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The Effectiveness of Cervical Traction and Exercise in Decreasing Neck and Arm Pain for Patients With Cervical Radiculopathy: A Critically Appraised Topic

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The effectiveness of cervical traction and exercise in decreasing neck and arm pain for patients with cervical radiculopathy: a critically appraised topic

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Title: The effectiveness of cervical traction and exercise in decreasing neck and arm pain for patients with cervical radiculopathy: a critically appraised topic

Key Points*:*

Clinical Question: Is there evidence to suggest intermittent cervical traction with cervical and scapular strengthening exercises is more effective in decreasing neck and arm pain when compared to cervical and scapular strengthening exercises alone in non-operative patients with cervical radiculopathy?

Clinical Bottom Line: There is currently inconsistent, high-quality evidence that suggests that the use of intermittent cervical traction in addition to strengthening exercises is more effective at decreasing pain in non-operative patients with cervical radiculopathy when compared to strengthening alone. Future research should continue to examine long-term outcomes associated with cervical radiculopathy patients who use intermittent cervical traction as an intervention.

CLINICAL SCENARIO

In patients diagnosed with cervical herniated discs or other neck injuries, radicular symptoms are usually the primary cause of pain and discomfort.[1,2] This discomfort, known as cervical radiculopathy, includes pain and neurological symptoms that extend from the neck into the distal extremity.[3-5] Traditional therapeutic exercise for patients with cervical radiculopathy has resulted in favorable outcomes;[6] however, another frequently used intervention in the treatment of patients with cervical radiculopathy is cervical traction.[3-5] Cervical traction has been recommended for patients who have peripheralization of symptoms with lower cervical mobility testing, positive shoulder abduction sign, positive manual distraction test, positive upper-limb tension test, and are 55 years of age or older.[7] While minimal cost is associated with traditional strengthening exercises, intermittent cervical traction units can cost beyond $3,000.[8] Once the patient is properly positioned in the device, the average treatment is approximately 15 minutes. Despite the frequent usage of this modality by healthcare providers, effectiveness of the treatment to support the use of cervical traction in these patients should be assessed. A synthesis and critical appraisal of the best available evidence is needed to evaluate the effectiveness of the intervention when compared to traditional strengthening exercises for future clinical consideration.

FOCUSED CLINICAL QUESTION

Is there evidence to support intermittent cervical traction with cervical/scapular strengthening exercises is more effective in decreasing neck and arm pain than cervical/scapular strengthening exercises alone in non-operative patients with cervical radiculopathy?

SEARCH STRATEGY

A computerized search was completed in September 2016 (Figure 1). The search terms used were:

- **P**atient/Client group: Cervical Radiculopathy
- **I**ntervention: Cervical Traction with Cervical and Scapular Strengthening Exercises
- **C**omparison: Cervical and Scapular Strengthening Exercises
- **O**utcome: Decreased Pain

Sources of Evidence Searched

- Medline
- SPORTDiscus
- CINAHL Plus with Full Text

The criteria for study selection were as follows:

Inclusion Criteria:

- Studies classified as level 2 evidence or higher before critical appraisal.[9,10]
- Studies that included adult (>18 years of age) patients.
- Studies that examined intermittent cervical traction and exercise compared to an alternative control group of just exercise.
- Studies published in English.
- Studies performed on human subjects.

Exclusion Criteria:

- Studies that did not measure patient-based outcomes to evaluate the effectiveness of treatments.
- Studies that utilized cervical traction in both the intervention and control groups.

Evidence of Quality Assessment

Validity of the selected studies was determined using the physiotherapy evidence database (PEDro) scale. The PEDro was selected due to the methodological design of the 2 eligible studies. Two authors (SB, JH) independently reviewed the studies, completed the PEDro and reviewed the completed appraisals to come to a consensus on study quality.

RESULTS OF SEARCH

Summary of Search, Best Evidence Appraised and Key Findings

- The literature search retrieved 5 studies (Figure 1). Two randomized controlled trials (RCTs)[11,12] met the inclusion criteria for this CAT and were categorized in Table 1. The level of evidence as suggested by the Oxford Centre for Evidence Based Medicine in 2009[10] was used to identify eligible studies.
- Both studies compared the effects of traditional strength training exercises to traditional strength training exercises and intermittent cervical traction. Patient-based outcomes were collected in both studies.[11,12]
- The results of one study indicated mechanical intermittent cervical traction and exercise can decrease neck and arm pain in patients with cervical radiculopathy at long-term follow-ups when compared with patients who only received traditional strengthening.[12] In contrast, the other study identified no significant difference between groups who received intermittent cervical traction and traditional strengthening as an intervention versus the use of a sham intermittent cervical traction control group and strengthening exercises.[11]

Results of Evidence Quality Assessment

The Fritz et al.[12] study received a PEDro score of 8/10 and the Young et al.[11] study received a PEDro score of 9/10. Neither study blinded the therapists. However, blinding the therapists poses a difficult task due to the direct involvement of the therapist in the implementation of the

intervention. Fritz et al.[12] also received a deduction due to lack of blinding of subject group assignment.

CLINICAL BOTTOM LINE

There is inconsistent, high quality evidence to support that cervical traction with strengthening exercise compared to strengthening exercises alone is a more effective treatment at decreasing pain in patients with cervical radiculopathy. One high-quality RCT demonstrated difference between groups who utilized intermittent cervical traction versus traditional exercise.[12] In contrast, another high-quality RCT demonstrated no significant difference between groups who utilized intermittent cervical traction and strengthening exercises versus those who utilized sham intermittent cervical traction in combination with traditional exercises.[11]

Strength of Recommendation

There is grade B evidence to support the use of cervical traction with exercise compared to exercise alone is more effective at decreasing pain in patients with cervical radiculopathy. The grade of B is recommended by the Strength of Recommendation of Taxonomy.[13] This recommendation was given due to the inconsistent patient-oriented evidence included in this CAT.

IMPLICATIONS FOR PRACTICE, EDUCATION AND FUTURE RESEARCH

The results of this CAT revealed inconsistent evidence regarding whether the use of intermittent cervical traction with traditional exercise was more effective at decreasing neck and arm pain in patients with cervical radiculopathy when compared to traditional exercise alone. Fritz et al.[12] compared three groups in their study. Patients were randomized into either an exercise only group, an exercise with mechanical intermittent cervical traction group, or into an

over the door cervical traction group. Results demonstrated that the mechanical intermittent cervical traction and exercise effectively decreased patients' neck and arm pain as measured by the Neck Disability Index (NDI) at 6-months compared to both groups, and these patients had lower NDI scores at 12-months compared to the exercise group (Table 1). The arm pain intensity ratings were also lower in the mechanical traction group when compared to the exercise alone group at both 6 and 12-months. Interestingly, 53 patients (61.6%) reported a successful outcome on the global rating of change, regardless of treatment intervention, at 4-weeks. Additionally, 32 (37.2%) reported success at 6-months, and 35 (40.7%) at 12-months. Thus, these results indicate that patients in each group perceived their treatment to be better, regardless of their intervention. Young et al.[11] also examined the effects of intermittent cervical traction on pain reduction by comparing two groups: an intermittent cervical traction plus traditional exercise group or sham intermittent cervical traction plus traditional exercise group. No statistical differences in the outcome measures were demonstrated between groups at either the 2-week follow-up or the 4-week follow-up.

In both studies, the researchers utilized exercise plans that targeted cervical and scapular strengthening. The exercise regimens used in both studies can be found in Table 1. However, Young et al.[11] also incorporated manual therapy for both groups. The intermittent cervical traction parameters were also very similar between the two studies. For both studies, patients were positioned supine at 15 degrees of cervical flexion. The total treatment time lasted 15 minutes with increases in traction force based **on** patient tolerance and centralization of symptoms. Despite these similarities, both studies utilized different protocols for the actual applications of the treatment. Fritz et al.[12] applied a 60/20 on and off cycle with an initial pull force of 5.44 kg (12lbs) and a relaxation force of 50 percent of the pull force. In contrast, Young

et al.[11] incorporated a 50/10 on off cycle with the traction force beginning at either 9.1 kg (20lbs) or 10% of the patient's body weight. The lesser weight was selected as the starting traction force. It is possible the results varied between the studies due to the differences in treatment parameters, inclusion of the mobilizations, and also the time points at which the outcomes were collected.

Patients with neck pain and radicular symptoms were recruited to participate in both studies. However, the studies incorporated different inclusion and exclusion criteria. In addition to chief complaint and age criteria, Fritz et al.[12] also included patients with a >10 on the Neck Disability Index (NDI) as inclusion/exclusion criteria. However, Young et al.[11] utilized a Clinical Prediction Rule (CPR)[4] to evaluate patients for inclusion and exclusion which did not include a self-reported symptoms score for inclusion. When examining the baseline NDI scores for the patients included in each of the studies, the patients in Fritz et al.[12] had a score of 32.8 (14.1) while the patients included in Young et al.[11] had an average score of 19.8 (8.7) and 17.1 (7.4) for the traction and exercise only group respectively. Thus, it appears Fritz et al. [12] included patients with high self-reported neck disability when compared to the patients in the Young et al. [11] investigation. Furthermore, similar outcome measures were employed to determine treatment effectiveness. Both studies incorporated the NDI and Numeric Pain Rating Scale (NPRS). Each study also used a dimension specific outcome to measure fear of re-injury or kinesiophobia as Fritz et al.[12] included the Tampa Scale of Kinesiophobia and Pain Catastrophizing Scale and Young et al.[11] the Fear Avoidance Belief Questionnaire. Young et al. [11] also included the Patient-Specific Functional Scale.

Despite many similarities between treatments, patient population, and outcome measures, the two studies reported differing results on the use of intermittent cervical traction in

combination with exercise when compared to exercise alone for patients with cervical radiculopathy. One of the biggest differences between the two studies is the time periods that outcome measures were collected. Young et al.[11] only collected outcome measures at 2 and 4-weeks following treatment, while Fritz et al.[12] collected outcome measures at 4-weeks, 6-months, and 12-months post treatment. Fritz et al.[12] demonstrated statistical differences for neck pain intensity between intermittent cervical traction and traditional exercise at 4-weeks ($p=0.20$), while no significant differences between groups were demonstrated in the Young et al.[11] study. No other observed outcome measures resulted in statistical differences at 4 weeks in the Fritz et al.[12] study. However, Fritz et al.[12] did find more notable significant differences at 6-months and 12- months. Fritz et al.[12] followed the patients for a longer period of time than Young et al.[11], which could suggest that intermittent cervical traction could be an effective intervention to improve long-term outcomes in patients with cervical radiculopathy. Future research should continue to measure long-term outcomes post-treatment in these patients to determine the duration of treatment effectiveness.

Clinically, intermittent cervical traction does not appear to be contraindicated for patients with cervical radiculopathy. While neither study demonstrated immediate decreases in pain levels in patients, intermittent cervical traction did not increase pain levels and has the potential for long-term benefits. Future studies should continue longitudinal research on patients with cervical radiculopathy and the reduction of neck and arm pain with intermittent cervical traction. In addition, future research should consider the clinical applicability of this tool in other patient populations such as young-adults with cervical radiculopathy symptoms. This CAT should be reviewed in two years (2018) to determine whether there is additional evidence that may change

the recommendations of the use of intermittent cervical traction as an intervention for patients with cervical radiculopathy.

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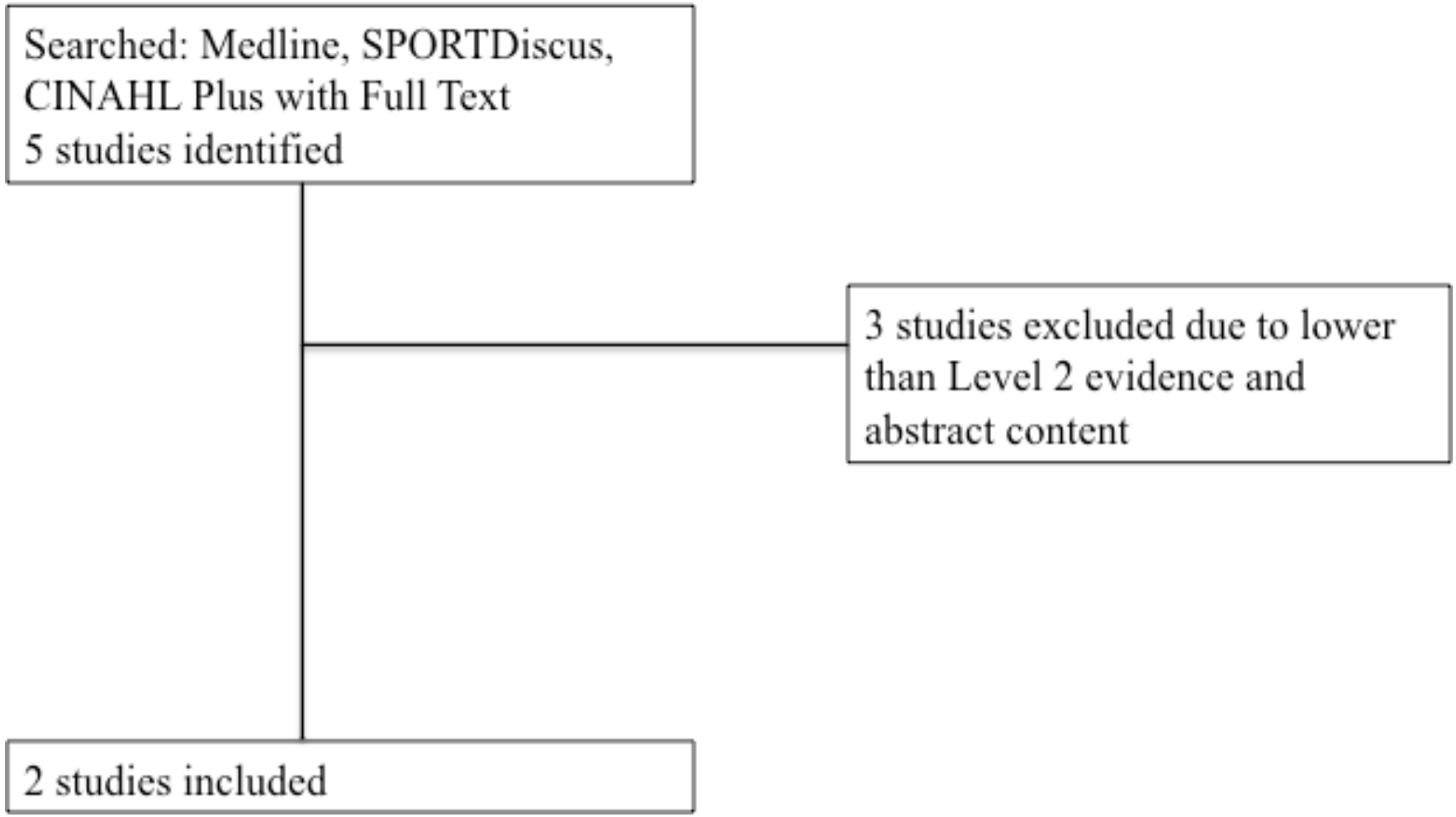

Figure 1. Summary of Search History and Included Studies

Table 1 Characteristics of Included Studies

Study Authors	Fritz, Julie M. Thackeray, Anne Brennan, Gerard P. Childs, John D.	Young, Ian A. Michener, Lori A. Cleland, Joshua A. Aguilera, Arnold J. Snyder, Alison R.
Study Title	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	Manual therapy, exercise, and traction for patients with cervical radiculopathy: a randomized clinical trial
Study Participants	Patients (n=86) with neck pain and radicular symptoms and >10 on the Neck Disability Index (NDI). Patients were divided into three groups **Exercise Group (n=28)** Demographics and baseline values include, Mean (SD): Age=44.9 (11.3) years, duration of symptoms >6 weeks= 8 (28.6); self-rated general health= 65.4(17.6), NDI= 35(13.9); Neck Pain Intensity=4.4 (2); Arm Pain Intensity=4.1 (2.5); Tampa Scale of Kinesiophobia=35.7 (7); Pain Catastrophizing Scale=20.7 (12.3) **Mechanical Traction Group (n=31)** Demographics and baseline values include, Mean	Patients with unilateral neck pain and parasthesia; Met 3 out of 4 Clinical Prediction Rule for CR (n=81) **MTEXTraction Group (n=45)** Demographics and baseline values include, Mean (SD): Age =47.8 (9.9) years; Duration of Symptoms (%) ≤ 3months=27 (60), > 3 months=18 (40); Neck Disability Index (NDI)=19.8 (8.7); Patient-Specific Functional Scale=3.5 (1.8); Numeric Pain Rating Scale=6.3 (1.9); Fear Avoidance Belief Questionnaire-Physical Activity (FABQ-PA)=17.7 (7.4); Fear Avoidance Belief Questionnaire-Work (FABQ-W)=24.1 (17.2)

	(SD): Age=48.1 (10) years; Duration of symptoms >6 weeks=12%(38.7%); Self-rate general health=65.9 (20.3); Neck Disability Index (NDI)=30.9 (14.8); Neck Pain Intensity=3.8 (2.1); Arm Pain Intensity=4.2 (2.2); Tampa Scale of Kinesiophobia=36.1 (6.9); Pain Catastrophizing Scale=18.9 (11.7) **Over-Door Traction Group (n=27)** Demographics and baseline values include, Mean (SD): Age=47.6 (10.9); Duration of symptoms > 6 weeks=13% (48.1%); Self-rate general health=72.2 (18.1); Neck Disability Index (NDI)=32.7 (13.8); Neck Pain Intensity=4.5 (2.1); Arm Pain Intensity=4.6 (2.6); Tampa Scale of Kinesiophobia=36.7 (7.6); Pain Catastrophizing Scale=17.1 (12.2)	**Sham Traction Group (n=36)** Demographics and baseline values include, Mean (SD): Age=46.2 (9.4) years; Duration of Symptoms % ≤ 3months=15 (42), > 3 months=21 (58); Neck Disability Index (NDI)=17.1 (7.4); Patient-Specific Functional Scale=3.3 (1.8); Numeric Pain Rating Scale=6.5 (1.7); Fear Avoidance Belief Questionnaire-Physical Activity (FABQ-PA)=18.3 (5.7); Fear Avoidance Belief Questionnaire-Work (FABQ-W)=18.7 (16.2)
Inclusion/Exclusion Criteria	Inclusion: Patients 18-70 years of age, chief complaint of neck pain with symptoms extending distal to acromioclavicular joint or caudal to superior border of the scapular, >10 on NDI Exclusion: History of surgery to the neck or thoracic spine, recent motor vehicle accident, and red flags indicative of serious or possible nonmusculoskeletal condition, cervical spinal stenosis diagnosed by MRI and/or CT, evidence of cervical myelopathy or central nervous system involvement, or if patients were unable to comply to treatment schedule	Inclusion: Patients between 18-70 years old, unilateral upper-extremity pain, paresthesia, or numbers, 3 of 4 test of clinical prediction rule positive. Exclusion: History of previous cervical or thoracic spine surgery, bilateral upper-extremity symptoms, signs or symptoms of upper motor neuron disease, medical red flags, cervical spine injections in previous 2-weeks, current usage of steroidal medication for radiculopathy symptoms

Intervention Investigated	Patients were randomized into either an exercise alone group, exercise plus mechanical traction group, or exercise plus over-door traction. All patients received 10 physical therapy visits over a 4-week period with each session lasting between 30-45 minutes. The exercise only group focused on cervical and scapular strengthening. The exercises included: Supine craniocervical flexion with feedback with 10 contractions of 10 second holds; supine cervical flexion for 3 set of 15 repetitions; seated cervical flexion for 30 repetitions with 10 second holds; scapular retraction using elastic bands or pulleys; scapular-strengthening exercises including prone horizontal abduction, sidelying forward flexion, prone extension of each shoulder, and prone push-ups with shoulder protraction for 3 sets of 10 repetitions. Resistance was added as tolerated. The mechanical traction group completed the same interventions as the exercise only group with the addition of intermittent cervical traction. Saunders 3D ActiveTrac or Chattanooga Triton Table was used for the traction. The patient as positioned supine in 15° of cervical flexion with a 60/20 on off cycle. The initial pull force was 5.44 kg (12lb) and was	Patients were treated for an average of 7 visits over 4.2 weeks. All treatments occurred in the same order throughout the 4.2 weeks. Patients began with postural education, manual therapy, exercises, and then patients ended with intermittent cervical traction or sham traction for 15 minutes. All patients were given a home exercise program that focused on cervical and scapular strengthening and received manual therapy. The exercise program consisted of cervical retraction, cervical extension, deep cervical flexor strengthening, and scapular strengthening. Manual therapy consisted of a high-velocity, low-amplitude thrust manipulation or a nonthrust manipulation at the upper and mid-thoracic spines of segments identified as hypomobile. For both groups during intermittent cervical traction or sham traction, patients were positioned supine at approximately 15° of cervical flexion. For the intermittent cervical traction group, the traction force started at 9.1 kg (20lbs) or 10% of the patient's body weight. Whichever weight was less was chosen as the starting weight for traction. Traction force was increased between 0.91 kg and 2.27 kg (2-5lbs)

	increased based off of patient tolerance and centralization of symptoms. The relaxation force was 50%of the pull force and each treatment lasted 15 minutes. Traction was applied before or after exercise per the physical therapist's decision. The over-door traction group also received the same exercise intervention, but used a Chattanooga Overdoor Traction Device (DJO, LLC) during treatment and daily at home. The initial traction force was between 3.63 and 5.44 kg (8-12lb) and was adjusted based off of patient tolerance and centralization of symptoms. Maximum force was 9.07kg (20lb). Each treatment lasted 15 minutes and occurred before or after exercise under the discretion of the treating physical therapist.	each visit, with a maximum force of 15.91 kg (35 lb.) for patients and an on/off cycle of 50/10. Treatment was applied for 15 minutes. For the sham traction group, only 2.27 kg (5lbs) force or less was applied.
Outcome Measures	The Neck Disability Index, the 11 point neck pain numeric intensity scale, and 11 point arm pain numeric intensity scale. All measures were assessed at baseline, 4-weeks, 6-months, and 12-months.	The Neck Disability Index, Patient-Specific Functional Scale, Numerical Pain Rating Scale, Body Diagram, Fear Avoidance Belief Questionnaire, and Satisfaction rating. All measures were assessed at baselines, 2-weeks, and 4-weeks. The Global Rating of Change Scale was assessed at 2 weeks and 4 weeks.
Results	Mechanical traction with exercises resulted in lower pain for patients with cervical radiculopathy,	There were no significant differences between experimental group and sham group at 2-weeks

	primarily at long-term follow-ups. **4 weeks** The results indicated significant difference in neck pain intesity scores between the mechanical traction group (1.4 ± 1.4) and the exercise group (2.6±2.0) (p= 0.020) , significant difference in arm pain intensity between the exercise group (1.6±2.0) and the over-door traction group (1.6±2.0) (p=0.002), and significant differences in arm pain intensity between the mechanical traction group (1.4±1.6) and the over-door traction group (1.6±2.0) (p=0.017.) There were no other significance differences between groups at 4-weeks. **6 months** The results indicated significant difference in neck pain intensity scores and NDI between the mechanical traction group (1.1±1.4, 9.2±9.4) and the exercise group (3.0±2.3, 22.5±14.1) (p=0.003, 0.001). The results also indicated significant difference in arm pain intensity between the exercise group (3.2±3.0) and the over-door traction group (1.0±1.4; p=0.004), and significant differences in NDI scores between the mechanical traction group (9.2±9.4) and the over-door traction group (17.3±11.7; p=0.031.) There were no other	or 4-weeks. **2 weeks** The results indicated no significant difference between the sham intermittent cervical traction group and the intermittent cervical traction groups at 2-weeks (NDI scores (p =0.31), Patient-Specific Functional Scale scores (p =0.91), Numerical Pain Rating Scale (p=0.24), Body Diagram (p=0.60), Fear Avoidance Belief Questionnaire Physical Assesment (p= 0.31), Fear Avoidance Belief Questionnaire Work (p=0.38), Satisfaction Rating (p=0.83) and Global Rating of Change Scale (p=0.76)). **4 weeks** The results indicated no significant difference between the sham intermittent cervical traction group and the intermittent cervical traction groups at 4-weeks (NDI scores (p =0.56), Patient-Specific Functional Scale scores (p =0.66), Numerical Pain Rating Scale (p=0.38), Body Diagram (p=0.46), Fear Avoidance Belief Questionnaire Physical Assesment (p= 0.38), Fear Avoidance Belief Questionnaire Work (p=0.87), Satisfaction Rating (p=0.83) and Global Rating of Change Scale (p=0.65)).

	significance differences between groups. **12 months** The results indicated significant difference in NDI scores between the mechanical traction group (10.3± 9.0) and the exercise group (20.1±18.4; p = 0.046). There were no other significance differences between groups at 12 months.	
Level of Evidence	2	2
Support for the Answer	The use of mechanical traction with traditional exercise can decrease neck and arm pain in patients with cervical radiculopathy.	The use of traction did not decrease pain; however, it is not contraindicated.