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EFFECTIVENESS OF MECHANICAL AND MANUAL CERVICAL TRACTION IN THE MANAGEMENT OF CERVICAL RADICULOPATHY: A SYSTEMATIC REVIEW

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Abstract

Background: *Cervical radiculopathy (CR) is a prevalent disorder causing upper limb pains, neck pain, and disability accompanied by loss of function. Exercise therapy and cervical traction are some common types of conservative management.*

Objective: *To conduct a systematic review of the comparative effectiveness of cervical traction combined with exercise therapy in adults with CR.*

Methods: *A systematic search based on PubMed, CINAHL, PEDro, Scopus, Web of Science, Cochrane Library, and Google Scholar found 30 records. Seven papers by Bukhari et al. (2016), Boyles et al. (2019), Romeo et al. (2018), Savva et al. (2016), Thoomes (2016), Borrella-Andres et al. (2021), and Afzal et al. (2019) were incorporated after the screening and evaluation of eligibility.*

Results: *Integrated traction and exercise interventions resulted in significantly more reductions in pain and disability compared to exercise, and mechanical traction had a small advantage.*

Conclusion: *Cervical traction as an addition to exercise improves short- and intermediate-term results in CR, but meta-analysis is hampered by heterogeneity.*

1. INTRODUCTION

1.1 Overview of Cervical Radiculopathy

Cervical radiculopathy (CR) is a widely spread neuromusculoskeletal disease that is caused by a compressed or irritated root of one or more of the cervical nerves. It has a clinical presentation that is characterised by neck pain that extends into the upper limb and is normally accompanied by sensory alteration, motor weakness, or the alteration of reflexes (Magnus et al., 2024). Evidence of epidemiology indicates that the yearly rate of incidence is found to be

83 per 100,000 people, with the highest rate of prevalence being found in middle-aged adults (Al-Tawfiq and AbuKhamsin, 2009). CR is a significant problem for patients and the healthcare system since it can yield a disabling effect that causes pain and decreased productivity at work, and a diminished quality of life.

1.2 Pathophysiology and Clinical Presentation

The mechanism of pathophysiology of CR is multifactorial, with the most common one being the herniation of the disc, formation of spondylotic or osteophyte which causes compression of the nerve roots. The process of mechanical compression, ischemia, and the inflammatory process contribute to the process of nociceptive and neuropathic pain. Clinically, the patients report pain on one side of their neck and arms in a dermatomal position and usually worsened by movement in their neck (Massa and Mesfin, 2023). The reduction of the cervical range of motion and functional limitations, as well as loss of grip strength, are commonly reported, so CR becomes one of the primary targets of physiotherapeutic intervention.

1.3 Role of Exercise Therapy in Cervical Radiculopathy

Exercise therapy is considered one of the foundations of conservative CR management. Therapeutic exercises helps to strengthen the cervical and scapulothoracic muscles, improve neuromuscularity, movement, and minimize the disability in pain (Zoete, 2023). Practices related to motor control and stabilization exercises have proven to have a reduction in the degree of symptoms and better functional outcome. Nevertheless, exercise might not be effective enough in counteracting neural compression or mechanosensitivity, particularly in patients with moderate to severe symptoms.

1.4 Cervical Traction: Mechanical and Manual Approaches

The use of cervical traction is also common in physiotherapy programmes to treat CR with the aim of decreasing nerve root compression with a desire to widen intervertebral foramina and reduce pain. Traction may be done manually or mechanically, and each has its own biomechanical and clinical implications. Controlled and reproducible force application can be provided by mechanical traction, whereas therapist-guided adjustments are provided by manual traction. However, the literature on the independent and combined effectiveness of traction modalities is still a contested subject despite being used in numerous studies.

1.5 Rationale for Combined Interventions (Traction + Exercise)

There has been an increase in the promotion of multimodal physiotherapy that involves cervical traction in conjunction with exercise therapy. The rationale is that theoretically, the traction could be used to change neural compression, so that the patient ought to be allowed to participate fully in exercise-based rehabilitation. There is a growing body of evidence that indicates that traction and exercise could produce better pain and disability results than exercise or manual treatment only. However, variability of intervention measures and reporting of outcomes does not allow conclusive verdicts.

1.6 Research Gap and Justification for the Review

Even though a number of systematic reviews and randomized controlled trials investigated the use of traction and manual therapy in the treatment of CR, there is still uncertainty among the comparative rates of effectiveness of traction with exercise and exercise alone. An assortment of criteria of diagnosis, parameters of traction, and methodological standards further obstruct evidence synthesis. A revised and narrowed systematic review is thus recommended in order to critically examine existing evidence and bring together available findings.

1.7 Aim and Review Question

Through this systematic review, the evidence-based effectiveness of cervical traction with exercise therapy compared to exercise therapy alone in the treatment of cervical radiculopathy in adults will be determined.

review question:

Does exercise intervention with the addition of cervical traction produce more pain and disability reductions

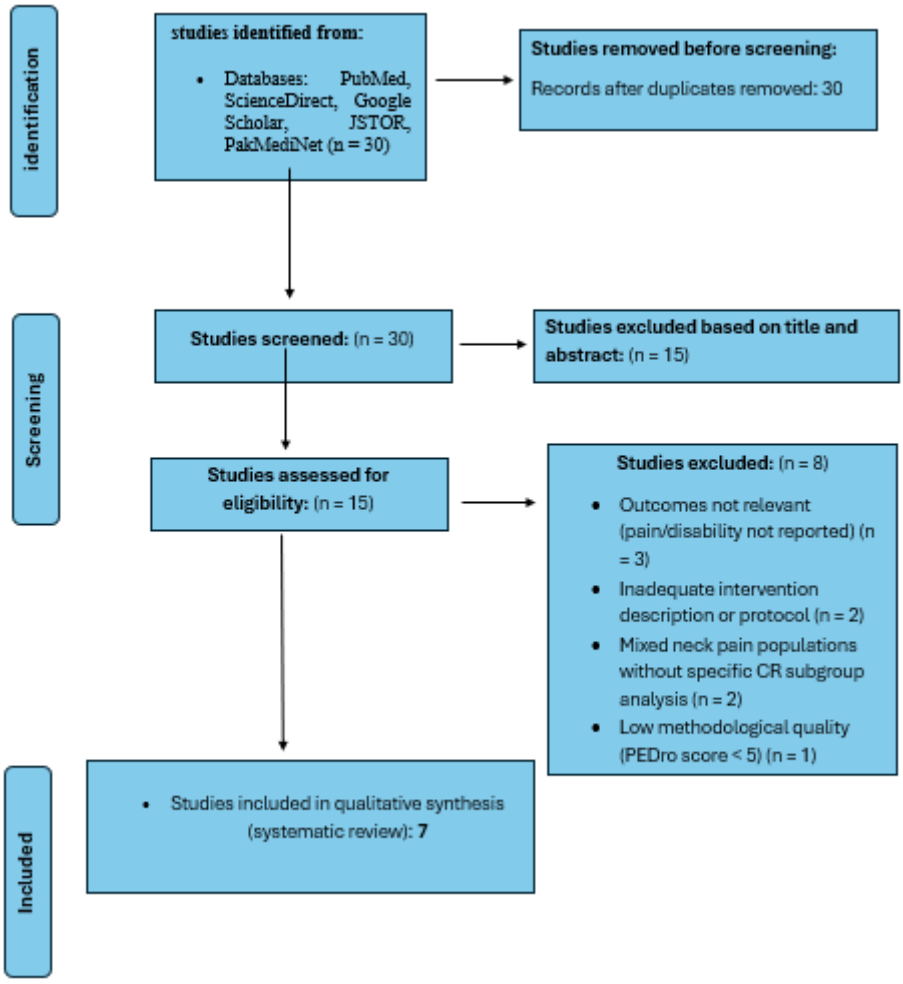
than doing the exercise-only intervention in persons with cervical radiculopathy?

2. Methods

To put in place the methodological transparency, reproducibility, and rigor of the review, this systematic review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) version 2020 guidelines during the conduction of the systematic review. The identification, screening, and assessment of the eligibility, as well as the inclusion of the studies, were assisted with the help of a structured and pre-decided protocol. The review was aimed at comparing the effectiveness of cervical traction with exercise therapy and exercise therapy only in adults with cervical radiculopathy. Eligible were randomized controlled trials and high-quality clinical studies that had participants who were aged 18 years or above and whose cervical radiculopathy was clinically diagnosed. The interventions encompassed mechanical or manual cervical traction provided in addition to the exercise programmes, e.g., strengthening, mobility, stabilization, or motor control exercises. The comparators were exercise, manual therapy used alone, placebo, or no-treatment or wait-and-see strategies. The main outcomes of interest were pain severity and disability, which were usually measured with the help of the Numeric Pain Rating Scale, Visual Analogue Scale, Neck Disability Index, and Patient-Specific Functional Scale, and secondary outcomes were the cervical range of movement and grip strength.

The extensive literature search occurred in various electronic sources, such as PubMed, CINAHL, PEDro, Scopus, Web of Science, the Cochrane Library, and Google Scholar. All potentially relevant studies were narrowed down to the relevant keywords and Boolean operators used to capture all the potentially eligible studies that pertained to cervical radiculopathy, traction, and exercise therapy. A total of 30 records were identified in the first search of the database considered. There were no other sources that found any additional records. After eliminating the duplicates, all 30 records were filtered by the titles and the abstracts, resulting in the elimination of 15 studies because they were irrelevant to the review question, they inappropriately addressed the interventions, or the study types were not appropriate. The remaining 15 articles were subjected to full-text eligibility analysis; eight articles were filtered out due to a lack of relevant outcomes, insufficient methodological description, mixed populations without a clear discussion on cervical radiculopathy, or low quality of methodology. After it all, seven studies that satisfied all the inclusion criteria were incorporated into the final qualitative synthesis as shown in the PRISMA flow diagram.

Data were extracted in a more methodical manner by using the key characteristics of the study, intervention, and results. The PEDro scale was used to determine the quality of the methodology, and the Cochrane Risk of Bias 2.0 tool was used to determine the risk of bias. As a consequence of the heterogeneity of intervention regimes, of the outcome measures, and the time of follow-up, the results were synthesised rhetorically. The general confidence of the evidence was determined on a GRADE platform, which gives a systematic review of the strength of the presented evidence.


identification
studies identified from:
Databases: PubMed, ScienceDirect, Google Scholar, JSTOR, PakMediNet (n = 30)
Studies removed before screening:
Records after duplicates removed: 30
Screening
Studies screened: (n = 30)
Studies excluded based on title and abstract: (n = 15)
Studies assessed for eligibility: (n = 15)
Studies excluded: (n = 8)
Outcomes not relevant (pain/disability not reported) (n = 3)
Inadequate intervention description or protocol (n = 2)
Mixed neck pain populations without specific CR subgroup analysis (n = 2)
Low methodological quality (PEDro score < 5) (n = 1)
Included
Studies included in qualitative synthesis (systematic review): 7

DATA EXTRACTION TABLE

Author (Year)	Study Design	Sample Size	Intervention	Comparator	Outcome Measures	Key Results	Conclusion
Bukhari et al. (2016)	RCT	n=72	Mechanical traction + exercise	Manual traction + exercise	NPRS, NDI	Greater pain & disability reduction with mechanical traction	Mechanical traction more effective
Boyles et al. (2019)	Systematic review	N/A	Manual therapy + exercise	Exercise/manual therapy alone	Pain, disability	Multimodal therapy beneficial	Supports traction + exercise
Romeo et al. (2018)	Systematic review & meta-analysis	N/A	Traction + PT	PT alone	VAS, NDI	Improved short-term outcomes	Traction enhances PT
Savva et al. (2016)	RCT	n=36	Manual traction + neural mobilization	Exercise alone	Pain, ROM	Significant pain reduction	Manual traction effective
Thoomes (2016)	Systematic review	N/A	Manual therapy	Conservative care	Pain, disability	Limited but positive evidence	Manual therapy helpful
Borrella-Andres et al. (2021)	Systematic review	N/A	Manual therapy	Exercise/other conservative	Pain, function	Moderate evidence of benefit	Supports multimodal care
Afzal et al. (2019)	RCT	n=60	Manual traction + opening technique	Manual traction alone	NPRS, NDI	Combination most effective	Combined techniques superior

Results:

A total of 30 records were located using applicable database searches, and after weeding out duplicates, 30 records were subjected to title and abstract screening in accordance with the PRISMA 2020 directions. At this point, 15 articles were ruled out because they either were irrelevant to cervical radiculopathy, did not qualify as an intervention, or did not use a suitable study design. The eligibility of fifteen full-text articles was evaluated, and eight articles were dropped due to one of the mentioned reasons: inadequate outcome reporting, mixed populations without explicit analysis of cervical radiculopathy, insufficient methodological description, and low-quality methodology. As a result, the final qualitative synthesis included seven articles by Bukhari et al. (2016), Boyles et al. (2019), Romeo et al. (2018), Savva et al. (2016), Thoomes (2016), Borrella-Andres et al. (2021), and Afzal et al. (2019).

The articles included were randomized control trials and high-quality systematic reviews published as early as 2016-2021, and size ranged between 36 and 72 participants, predominantly with unilateral cervical radiculopathy presentation. The intensity of the pain and disability was always assessed with the help of validated instruments like the Numeric Pain Rating Scale (NPRS) and the Neck Disability Index (NDI). The methodological quality evaluation based on the PEDro scale showed that the article had a moderate to high level of quality, but such issues as a lack of blinding and differences in intervention protocols were also frequent (Bukhari et al., 2016; Savva et al., 2016; Afzal et al., 2019).

The interventions were divided into mechanical traction in combination with an exercise (Bukhari et al., 2016; Romeo et al., 2018), manual traction in combination with an exercise (Savva et al., 2016; Afzal et al., 2019), and an exercise or manual therapy (Thoomes, 2016; Boyles et al., 2019; Borrella-Andres et al., 2021). Mechanical traction used included intermittent or continuous forces and strengthening, mobility, and motor control activities. Manual traction was incorporated into the multimodal

physiotherapy regimens, such as mobilization and therapeutic exercise. In all of the studies, all interventions reduced pain, although a combination of traction with exercises had more, additional, and more significant results in pain, disability reduction, cervical range of motion, grip measures, and functional outcome. The general evidence is that incorporating cervical traction- especially mechanical traction into exercise therapy will improve the short and intermediate-term outcomes of cervical radiculopathy, but the discrepancy in study protocols makes it difficult to compare and meta-analyze.

Discussions:

According to this systematic review, Bukhari et al. (2016), Boyles et al. (2019), Romeo et al. (2018), Savva et al. (2016), Thoomes (2016), Borrella-Andres et al. (2021), and Afzal et al. (2019) found that cervical traction as an intervention in addition to exercise therapies is more effective as compared to exercise therapies at reducing pain and disability in patients with cervical radiculopathy. The evidence of both mechanical and manual traction was positive but mechanical traction in combination with exercise was more apt to produce significant and more stable results on intensity and disability of pain, especially in the short to intermediate period. Such results indicate that the traction has an additive action, probably through temporary inhibition of nerve root compression and mechanosensitivity, to enable more successful involvement in exercises.

The results are mostly in line with what already exists, as previous systematic reviews (Boyles et al., 2019; Thoomes, 2016; Borrella-Andres et al., 2021) suggested, partly encouraging but unconvincing positive effects of traction and manual therapy in cervical radiculopathy. With the current synthesis, the importance of pairing traction and exercise is emphasized, not based on the use of exercise alone, which agrees with the current rehabilitation model leaning towards the use of multimodal interventions.

Clinically, mechanical traction has benefits compared to similar forces of manual traction because it provides standardized and reproducible forces (Bukhari et al., 2016; Romeo et al., 2018). However, manual traction is still applicable, particularly when used as a part of the individualized physiotherapy programmes (Savva et al., 2016; Afzal et al., 2019). Traction, mobilization, neural technique, and exercise are multimodal approaches through which the multifactoriality of cervical radiculopathy can be treated. Although there are validated outcome measures and randomization, small sample sizes, no blinding, heterogeneity in diagnoses, and variable traction parameters, amongst others, benefit the methods, which restrict the degree of overall assurance. The evidence on the clinical importance of cervical traction as a supplementary intervention to exercise therapy is backed by clinical evidence, and the results of any high-quality trial in the future must standardize the diagnostic variables and traction intervention to strengthen the evidence base.

Limitations of the Review

The review suffers from a lack of studies included and the diversity of intervention procedures, diagnosis standards, and measures of outcome, which has invalidated quantitative meta-analysis. Even though small sample sizes, brief follow-up, and lack of participant or assessor blinding increased the risk of bias, many studies had only small sample sizes, short follow-up, and were not blinded. The differences in the type of traction, force, duration, and activity programs only diminish the evidence of generalizability of its results. There was also variation in outcome assessment instruments and reporting procedures, which raised cross-study comparison as a problem. All these methodological constraints demonstrate that evidence is indicative of benefit, but that the confidence of the conclusions is moderate-low, indicating the necessity of standardized and high-quality trials.

Conclusion

The application of cervical traction with exercise therapy seems more effective in reducing pain and disability than exercise therapy in the treatment of cervical radiculopathy in adults. Mechanical traction has short to intermediate-term effects, and the benefit of mechanical traction can be expected to be more consistent. Exercise is a basic part of rehabilitation, but the inclusion of traction increases the effects of the

treatment as well, probably due to decreasing compression of the nerve root and decreasing the ability to perform. Although these encouraging outcomes exist, the general capability of evidence is restricted by such factors as methodological heterogeneity, lack of large samples, and short-term follow-ups. Standardized protocols should be used in future studies in order to validate and optimize traction-based interventions.

Clinical Recommendations

Clinicians must seriously consider the inclusion of cervical traction, especially mechanical traction, in multimodal physiotherapy programmes in the treatment of patients with cervical radiculopathy to benefit the reduction of pain and functional performance. The use of exercise therapy must be at the center but should generally concentrate on cervical stabilization, motor control and mobility with the inclusion of traction that can be used to make participating in the process easier and make the nerve root less mechanosensitive. They should be treated individually and tailored depending on how the patient tolerates, the severity of symptoms, and functional objectives. Close observation of the reaction and negative outcome is advisable. Practice should be guided by standardized parameters of intervention and validated outcome measures, and evidence-based research with high quality should continue to update clinical guidelines regarding the use of traction in the treatment of cervical radiculopathy.

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