2018

Effectiveness of Intermittent Mechanical Traction in Cervical Radiculopathy: A Systematic Review

Gilmour Gregory

James M. McKivigan
Touro University Nevada, jmckivig@touro.edu

REVIEW ARTICLE

Effectiveness of Intermittent Mechanical Traction in Cervical Radiculopathy: A Systematic Review

https://doi.org/10.20936/jmrp/07/02/01

Gilmour Gregory[1*] and James McKivigan[2]

ISSN : 2162-6391 (Print) | 2162-6375 (Online)

ABSTRACT

The aim of this review was to assess the effectiveness of intermittent mechanical traction (IMT) in treating cervical radiculopathy (CR). A literature search was conducted electronically, and the data were extracted from the available papers that evaluated IMT and its combination with other therapies. The risk of bias was assessed using the criteria recommended by the Cochrane Back Review Group. The quality of evidence was evaluated using the grading of recommendations, assessment, development, and evaluation method (GRADE). Nine of the articles met the inclusion criteria and were included in the review. Results showed that four studies with very low level of evidence, four had a low level of evidence, and one had a moderate level of evidence. Seven studies were determined to have a high risk of bias while two had a low risk of bias. The literature with a moderate level of evidence and a low risk of bias indicated that IMT reduced the disability and pain scores, suggesting that the treatment has a positive effect on patients with CR. Very low, low, and moderate evidences indicated that IMT is effective in lowering disability and pain scores for patients with CR. Conclusions and future directions for research are discussed.

KEYWORDS intermittent mechanical traction, cervical radiculopathy, neck pain, arm pain, physical therapy

INTRODUCTION

Cervical radiculopathy (CR) is a common diagnosis associated with neck pain that extends to the arm and is accompanied by signs of nerve root compression upon physical examination.[1] CR is commonly called a "pinched nerve" because the nerve in the neck is compressed or irritated resulting in shoulder pain, muscle weakness, and arm to hand numbness. The annual incidence rate of CR is 83 cases per 100,000 individuals; the incidence increases after 50 years of age (203 cases per 100,000 individuals).[2–5]

The onset of CR is usually caused by cervical disc pathology or another space-occupying lesion that causes nerve root irritation.[6] The pathology underlying CR commonly includes a reduction in the size of the intervertebral foramen due to irritation and/or degenerative changes. This reduction in the size of the intervertebral foramen can result in neural inflammation, edema, hypoxia, ischemia, fibrosis, constrained gliding movement, and expanded mechanosensitivity.[2] Patients may have radicular pain, paresthesia, or motor findings, such as muscle weakness in the dermatomal or myotomal pattern of an affected nerve root. There appears to be general agreement that the C6 and C7 vertebrae of the cervical spine are the most frequently involved nerve roots. Range of motion can be restricted, causing impairment in patients with CR.[5,7] Although the causes of CR have been established, the mechanism that generates radicular pain is not completely understood. Manual interventions have been proposed not only to restore the normal function of the affected nerves and body parts but also to reduce/eliminate the pain and disability caused by CR.[6]

The symptoms of CR vary depending on the involved nerve root. Although patients with CR may experience episodes of neck pain, but arm pain is the most common reason for seeking treatment. Patients are generally presented with pain, shivering, numbness, and weakness in the upper extremity, which frequently cause substantial functional restrictions and disability.[3,5] Patients with both neck and upper extremity symptoms reportedly have more prominent functional restriction and disability than patients with only neck pain.[5]

Magnetic resonance imaging and electrophysiological tests are often used to diagnose CR. Utilizing electrophysiological test (nerve conduction velocity and electromyography) data as a gold standard, a clinical prediction rule was established to distinguish the level of CR using a restricted subset of variables from the clinical examination.[5] The rates of surgical intervention for CR (e.g., anterior cervical discectomy and fusion, artificial disk replacement, and posterior cervical laminoforaminotomy) and degenerative conditions have

[1]Michigan State University, Physical Medicine and Rehabilitation, United States
Kyroguy@yahoo.com
[2]Touro University Nevada, School of Physical Therapy, United States
Corresponding author: *James McKivigan,
Assistant Professor, School of Physical Therapy, Touro University Nevada, College of Health and Human Services, 874 American Pacific Drive/Henderson, NV 89014.
E-mail: james.mckivigan@tun.touro.edu
Conflicts of Interest: None.

Received : 10 January 2018 Accepted : 02 March 2018 Published Online : 18 March 2018

increased steadily over the past decade; however, such interventions are associated with increased expense and risk of complications, highlighting the need to determine the best non-operative management strategies.[1] One study reported that 26% of individuals who underwent surgery continued to experience pain at follow-up after 1 year. Research suggests that patients who were treated conservatively showed better results than patients undergoing surgical treatment. In 75% of cases, treatment was conservative and focused on rehabilitation. The rehabilitation programs are generally multifaceted with a variety of physical techniques, none of which have ensured efficacy.[4] A large number of physical therapy interventions have been proposed for managing CR, including traction, postural training, exercise, and manual therapy of the cervical and thoracic spine.[3,4]

Physical therapists often use traction to treat CR. The assessment of the application techniques and clinical results of traction shows a discrepancy. Cervical traction comprises of controlling a diverting force in the Y-axis to the neck to distract the cervical segments, enlarge the intervertebral foramen, and reduce the intradiscal pressure in an attempt to ease the mechanical irritation of the nerve root caused by the intervertebral discs. Treatment can be applied intermittently or continuously. Traction may prevent or reduce attachments/adhesions inside the dural sleeve, and can ease nerve root compression inside the central foramina. The research confirms that traction reduces pressure inside the vertebral discs, and unloads the spine's structures by extending the muscles and ligaments.[2,5,8,9] Additional physical therapy treatments are often applied as part of CR management, although it is not clear which treatment is the most effective.[2]

METHODS

The present review was conducted by searching through the following databases: Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials, MEDLINE with Full Text, Cochrane Methodology Register, and SPORTDiscus with Full Text. The followingkey terms were used to search articles regarding the systematic review: "arm pain," "cervical intermittent traction," "cervical radiculopathy," "cervical traction," "intermittent mechanical traction," "mechanical traction," "manual therapy," "neck pain," and "physical therapy." All studies dated from 2000 to 2016 were included in the search process.

The papers were selected for study inclusion based on the following criteria: (a) the full text of the studies were available in English, (b) the presented patients were diagnosed with "cervical radiculopathy," (c) the patients used "intermittent mechanical traction" as an intervention method, (d) the studies were published within the year 2000–2016, and (e) the papers provided statistical analyses and all relevant statistics helpful to evaluate the effectiveness of IMT in treating CR. The extracted information included the publication details, study design, intervention protocol, outcome measures, patient sample, and statistical results. According to the Cochrane Back Review Group's recommendations, a risk of bias assessment form was used to assess the quality of the studies. Two independent reviewers (GJG and JMM) evaluated the following aspects: randomization, allocation concealment, participant blinding, personnel blinding, assess or blinding, drop-out rate, the method of dealing with missing data, selective outcome reporting, similarity at baseline, co-intervention, compliance, and the timing of the outcome.[10] Figure 1 presents the selection process.

The best evidence synthesis approach, GRADE,[11] was used to assess the quality of evidence because the heterogeneity of the participants, interventions, and outcomes indicated that a meta-analysis was not applicable. GRADE addresses many of the perceived shortcomings of existing models of evidence evaluation. Specifically, GRADE focuses on assessing: (a) methodological flaws within component studies, (b) consistency of results across different studies, (c) generalizability of research results to the wider patient base, and (d) how effective the treatments have been shown to be.[11] Two independent reviewers (GJG and JMM) evaluated the quality and validity of the studies. The following factors lowered the level of evidence: (1) study design (downgraded when >25% of the participants were from studies with a high risk of bias); (2) within-study risk of bias; (3) consistency of the results (downgraded when statistical heterogeneity [$I^2 > 40\%$] or findings were inconsistent [defined as <75% of the participants reporting findings in the same direction]); (4) precision (downgraded when the total number of participants across studies was <300 for each outcome); and (5) reporting bias. The following factors increased the level of evidence: (1) a large magnitude of effect; (2) confounding that reduced a demonstrated effect; and (3) a high dose-response gradient.

Four levels of evidence exist in the GRADE approach:[12]

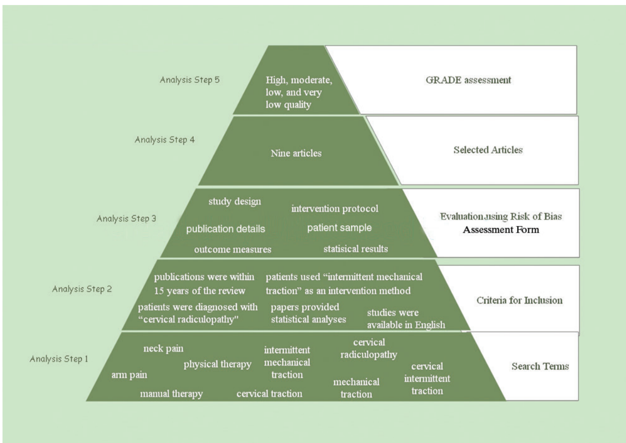

Fig. 1 Selection process.

(1) *High quality*: Further research is highly unlikely to change the confidence in the estimate of effect.
(2) *Moderate quality*: Further research is likely to have a significant effect on the confidence in the estimate of effect that may lead to change in the estimate.
(3) *Low quality*: Further research is highly likely to have a significant effect on the confidence in the estimate of effect, and may probably lead to change in the estimate.
(4) *Very low quality*: We are very uncertain about the estimate.

RESULTS

The described database search yielded 27 papers; nine met the specified inclusion criteria. Table 1 summarizes objective characteristics of each paper.

The study participants from the included nine studies were recruited from either physical therapy clinics[1,2,4,9] or hospitals[3,8,10] across different locations including Turkey,[2] United States,[1,3,19] Greece,[8] Tunisia,[10] and Iran.[4] In total, 393 patients were analyzed from the nine studies. The participants wereolder than 18 years of age with the mean age of 34.32 years old. All studies included IMT as the principal intervention method while some also included other interventions in combination with IMT (Table 2). The considerable variation of follow-up periods, outcome measures, levels of traction intensity, and intervention frequencies in the included studies limited the author's ability to pool the data.

Independent reviewers reached agreement about the risk of bias assessment for the included studies (Table 3). Any differences that occurred between reviewers were resolved based on risk of assessment categories. The risk of bias was determined according to how each study adhered to the 12 points used to assess the risk of bias. These 12 points include: randomization, allocation concealment, patient blinding, care provider blinding, outcome assessor blinding, acceptability of dropouts, intention to treat, selective outcome reporting, similarity of groups at baseline, avoidance and similarities of co-interventions, compliance, and timing of outcome assessment. The risk of bias was assessed according to how each of the study adhered to the aforementioned 12 points. Therefore, a study was considered to have low risk of bias if the number of points it adhered positively is higher than six (half of the total) whereas a study was considered to have high risk of bias if the number of points it adhered positively is lower than six. As a result, only two studies[1,5] were considered to have low risk of bias and the rest were considered to have high risk of bias.

Table 4 describes the interventions used in the included studies and the application of the GRADE method to assess the studies' overall level of evidence, which ranged from moderate[1] to low[2–5] and very low.[5,6,8,9]

TABLE 1 Study publication and objective characteristics.

Citation	Author(s)	Title	Source	Year	Objective	Concluding results
Albayrak Aydin and Yazicioğlu[2]	Albayrak Aydin N. and Yazicioğlu K.	Cervical intermittent traction: does it really work in CR due to herniated disc?	Turkish Journal of Physical Medicin& Rehabilitation	2012	To compare the difference between two treatment protocols (regular physical therapy treatment: hot packs, ultrasound, TENS, and exercise, with or without traction) in the treatment of CR as a result of a herniated disc	Significant increase in grip strength and significant decrease in VAS ratings compared with the pretreatment score in both the groups after 15 physiotherapy treatment sessions.
Cleland et al.[3]	Cleland J.A., Whitman J.M., Fritz J.M., and Palmer J.A.	Manual physical therapy, cervical traction, and strengthening exercises in patients with CR: a case series.	Journal of Orthopaedic and Sports Physical Therapy	2005	To describe the outcomes of a consecutive series of patients with CR who were managed with manual physical therapy, cervical traction, and strengthening exercises	Ten of the 11 patients (91%) demonstrated clinically meaningful improvement in pain and function following a mean of 7.1 (SD, 1.5) physical therapy visits and at the six-month follow-up.
Constantoyannis et al.[8]	Constantoyannis C., Konstantinou D, Kourtopoulos H, and Papadakis N.	Intermittent cervical traction for CR caused by large-volume herniated disks	Journal of Manipulative and Physiological Therapeutics	2002	To describe the use of intermittent cervical traction in four patients with CR and large-volume herniated disks	Cervical spine traction could be considered a therapy of choice for radiculopathy caused by herniated disks, even in cases of large-volume herniated disks or recurrent episodes.
Elnaggar et al.[7]	Elnaggar I. M., Elhabashy H. R., and Abd El-Menam E. M.	Influence of spinal traction in treatment of CR	The Egyptian Journal of Neurology and Neurosurgery	2009	To compare the efficacy of intermittent cervical traction and continuous cervical traction on neck and arm pain severity, amplitude and latency of the H-reflex of the flexor carpi radialis muscle, and neck mobility in patients with C6 and C7 radiculopathy	Intermittent and continuous cervical traction significantly reduced the neck and arm pain, improved nerve function, and increased neck mobility. Intermittent traction was more effective than continuous traction.

Citation	Author(s)	Title	Source	Year	Objective	Concluding results
Fritz et al.[1]	Fritz J.M., Thackeray A., Brennan G.P., and Childs J.D	Exercise only, exercise with mechanical traction, or exercise with over-door traction for patients with CR, with or without consideration of status on a previously described subgrouping rule: a randomized clinical trial	Journal of Orthopaedic and Sports Physical Therapy	2014	To examine the effectiveness of cervical traction plus exercise for specific subgroups of patients with neck pain	Adding mechanical traction to exercise for patients with CR reduced disability and pain, particularly at long-term follow-up.
Jellad et al.[4]	Jellad A., Ben Salah Z., Boudokhane S., Migaou H., Bahri I., and Rejeb N.	The value of intermittent cervical traction in recent CR	Annals of Physical and Rehabilitation Medicine	2009	To assess the effects of mechanical and manual intermittent cervical traction on pain, analgesic use, and disability during recent CR	Manual or mechanical cervical traction appeared to make a major contribution to CR rehabilitation, particularly as part of a multimodal rehabilitation approach.
Moeti and Marchetti.[9]	Moeti P. and Marchetti G.	Clinical outcome from mechanical intermittent cervical traction for the treatment of CR: a case series	Journal of Orthopaedic and Sports Physical Therapy	2001	To describe the clinical outcomes of 15 patients with CR, treated with mechanical intermittent cervical traction	The Neck Disability Index (NDI), when used in conjunction with the NPRS, provides a more comprehensive assessment of patients with CR, thus allowing clinician to make better judgments about the clinical effects of cervical traction
Savva and Giakas[6]	Savva C., and Giakas G.	The effect of cervical traction combined with neural mobilization on pain and disability in CR. A case report	Manual Therapy	2013	To present the effect of cervical traction combined with neural mobilization on pain and disability in a patient experiencing CR	Cervical traction combined with neural mobilization can significantly reduce pain and disability in CR.
Young et al.[5]	Young I. A ., Michener L. A., Cleland J. A., Aguilera A. J., and Snyder A. R.	Manual therapy, exercise, and traction for patients with CR: a randomized clinical trial	Physical Therapy Journal	2009	To examine the effects of manual therapy and exercise with or without cervical traction on pain, function, and disability in patients with CR	No significant differences existed between the groups for any of the primary or secondary outcomes at two or 4 weeks. The effect size between the groups for each of the primary outcomes was small.

TABLE 2 Study data and measure characteristics.

Citation	Sample	Study design	Method	Follow-up	Measures	RESULTS
Albayrak Aydin and Yazicioğlu[1]	27 patients (mean age: 43.07 years)	Prospective RCT	Group 1 (n =13): regular physiotherapy and exercise; Group 2 (n =14): regular physiotherapy, exercise, and intermittent cervical traction	3 weeks; 15 sessions	VAS and MGS	Change in pain (VAS): G1: -44.62 ± 15.6; G2: -33.57 ± 11.5; $p = 0.037$; Change in grip strength (MGS): G1: 4.79 ± 5.12; G2: 1.39 ± 1.71; $p = 0.042$
Cleland et al.[2]	11 patients (mean age: 51.7 years)		One group: manual physical therapy, cervical traction, and strengthening exercises	6 months follow-up; mean sessions: 7.1	NPRS, PSFS, and NDI	Changed from baseline to discharge: 2 points (PSFS) and 7 points (NDI) At 6-month follow-up: 5 (45%) patients scored 10 at PSFS
Constantoyannis et al.[8]	Four patients (mean age: 35.25 years)	Descriptive Comparative	Four cases with intermittent on-the-door cervical traction	3 weeks	MRI	One patient who had an episode of recurrence 16 months after the first treatment was successfully managed again with cervical traction and physiotherapy
Elnaggar et al.[7]	30 patients (mean age: 47.13 years)		Group 1 (n = 15): infrared radiation followed by intermittent cervical traction; Group 2 (n = 15): infrared radiation followed by continuous cervical traction	3 weeks; 12 sessions	Neck pain severity, arm pain severity, amplitude and latency of flexor carpiradialis H-reflex, and neck mobility	G1: post-treatment decrease in neck pain and arm pain ($t = 12.2$, $p = 0.0001$ and $t = 14.6$, $p < 0.0001$, respectively); G2:post-treatment decrease in neck pain and arm pain ($t = 10.5$, p<0.0001 and $t = 12.0$, $p < 0.0001$, respectively)

Citation	Sample	Study design	Method	Follow-up	Measures	RESULTS
Fritz et al.[1]	86 patients (mean age: 46.9 years)	RCT	Three groups randomized: exercise ($n = 28$), exercise with mechanical traction ($n = 31$) or exercise with over-door traction ($n = 27$)	4 weeks, 6 months, 12 months	Neck pain intensity, arm pain intensity, and NDI	Six months - Exercise vs. mechanical traction: 13.3 (5.6, 21.0), $p = 0.001$; Mechanical versus over-door traction: –8.1 (0.8, 15.3), $p = 0.031$; 12 months - exercise versus mechanical traction: 9.8 (0.2, 19.4), $p = 0.046$; Mechanical versus over-door traction:–7.6 (–17.2, 2.0), $p = 0.12$
Jellad et al.[4]	39 patients (mean age: 41.6 years)	Prospective RCT	Group 1 ($n = 13$): conventional rehabilitation with manual traction; Group 2 ($n = 13$): conventional rehabilitation with IMT; Group 3 ($n = 13$): conventional rehabilitation	One, three, and six months	Cervical pain, radicular pain, and self-perceived disability on VASs	Neck pain: Baseline- EoT: G1: 21.2 ± 24.6; G2: 25.2 ± 13.6; G3: 0.3 ±17.2 EoT-1 mo: G1: 8.0 ± 14.7; G2: 0.7 ± 10.6; G3: 3.3 ± 17.4; 1–3 mo: G1: 4.9 ± 9.5; G2: 0.6 ± 10.3; G3: 3.7 ± 11.2; 3–6 mo: G1: 1.7 ± 8.1; G2: 7.0 ± 12.0; G3: 1.3 ± 9.7 Arm pain: Baseline- EoT: G1: 22.3 ± 25.2; G2: 25.2 ± 18.5; G3: 2.5±13.6 EoT-1 month: G1: 2.4 ± 26.1; G2: 7.7 ± 13.4; G3: 12.5 ± 20.8 1–3 months: G1: 1.7 ± 10.3; G2: 0.7 ± 11.8; G3: 7.3 ± 27.4 3–6 months: G1: 1.4 ± 14.4; G2: 4.5 ± 5.9; G3: 3.1±8.4 Disability: Baseline- EoTt: G1: 16.3 ± 26.2; G2: 23.5 ±15.4; G3: 2.0±17.2; EoT-1 month: G1: 8.6 ± 24.6; G2: 2.7 ± 22.3; G3: 1.9 ± 15.4; 1-3 months: G1: 2.6 ± 12.21; G2: 4.2 ± 14.1; G3: 2.3 ± 8.7; 3-6 months: G1: 4.5 ± 11.4; G2: 1.6 ± 6.1; G3: 0.7±7.4
Moeti and Marchetti[9]	15 patients (mean age: 45.5 years)		One group: intermittent mechanical cervical traction	12 weeks	NPRS and NDI	N/A
Savva and Giakas[6]	One patient (52 years)	Case Observation/ Evaluation	One patient with cervical traction and slider neural mobilization of the medial nerve	4 weeks	NPRS, PSFS, and NDI	Initial: NDI 64; NPRS 8; PSFS 7; 2 weeks: NDI 30; NPRS 4; PSFS 3; 4 weeks: NDI 8; NPRS 1; PSFS 0
Young et al.[5]	81 patients (mean age: 47.08 years)	RCT	Group 1: manual therapy, exercise, and intermittent cervical traction; Group 2: manual therapy, exercise, and sham intermittent cervical traction	2 weeks; 4 weeks	NPRS, PSFS, and NDI	MT+EX+Traction Pain: (NPRS) 2 weeks: 4.2 (3.0); 4 weeks: 3.3 (3.1) Pain: (symptom distribution) 2 weeks: 16.5 (31.4); 4 weeks: 13.1 (31.7) GPE: 2 weeks: 10.1 (3.4); 4 weeks: 11.1 (3.3) Disability: (NDI) 2 weeks: 14.0 (12.3); 4 weeks: 11.1 (12.3) Disability: PSFS 2 weeks: 5.3 (3.8); 4 weeks: 7.0 (3.8) FABQ Phys. Act: 2 weeks: 15.5 (10.4); 4 weeks: 12.4 (10.5) FABQ work: 2 weeks: 16.8 (28.3); 4 weeks: 14.5 (28.3); Satisfaction rating: 2 weeks: 6.1 (4.5); 4 weeks: 7.1 (4.6) MT+EX+Sham Pain: (NPRS) 2 weeks: 4.8 (3.0); 4 weeks: 2.8 (3.4) Pain: (symptom distribution) 2 weeks: 16.6 (30.7); 4 weeks: 12.7 (34.7) GPE: 2 weeks: 10.0 (3.4); 4 weeks: 10.8 (3.9); Disability: (NDI) 2 weeks: 12.2 (11.8); 4 weeks: 9.6 (14.1) Disability: PSFS 2 weeks: 5.6 (3.8); 4 weeks: 6.7 (4.3); FABQ Phys. Act: 2 weeks: 17.0 (10.5); 4 weeks: 14.2 (11.9) FABQ work: 2 weeks: 15.1 (28.2); 4 weeks: 11.6 (31.7); Satisfaction rating: 2 weeks: 6.2 (4.6); 4 weeks: 7.5 (5.2)

TABLE 3 Risk of bias assessment.

	Randomization?	Allocation concealment?	Patient blinding?	Care provider blinding?	Outcome assessor blinding?	Drop-out acceptable?	Intention to treat?	Free of selective outcome reporting?	Similar groups at baseline?	Co-interventions avoided or similar?	Compliance acceptable?	Similar timing of outcome assessment?	Risk of bias
Albayrak Aydin and Yazicioğlu[2]	+	–	–	+	+	?	?	–	+	+	?	+	Low
Cleland et al.[3]	–	?	–	–	–	–	+	?	–	+	+	+	High
Constantoyannis et al.[8]	–	–	–	–	–	?	+	+	+	–	?	+	High
Elnaggar et al.[7]	+	?	–	–	–	?	?	?	–	?	?	+	High
Fritz et al.[1]	+	+	–	+	+	–	+	?	+	?	?	+	Low
Jellad et al.[4]	+	?	–	–	–	+	+	?	–	?	?	+	High
Moeti and Marchetti[9]	?	?	–	–	–	?	–	+	–	+	–	+	High
Savva and Giakas[6]	–	–	–	–	–	?	?	+	–	+	?	+	High
Young et al.[5]	+	+	?	–	?	–	+	?	+	?	?	+	High

+: Element contained in study; –: Element not contained in study; ?: Unclear if element was contained.

TABLE 4 Quality of evidence.

Type of intervention	References	No. of studies and no. of participants	Outcomes	Favors which intervention	Level of evidence
PhT + Exc vs. PhT + Exc + ICT	Albayrak Aydin and Yazicioğlu[2];Cleland et al.[3]	(1 RCT and 1 nonrandomized) $n = 27$; $n = 11$	Pain/disability	Therapy + traction	Low
Exc vs. MT vs. traction	Fritz et al.[1]	(1 RCT) $n = 86$	Pain/disability	Mechanical traction	Moderate
Intermittent traction vs. continuous traction	Elnaggar et al.[7]; Jellad et al.[4]	(2 RCT) $n = 30$; $n = 39$	Pain	Intermittent traction	Low
Cervical traction	Constantoyannis et al.[8]; Moeti and Marchetti[9]; Savva and Giakas[6]	(Three nonrandomized) $n = 4$; $n = 15$; $n = 1$	Pain/disability	Traction	Very Low
MT+Traction+MT/Exc vs. MT/Exc	Young et al.[5]	(One RCT); $n = 81$	Pain/disability	–	Very Low

Exc: exercise; ICT: intermittent traction; MT: manual therapy; PhT: physical therapy; RCT: randomized clinical trial.

A meta-analysis of the different conservative treatments was not possible because of the differences in the participants, interventions, and outcomes. However, taking each study individually and comparing it to somewhat similar studies can still generate valuable insights. Two of the studies examined the effect of physiotherapy exercises and IMT.[1,2] One of those studies had a high risk of bias and a low level of evidence; the study observed that 10 of 11 patients with CR who underwent IMT exhibited reduced pain and improved function at 6-month of follow-up.[3] While the other study conducted by Albayrak Aydin and Yazicioğlu[2] that had a low risk of bias provided a statistical analysis demonstrating that physical therapy and exercise led to reduced pain at 3 weeks of follow-up (VAS: 44.62 ± 15.6 and MGS: 4.79 ± 5.12; $p = 0.037$; $p = 0.042$, respectively). Integrating IMT as an interventional method resulted in much greater changes of pain and strength (VAS: −33.57 ± 11.5 and MGS: 1.39 ± 1.71; $p = 0.037$; $p = 0.042$, respectively). Similarly, the authors concluded that traction with regular physiotherapy modalities (e.g., hotpack, ultrasound, and TENS) accompanied by home exercises for 3 weeks increased hand-grip strength on the affected arm and reduced neck and arm pain substantially in C7 radiculopathy due to herniated disc.

Two other studies have examined the effect of intermittent traction vs. a continuous traction.[4,7] Both studies conducted RCTs with a total of 86 patients. The results of both studies revealed that mechanical traction significantly reduced the neck and arm pain, improved nerve function, and increased neck mobility as compared to continuous traction.

Three studies have examined the effect of cervical traction.[5,8,9] All three studies conducted nonrandomized trials with a total of 20 patients. Constantoyannis et al.[8] concluded that cervical spine traction could be considered as a therapy of choice for radiculopathy caused by herniated disks, even in cases of large-volume herniated disks or recurrent episodes. Moeti and Marchetti[9] reported that NDI, when used in conjunction with the NPRS, provides a more comprehensive assessment of patients with CR, thus allowing clinician to make better judgments about the clinical effects of cervical traction. Meanwhile, Savva and Giakas[6] found out that cervical traction combined with neural mobilization could significantly reduce pain and disability in CR. All these three studies clearly established the effectiveness of cervical traction in reducing pain and disability in CR.

Fritz et al.[1] examined the effectiveness of cervical traction plus exercise for specific subgroups of patients with neck pain. A total of 86 patients were collected using RCT. These participants were divided into three groups and were measured at three times: 4 weeks, 6 weeks, and after 1 year. The results revealed that adding mechanical traction to exercise for patients with CR reduced disability and pain, particularly at long-term follow-up. Lastly, Young et al.[5] examined the effects of manual therapy and exercise with or without cervical traction on pain, function, and disability in patients with CR. A total of 81 patients were collected using RCT. The participants were divided into two groups and were measured at 2 and 4 weeks after the interventions. The authors reported that there is no significant differences existed between the groups for any of the primary or secondary outcomes at 2 or 4 weeks.

DISCUSSION

From the systematic review of studies assessing the effectiveness of IMT in treating CR, it cannot be concluded firmly that a difference in the effect existed between the physical therapy combined with exercise, and the addition of IMT. Particularly, only two out of the nine studies revealed that IMT with physical therapy do significantly reduce pain and disability in CR. However, almost all studies except one, concluded that tractions are better than other interventions. That is, providing tractions result to significant decrease in pain, increase in mobility, and improve in nerve function.

Furthermore, what can be inferred from Tables 3 and 4 is that studies with a very low level of evidence and a high risk of bias examined only the effect of IMT,[8,9] and another study with a high risk of bias and a very low level of evidence combined IMT with the neutral mobilization of pain.[5] These three studies included a total of 20 participants. The studies favored IMT as a treatment for CR, but their lack of evidence and high risk of bias prevented the authors from concluding IMT being the best treatment approach.

Two of the studies that compared continuous and intermittent traction provided very low-level evidence on the ineffectiveness of intermittent traction over continuous traction used against pain. The authors of these studies stated that the manual or mechanical cervical traction appeared to contribute significantly towards the rehabilitation of CR that may considerably reduce the neck and arm pain.[4,7]

Another study with a high risk of bias examined manual therapy combined with exercise and intermittent cervical traction. The primary outcomes' effect size was small (Neck Disability Index (NDI)_ 1.5, 95% CI =−6.8 to 3.8; PSFS = 0.29, 95% CI =−1.8 to 1.2; and NPRS = 0.52, 95% CI =−1.8 to 1.2), resulting in very low-level evidence with no significant effect on pain or disability.[5]

The recent study by Fritz et al.[1] with a low risk of bias and a moderate level of evidence examined the effects of exercise combined with IMT compared with only exercise and over-door mechanical traction. The results of the intention-to-treat analyses for the primary outcome indicated lower NDI scores in the mechanical traction group at 6-month follow-up (mean difference compared with the exercise group, 13.3; 95% CI: 5.6, 21.0; mean difference compared with the over-door traction group, 8.1; 95% CI: 0.8, 15.3). The study concluded that including IMT to a standard exercise program for patients with CR resulted in lower disability and pain intensity ratings at long-term follow-up. Fritz et al. stated that the effectiveness of IMT may be enhanced when it is provided in conjunction with an exercise program.

Overall, very low-level evidence from three other studies indicated that IMT was effective in the patients with CR.[1,5,9] No effect sizes for pain and disability were pooled from these studies; they were insignificant and clinically irrelevant. One of the low-risk-of-bias study indicated that at 3-weeks of follow-up, IMT was more effective in relieving neck pain and disability than physical therapy and exercise.[2] One of the studies with a very low level of evidence and high risk of bias reported no significant effects on pain or disability.[5]

CONCLUSIONS

The aim of this study was to evaluate evidence to determine if IMT is an effective treatment for CR. A systematic review revealed differences in the methodologies of the included studies. Contradictory results regarding the effect of IMT were also noted. Nine studies tested the intervention; four had a very low level of evidence, four had a low level of evidence, and one had a moderate level of evidence. Seven studies were determined to have a high risk of bias; two had a low risk of bias. The literature with a moderate level of evidence and a low risk of bias indicated that IMT reduced the disability and pain scores, suggesting that the treatment has a positive effect on patients with CR. Future research should be conducted focusing on the development of new randomized clinical trials with a low risk of bias and high-quality evidence that include larger sample sizes, and compare the effectiveness of conservative interventions and IMT to provide more adequate results.

DECLARATIONS

Ethics approval and consent to participate

Not Applicable

Consent for publication

Not Applicable

Availability of data and material

Competing interests

The authors declare that they have no competing interests.

Funding

Not Applicable

Authors' contributions

All authors read and approved the final manuscript.

All authors collected and analyzed data to comprise this systematic review.

Acknowledgements

Not Applicable

LIST OF ABBREVIATIONS

Intermittent Mechanical Traction (IMT, Cervical Radiculopathy (CR), Grading of Recommendations, Assessment, Development and Evaluation method (GRADE), Neck Disability Index (NDI), Randomized Clinical Trial (RCT), Numeric Pain Rating Scale (NPRS)

PERSPECTIVE

This article analyzes the strength of evidence and risk of bias in the current literature regarding the treatment of cervical radiculopathy (CR) by using intermittent mechanical traction. This analysis may help the practicing clinicians to quickly assess multiple studies and decide at a conclusion regarding the use of CR.

REFERENCES

1. Fritz J, Thackeray A, Brennan G, Childs J. Exercise only, exercise with mechanical traction, or exercise with over-door traction for patients with cervical radiculopathy, with or without consideration of status on a previously described subgrouping rule: a randomized clinical trial. J Orthopaedic& Sports Phys Therapy. 2014;44:45–57.
2. Young I, Michener L, Cleland J, Aguilera A, Snyder A. Manual therapy, exercise, and traction for patients with cervical radiculopathy: a randomized clinical trial. Physical Therapy. 2009; 89:632–642.
3. Cleland J, Whitman J, Fritz J, Palmer J. Manual physical therapy, cervical traction, and strengthening exercises in patients with cervical radiculopathy: a case series. J Orthopaedic Sports Phys Therapeut. 2005;35:802–811.
4. Jellad A, Ben Salah Z, Boudokhane S, Migaou H, Bahri I, Rejeb N. The value of intermittent cervical traction in recent cervical radiculopathy. Ann Phys Rehabil Med. 2009;52:638–652.
5. Albayrak A, Yazicioğlu K. Cervical intermittent traction: does it really work in cervical radiculopathy due to herniated disc? Turk J Phys Med Rehabil. 2012;58:277–282.
6. Savva C, Giakas G. The effect of cervical traction combined with neural mobilization on pain and disability in cervical radiculopathy. A case report. Manual Therapy. 2013;18:443–446.
7. Elnaggar I, Elhabashy H, Abd El-Menam E. Influence of spinal traction in treatment of cervical radiculopathy. Egypt J Neurological Psychia Neurosurg. 2009;46:455–460.
8. Constantoyannis C, Konstantinou D, Kourtopoulos H, Papadakis N. Intermittent cervical traction for cervical radiculopathy caused by large-volume herniated disks. J Manipulative Phys Therapeut. 2002;25:188–192.
9. Moeti P, Marchetti G. Clinical outcome from mechanical intermittent cervical traction for the treatment of cervical radiculopathy: a case series. Journal Of Orthopaedic Sports Physical Therapy. 2001;31:207–213.
10. Furlan A, Pennick V, Bombardier C, van Tulder M. 2009 updated method guidelines for systematic reviews in the Cochrane Back Review Group. Spine. 2009;34:1929–1941.
11. Atkins D, Best D, Briss PA, Eccles M, Flack-Ytter Y, Flottorp S, et al. Grading quality of evidence and strength recommendations. BMJ: British Medical Journal. 2004;328:1490–1494.
12. Guyatt G, Oxman A, Schünemann H, et al.GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. Br Med J. 2008;336:924–926.