Prone Lumbar Traction: An Underexplored Alternative for Lumbar Radiculopathy and Discogenic Low Back pain

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Abstract

Lumbar disc disorders and herniation are leading causes of discogenic low back pain (DLBP) and lumbar radiculopathy, often resulting in spinal surgery. Lumbar traction is an effective conservative treatment for DLBP, shown to decrease pain, improve functional disability, and positively affect disc height and herniation index. While typically applied in the supine position, lumbar traction can also be administered prone. However, many practitioners are unaware of this alternative approach. Studies have demonstrated that prone lumbar traction can effectively alleviate pain and disability in persons with DLBP, lumbar disc herniation, and radiculopathy. Some research suggests it may be more effective than supine traction for certain subgroups. Despite these promising findings, additional research is needed to further explore the clinical and biomechanical effects of prone traction. Additionally, it is important to identify which patient subgroups are more likely to benefit from prone versus supine traction. This review explores the potential of prone lumbar traction as an underutilized yet promising alternative in the management of DLBP and lumbar radiculopathy.

Keywords: Disc herniation, intervertebral disc displacement, low back pain, radiculopathy, sciatica, traction, physical therapy.

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Introduction

Lumbar spine is a common site of pain and musculoskeletal symptoms, with low back pain being a leading cause of disability worldwide.[1] Different structures can serve as the source of low back pain, one of which is the lumbar intervertebral discs.[2-6] Conditions such as degenerative disc disorders, lumbar disc bulge, protrusion, and herniation can result in discogenic low back pain, which is characterised by local and radiating pain, numbness, paresthesia, increased functional disability and fall risk, decreased range of motion, and impaired postural stability and sensory integration of balance.[2-6] Literature has shown disc related disorders as the most common cause of low back pain requiring surgery, particularly in the working-age population[1] and 58.6% of symptomatic young patients under 30 years of age demonstrate radiological evidence of lumbar disc degeneration.[2] Lumbar disc herniation or prolapse can cause central or foraminal stenosis, depending on the direction of the protrusion. This can result in either bilateral or unilateral radiating symptoms. In addition to discogenic low back pain, posterolateral, paracentral, and foraminal disc herniation can result in lumbar radiculopathy and sciatica. Treatment options for discogenic low back pain range from conservative approaches to surgical procedures. Conservative treatments include physical therapy and medication, while surgical options may involve discectomy or laminectomy. Among the conservative treatments, lumbar traction is the mainstay for managing discogenic low back pain and lumbar radiculopathy,[5,7] however it is mostly applied in the supine position, and most practitioners are unaware of other positions in which lumbar traction can be administered. This review focuses on exploring the potential benefits and applications of prone lumbar traction as an alternative to the conventional supine approach.

Lumbar Traction as a treatment modality for discogenic low back pain and lumbar radiculopathy

Lumbar traction is the mainstay for managing discogenic low back pain and lumbar radiculopathy, among conservative treatments.[5,7] It involves the application of a distraction force to the lumbar spine, which separates the spinal segments, consequently reducing intervertebral disc pressure and spinal nerve root compression,[8-10] as shown in Figure-1. This distraction force at the lumbar spinal segments also creates negative pressure within the intervertebral disc that pulls the disc's contents toward its center.[8-10] This process increases intervertebral disc height.[3,4,11] As a result, the antero-posterior width of the disc decreases,[8-10] which ultimately reduces the extent of disc protrusion.[8,10,11]

Recent systematic reviews have shown lumbar traction to be effective in reducing pain and disability in individuals

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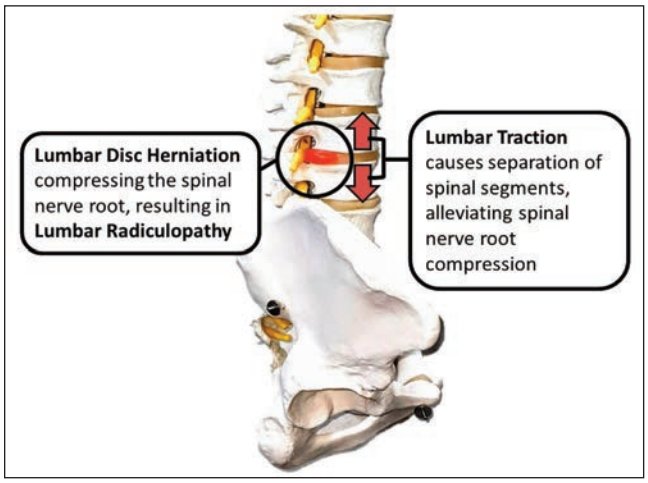

Figure-1: Mechanism of action of lumbar traction for alleviating symptoms of discogenic low back pain and lumbar radiculopathy.

Figure-2: Administration of lumbar traction in different positions: Supine with hips and knees flexed at 90° (top left), Supine (top right), Prone (bottom left) and Prone with pillow placed beneath abdomen (bottom right).

with lumbar disc herniation[5] and radiculopathy[7] and suggest the use of lumbar traction in conjunction with other physical therapy techniques.[5] Furthermore, numerous studies have demonstrated that mechanical traction leads to significant improvements in radiological outcomes, such as increased disc height and reduced disc herniation index, in individuals with discogenic low back pain.[3,4,11]

When considering lumbar traction as a treatment modality, multiple variables can be adjusted, which include the force applied, the angle of pull, and the patient's position.[10] Traction can be administered in various positions, such as supine, supine with knees and hips flexed, prone, prone with pillows placed underneath the belly, side lying and sitting (Figure-2).[10] Additionally, the mode of traction may vary; it can be manual or mechanical and can be administered in a sustained or intermittent manner.[10] Moreover, the angle of pull is also said to determine which spinal segment will be targetted when lumbar traction is applied.[10]

Lumbar Traction in Prone - An Underexplored Alternative

Even though traction can be applied in various positions, it is usually applied as the patient lies supine. As most clinicians are unaware of other possible positions, such as the prone position, they are often overlooked, underexplored and underutilized.[5,7,10] The supine position facilitates patient comfort and ease of setup, and it has been extensively studied, demonstrating efficacy in relieving symptoms and improving function.[5,7] However, the supine position may not be optimal for all patients. Furthermore, some research studies have also shown lumbar traction administered in prone position to be effective in improving pain and disability in persons with discogenic low back pain and lumbar radiculopathy as well.[12-14] Some additional positives of administering lumbar traction in prone include the simultaneous application of electrotherapeutic and heating modalities in combination with traction,[8,9] as well as inclusion of lumbar extension in combination with lumbar traction in prone, as the combination of lumbar extension and traction have been found to facilitate recovery in lumbar disc herniation[15] and can be especially useful in persons who respond well to extension bias treatment.

Comparative Analysis of Prone and Supine Lumbar Traction: Clinical Decision-Making

While evidence comparing prone and supine lumbar traction for discogenic low back pain and lumbar radiculopathy is limited, existing studies consistently report that prone traction is more effective in improving low back pain and disability,[12-14] as shown in Table. Although traction administered in the prone position has been found to be more effective, the decision of whether to use traction for patients with discogenic low back pain, lumbar disc herniation and radiculopathy in the supine or prone position is not straightforward. The choice of patient positioning during lumbar traction should be tailored to the individual's specific biomechanical dysfunction to ensure the technique provides the greatest relief. For example, patients with postero-lateral and para-central disc herniation, which can cause lumbar radiculopathy, often respond well to extension-based treatments such as McKenzie's extension bias protocol.[16] Extension

Table: Published studies comparing the effects of traction administered in supine and prone position.

Reference	Population	Sample Size	Treatment duration	Traction Protocol	Additional treatment	Outcome Measures	Results
Beyki M et al, 2007[12]	Discogenic low back pain	124 (Prone traction=62, Supine Traction=62)	4 weeks (10 sessions)	Intermittent (35-40% BW) for 30 min	TENS and Heating Pad	NPRS and ODI	Both groups demonstrated significant improvements in terms of NPRS and ODI, however a significantly greater improvement was observed in participants receiving traction in prone position as compared to supine.
Filiz MB et al 2018[13]	Lumbar radiculopathy	115 (Prone traction=39, Supine Traction=39, PT only=40)	3 weeks (15 sessions)	Intermittent (25-50% BW) for 15 min	US, TENS, Heating Pad and strengthening exercises.	VAS, ODI and mLST	All groups were effective in terms of improving VAS, ODI and mLST. No significant differences were observed between the supine traction as compared to prone traction, and between supine traction and PT only groups. However, prone traction was found to be more effective than PT only in terms of VAS and ODI. No significant differences were observed between the three groups in terms of mLST.
Khan RR et al 2021[14]	Lumbosacral radiculopathy	60 (Prone traction =30, Supine Traction=30)	2 weeks (10 sessions)	Intermittent (50% BW) for 20 min	TENS and Heating Pad	NPRS and ODI	Both groups demonstrated significant improvements in terms of NPRS and ODI, however a significantly greater improvement was observed in participants receiving traction in prone position as compared to supine.

PT: Physical Therapy, BW: Body Weight, TENS: Trans-cutaneous Electrical Nerve Stimulation, US: Therapeutic Ultrasound, NPRS: Numeric Pain Rating Scale, ODI: Oswestry Disability Index, VAS: Visual Analogue Scale, mLST:Modified Lumbar Schober Test.

movements in these treatments help the disc contents migrate anteriorly,[16] thereby relieving symptoms of back pain and lumbar radiculopathy. As a result, these patients might benefit more from traction administered in the prone position rather than in supine, which facilitates extension and promotes the anterior migration of disc contents.

Research by Chowet al. demonstrates that traction in the supine position increases disc height in the anterior, central, and posterior regions, with a greater increase in posterior disc height as compared to anterior disc height.[9] While this effect may benefit some patients, it could potentially be less effective for those who respond well to extension-biased treatments. The biomechanical effects of prone traction on disc height have not been extensively studied and remain unclear. However, it is hypothesized that prone traction might have a different effect on disc height compared to supine traction, potentially making prone traction more suitable for patients who respond well to extension-based treatments. This hypothesis is partly supported by studies showing that recovery in lumbar disc herniation can be facilitated by combining traction with lumbar extension.[13,15] However, it is important to note that the specific effects of prone traction on anterior and posterior disc height have not been definitively established and require further investigation through rigorous original research.

It is important to recognize that prone traction may not be more effective than supine traction for all sub-groups of low back pain patients, as individual responses to treatment can vary significantly. Therefore, a biomechanical approach to make treatment-related decisions should be adopted, similar to the Treatment-Based Classification (TBC) and Mechanical Diagnosis and Therapy (MDT) approaches. To sum up, the choice of position adopted when administering traction should be individualized centered on a thorough understanding of an individual's biomechanical dysfunction and how they respond to different treatments. In future mechanistic studies should be carried out to understand the true biomechanical effects of lumbar traction when applied in different positions. Moreover, future studies should also explore which specific patient subgroups would respond well to traction being administered in which specific position. These insights would provide us with a more personalized approach towards the administration of lumbar traction for management of low back pain, resulting in more optimized patient treatment.

Conclusion

Lumbar traction is a key conservative management strategy for DLBP, lumbar disc herniation, and radiculopathy. While traditionally applied in the supine position, prone lumbar traction is emerging as a promising alternative. Current evidence suggests that prone traction may be more effective for certain patient subgroups, highlighting the need for a personalized approach to treatment. Future research should focus on exploring the biomechanical effects of prone versus supine traction on disc height and herniation index. Additionally, identifying specific patient subgroups that respond optimally to prone or supine traction is important. Investigating the long-term outcomes of prone traction compared to supine traction and exploring its combination with other treatment modalities, such as extension-based exercises or electrotherapy, will further enhance our understanding of the underlying mechanisms. The potential impact of this research on clinical practice will likely be significant. By

optimizing lumbar traction techniques, we may enhance treatment outcomes, reduce the need for invasive procedures, and improve patients quality of life. Moreover, a better understanding of traction positioning could lead to the development of targetted treatment protocols, potentially improving our approach to conservative management of disc-related low back pain. As we continue to refine our understanding of prone lumbar traction, we move closer to a more effective, personalized approach to spinal care that could significantly reduce the global burden of low back pain.

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