BIOMECHANICAL AND CLINICAL EFFECTS OF SPINAL TRACTION: ENHANCING LUMBAR HEALTH AND RESTORING SPINE FUNCTION

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Abstract

Introduction: Lumbar disc degeneration (DD), one of the leading causes of disability worldwide, disrupts spinal biomechanics, leading to pain, disability, and reduced quality of life. Low back pain (LBP) affects up to 80% of the global population [1]. This degeneration process reduces disc height, alters load distribution, and contributes to herniation and nerve impingement [2]. Spinal traction, a non-invasive therapy rooted in biomechanical principles, offers the potential for restoring spinal mechanics by increasing disc height, reducing herniation size, and alleviating pain symptoms [3]. Although widely used clinically, the precise biomechanical and therapeutic mechanisms underlying traction remain insufficiently understood. This study investigates the biomechanical effects and therapeutic outcomes of spinal traction, highlighting its potential to restore spinal health and improve patient outcomes.

Methods: This systematic review (PROSPERO ID: CRD42024598574) analysed studies (1990–2024) on lumbar traction's biomechanical and clinical effects in adults with lumbar DD, herniation, or LBP. Using PRISMA guidelines, it included RCTs and clinical studies comparing traction to sham devices, placebo, or physiotherapy. Key outcomes were biomechanical measures (e.g., disc height, pressure) and clinical results (e.g., pain, disability, herniation size via MRI/CT) and were assessed qualitatively and quantitatively.

Results: The review included 29 studies. Traction therapy showed increases in posterior disc height (+1.0±0.35 mm, n=3), spinal height (+4.3 mm, n=1), and reductions in intradiscal pressure (-100 to -160 mmHg, n=1). Larger hernias showed greater reductions (up to 27.6%). Clinically, traction reduced pain (average VAS reduction: -2.5 points, n=15) and disability (average ODI reduction: -13.8 points, n=11). While no significant differences in efficacy were found between traction and physiotherapy for hernia size or pain, traction outperformed placebo in improving disc height. Most studies used intermittent mechanical traction (35–55% body weight, 10–30 minutes/session, 10–20 sessions), but protocol variability limited conclusions on optimal parameters. Nonetheless, the findings highlight traction's biomechanical and clinical benefits in lumbar decompression and pain relief.

Discussion: Spinal traction demonstrated significant biomechanical effects, particularly in reducing intradiscal pressure and increasing disc height. The greater posterior widening of the discs, potentially correlated to changes in lumbar lordosis and spinal curvature, promotes hydration and relieves stress on degenerative discs (Figure 1). The reduction in hernia size was correlated with increases in disc height, suggesting that unloading the spine promotes posterior migration and reabsorption of herniated material. Positive structural changes and prolonged hernia size reduction were observed in some cases, though long-term effects on disc height remain unclear due to limited follow-up assessments. Traction showed greater efficacy in younger patients or those with mild-to-moderate degeneration, whereas its impact was limited in severe degeneration. These findings highlight the biomechanical relevance of traction in unloading the lumbar spine, restoring load balance, and supporting structural recovery, particularly in selected patient populations. However, limitations include variability in traction protocols, heterogeneity in study populations, and reliance on self-reported clinical outcomes. The absence of long-term follow-up data further limits conclusions on the permanence of biomechanical changes. Standardized traction protocols and objective biomechanical metrics are essential for future research to clarify optimal parameters and better define traction therapy's role as an evidence-based intervention for lumbar spine disorders.

Figure

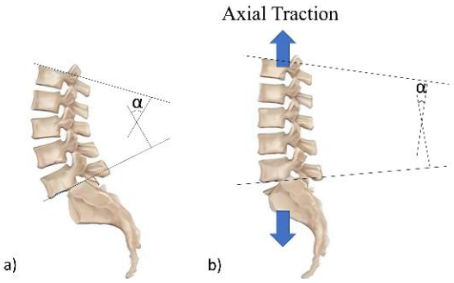


Figure 1: Lumbar spine (a) before and (b) after traction. Traction leads to a reduction in lumbar lordosis (Cobb angle – α) and subsequent increased separation of the posterior region of the vertebrae.

References

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