposite quadratus lumborum.

The QL is vital part of the flexion and extension of your core. Keeping it in good health will benefit overall spinal health and stability. Quadratus lumborum stretches are just one way to maintain a healthy back.



Upper body extension exercise



Supine Rotation stretch

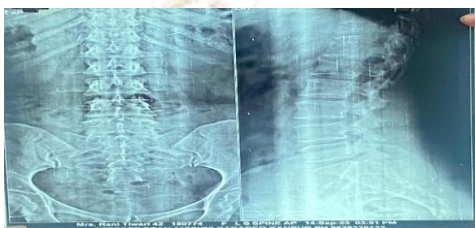


3rd week:

Apply Tens for 20 mins and Perform same exercises as above with 10 repetitions and 6 seconds holding time.

The quick reduction in lumbar disc herniation would appear to be related to a segmental disc unloading force produced during extension traction procedures for increasing the lumbar curvature. Back extension exercises improve the stability and strength of erector spinae muscles. They also improve the range of motion of lower back and can have a rehabilitative effect on people with poor lumbar or thoracic back posture.

RADIOLOGICAL FINDINGS:



KAPUR THESIS	
<small>(Department of Physiotherapy, All India Institute of Physical and Occupational Therapy, Delhi)</small>	
Name :	RANI TIWARI
Date :	16. 10. 2023
Referred by :	DR. K. SINGH
MF No. :	00
Age :	
Sex :	F
PHYSIOLOGY OF LUMBO-SACRAL SPINE	
<small>(A Study of the Effect of Extension and Flexion on the Intervertebral Disc)</small>	
General notes: Diffuse disc bulge seen at L4, 5 & L5-S1 levels producing mild to moderate anterolateral compression over Central aspect of thecal sac. Latent recesses & posterolateral recesses are mildly compromised.	
FINDINGS	
L4/5: Disc bulge, mild annular tears.	
L5/S1: Disc bulge, mild annular tears.	
FINDINGS	
Bony of the vertebrae and intervertebral disc are showing normal height, morphology, fracture, dislocation and spinal cord. No significant disc bulging or protrusion or extrusion or sequestered disc fragments are observed over entire levels of lumbar spine.	
L4/5 & L5/S1 levels show mild disc bulging, annular tear, mild posterolateral, posteromedial and lateral recess compromise, mild spinal stenosis, & mild foraminal stenosis. No evidence of primary spinal stenosis.	
IMPRESSION:	
MINOR TO MODERATE DEGENERATIVE CHANGE BROAD BASE DEGENERATIVE DISC	
AT L4, 5 & L5-S1 LEVEL WITH MINIMAL SPINAL STENOSIS	
POSTEROLATERAL RECESS COMPROMISE	
DR. K. SINGH MPT (Diploma)	

DISCUSSION: PIVD is the result from torn annulus fibrosus. This causes coming out the nucleus pulposus from disc and pain may result. According to Parker SL, Mendenhall SK, Godil SS, et al, 29% disc herniation are associated with nucleus pulposus [13]. The study sought to analyze the effect of long-term TENS therapy in patients with degenerative disc disease to reduce pain. TENS therapy contributed to pain relief and improvement of function and mobility of the lumbosacral spine [18]. Linda S. et al. Suggested that the effects of varying frequency, intensity and stimulation site, of transcutaneous electrical nerve stimulation (tens) in an experimental model of pain. They concluded in their research that the effectiveness of tens for pain relief took the treatment duration of 30-45 min thrice in a day and found that the effective diminishing of pain through Tens. [18] this is backed up by another study published in literature as well. [19]. Basic purpose of TENS-treatment is to provide a measure for pain relief in connection with symptomatic way. TENS causes stimulation of pain-gate mechanism and opioid systems through exciting sensory nerves [20]. One more study by Marchand S, et al. Emphasized that TENS is effective at reducing pain and helps to improve the physical functions [17]. All these studies have supported my current study findings in terms of reducing pain with the help of TENS therapy. Since TENS work through central and peripheral mechanisms by using the pain-gate theory strategy to control the pain signals in a effective way. As TENS decreases the number of pain stimulus going towards the brain via spinal cord. Thus C-fibres are inhibited this way leading to pain relief. Thus effectiveness of TENS therapy regarding herniated disc cannot be deselected.

Study by Lee Y, et al. has investigated that lumbar extension exercise has been found to be effective to increase lumbar flexion and extension which is contradictory to this study [14]. Upper body extension treatment having power to increase the strength of weak extensor muscles after PIVD issues. [15] And as declared by O'sullivan et.al, core stabilization exercises program of 10 weeks given to the patient results in pain relief following disc prolapsed. [16]] these statements match with our research-findings. Also extension exercises were found to be more effective in comparison to core strengthening in patients with low back pain following PIVD. So once again these published research-outcomes are in favour of my current study. These extension exercises restore or maintain the lumbar lordosis or decrease pain after herniated disc. [21]] extension exercises have been found to be valuable in centralizing pain, and regaining functionality [22]. Extension exercise helps shifting the disc in opposite side of derangement thus reducing the disc prolapsed [22]. McKenzie recommends repeated spinal extension exercises for the posterior disc herniation. Key point of concern In the presence of listing, listing correction must be done before extension exercises start. [23]. Exercises help in improving range of motion and strengthening the muscle.

These published studies-outcomes have strongly favoured my current study-results as upper extension exercises regimen used in current study has showed that tremendous improvements in the patients with low back pain after the disc conditions. This manoeuvre causes restoration of extensor muscles strength, increasing stability of spine, pushing the disc materials in anterior directions, causing re-arrangement of the internal disc-issues and finally getting the pain relief. In the course of the upper extension exercise cause many repetitions leading to re-adjustment of the bulged disc materials as well.

The quadratus lumborum muscle involves the 12th rib (internal surface) and the transverse processes of the lumbar bodies of L1-L4, while it comes from the iliac crest (inner lip) and the iliolumbar ligament [24]. The positive role of the Muscle energy technique to release the short, tightened and spasmodic quadrates lumborum muscle has been supported by literature. The one study was undertaken to assess the immediate effectiveness of Muscle Energy Technique on Quadratus Lumborum muscle in patients with acute and sub acute nonspecific low back pain. The changes observed in this study are noteworthy in terms of significant reduction in low back pain. The reduction in pain due to MET can be explained on the basis of neurophysiology, as described by Chaitow that Post-isometric relaxation refers to: the subsequent reduction in the tone of agonist muscle after isometric contraction, it occurs due to Golgi tendon organ stretch receptors located in the tendon of the agonist muscle. These stretch receptors react to overstretching of muscle by inhibiting further muscle contraction. Muscle relaxation following MET results in pain reduction and increased mobility in lumbar spine. A study conducted by Ronald Schenk, et al. Concluded that Muscle energy technique of Quadratus Lumborum along with hot pack is beneficial in immediately reducing non specific low back pain and improving lumbar spine mobility Quadratus lumborum. Because it connects the pelvis to the spine and bilateral contraction produces lumbar-extension [25]. The QL muscle is flattened and has a quadrangular shape; along with the multifidus and erector spinae muscles, it helps to create an antagonist force compared to the muscles of the abdomen [26]. Stretching of the quadratus lumborum is also effective in patients with nonspecific low back pain. The quadratus lumborum, or QL, is a common source of lower back pain Because the QL connects the pelvis to the spine and is therefore capable of extending the lower back when contracting bilaterally, the two QLs pick up the slack, as it were, when the lower fibers of the erector spinae are weak or inhibited [27]. A strong QL can help maintain proper spinal alignment, prevent lower back pain, and support optimal movement patterns during daily activities and sports. QL-strengthening causes reduced lower back pain, improve posture, and enhance overall performance. [28].

So, QL muscle release is the key concern given low back pain after the disc associated problems. Since both QL contraction results in extension of the spine, during upper extension exercise performed in the current study definitely will use the QL muscle. Thus role of QL obviously cannot be ignored during upper extension exercises regimen. Also, supine rotation stretch used in the current study surely will involve the QL muscle in terms of its stretching. Therefore, this exercise program along with QL release will be effective criteria to solve the problems associated with low back pain consequences following disk prolapsed.

LIMITATION:

1. Single subject study shows very small sample size, thus study results cannot be properly generalized.
2. Different patients have various responses from the particular treatment.
3. Others combinations of treatments can be used and various changes following treatment could be seen.
4. Treatment duration could be modified to get the different outcomes.
5. Psychological impact over patients after long terms-illness also could be considered in this regards.

CONCLUSION: this study results shows that in case of prolapsed disc conditions, TENS therapy, upper extension and supine rotational stretch along with QL-release exercise could be applicable to get the better therapeutic results to make the patients functional. These outcomes could also be performed in clinical-settings to help the patients in recovering from low back pain after disc issues.

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