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

3 **Key Points:**

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

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

13

14 **CLINICAL SCENARIO**

15 In patients diagnosed with cervical herniated discs or other neck injuries, radicular symptoms are
16 usually the primary cause of pain and discomfort.^{1,2} This discomfort, known as cervical
17 radiculopathy, includes pain and neurological symptoms that extend from the neck into the distal
18 extremity.³⁻⁵ Traditional therapeutic exercise for patients with cervical radiculopathy has resulted
19 in favorable outcomes;⁶ however, another frequently used intervention in the treatment of
20 patients with cervical radiculopathy is cervical traction.³⁻⁵ Cervical traction has been
21 recommended for patients who have peripheralization of symptoms with lower cervical mobility
22 testing, positive shoulder abduction sign, positive manual distraction test, positive upper-limb
23 tension test, and are 55 years of age or older.⁷ While minimal cost is associated with traditional
24 strengthening exercises, intermittent cervical traction units can cost beyond \$3,000.⁸ Once the
25 patient is properly positioned in the device, the average treatment is approximately 15 minutes.
26 Despite the frequent usage of this modality by healthcare providers, effectiveness of the
27 treatment to support the use of cervical traction in these patients should be assessed. A synthesis
28 and critical appraisal of the best available evidence is needed to evaluate the effectiveness of the
29 intervention when compared to traditional strengthening exercises for future clinical
30 consideration.

31 **FOCUSED CLINICAL QUESTION**

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

35 **SEARCH STRATEGY**

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

- 38 • **Patient/Client group:** Cervical Radiculopathy
- 39 • **Intervention:** Cervical Traction with Cervical and Scapular Strengthening Exercises
- 40 • **Comparison:** Cervical and Scapular Strengthening Exercises
- 41 • **Outcome:** Decreased Pain

42 **Sources of Evidence Searched**

- 43 • Medline
- 44 • SPORTDiscus
- 45 • CINAHL Plus with Full Text

46 The criteria for study selection were as follows:

47 **Inclusion Criteria:**

- 48 • Studies classified as level 2 evidence or higher before critical appraisal.^{9,10}
- 49 • Studies that included adult (>18 years of age) patients.
- 50 • Studies that examined intermittent cervical traction and exercise compared to an
51 alternative control group of just exercise.
- 52 • Studies published in English.
- 53 • Studies performed on human subjects.

54 **Exclusion Criteria:**

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

58 **Evidence of Quality Assessment**

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

63 **RESULTS OF SEARCH**

64 **Summary of Search, Best Evidence Appraised and Key Findings**

- 65 • The literature search retrieved 5 studies (Figure 1). Two randomized controlled trials
66 (RCTs)^{11,12} met the inclusion criteria for this CAT and were categorized in Table 1. The level
67 of evidence as suggested by the Oxford Centre for Evidence Based Medicine in 2009¹⁰ was
68 used to identify eligible studies.
- 69 • Both studies compared the effects of traditional strength training exercises to traditional
70 strength training exercises and intermittent cervical traction. Patient-based outcomes were
71 collected in both studies.^{11,12}
- 72 • The results of one study indicated mechanical intermittent cervical traction and exercise can
73 decrease neck and arm pain in patients with cervical radiculopathy at long-term follow-ups
74 when compared with patients who only received traditional strengthening.¹² In contrast, the
75 other study identified no significant difference between groups who received intermittent
76 cervical traction and traditional strengthening as an intervention versus the use of a sham
77 intermittent cervical traction control group and strengthening exercises.¹¹

78 **Results of Evidence Quality Assessment**

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

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

84 **CLINICAL BOTTOM LINE**

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

92

93 **Strength of Recommendation**

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

99 **IMPLICATIONS FOR PRACTICE, EDUCATION AND FUTURE RESEARCH**

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

105 over the door cervical traction group. Results demonstrated that the mechanical intermittent
106 cervical traction and exercise effectively decreased patients' neck and arm pain as measured by
107 the Neck Disability Index (NDI) at 6-months compared to both groups, and these patients had
108 lower NDI scores at 12-months compared to the exercise group (Table 1). The arm pain intensity
109 ratings were also lower in the mechanical traction group when compared to the exercise alone
110 group at both 6 and 12-months. Interestingly, 53 patients (61.6%) reported a successful outcome
111 on the global rating of change, regardless of treatment intervention, at 4-weeks. Additionally, 32
112 (37.2%) reported success at 6-months, and 35 (40.7%) at 12-months. Thus, these results indicate
113 that patients in each group perceived their treatment to be better, regardless of their intervention.
114 Young et al.¹¹ also examined the effects of intermittent cervical traction on pain reduction by
115 comparing two groups: an intermittent cervical traction plus traditional exercise group or sham
116 intermittent cervical traction plus traditional exercise group. No statistical differences in the
117 outcome measures were demonstrated between groups at either the 2-week follow-up or the 4-
118 week follow-up.

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

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

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

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

151 combination with exercise when compared to exercise alone for patients with cervical
152 radiculopathy. One of the biggest differences between the two studies is the time periods that
153 outcome measures were collected. Young et al.¹¹ only collected outcome measures at 2 and 4-
154 weeks following treatment, while Fritz et al.¹² collected outcome measures at 4-weeks, 6-months,
155 and 12-months post treatment. Fritz et al.¹² demonstrated statistical differences for neck pain
156 intensity between intermittent cervical traction and traditional exercise at 4-weeks ($p=0.20$),
157 while no significant differences between groups were demonstrated in the Young et al.¹¹ study.
158 No other observed outcome measures resulted in statistical differences at 4 weeks in the Fritz et
159 al.¹² study. However, Fritz et al.¹² did find more notable significant differences at 6-months and
160 12- months. Fritz et al.¹² followed the patients for a longer period of time than Young et al.¹¹,
161 which could suggest that intermittent cervical traction could be an effective intervention to
162 improve long-term outcomes in patients with cervical radiculopathy. Future research should
163 continue to measure long-term outcomes post-treatment in these patients to determine the
164 duration of treatment effectiveness.

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

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

175

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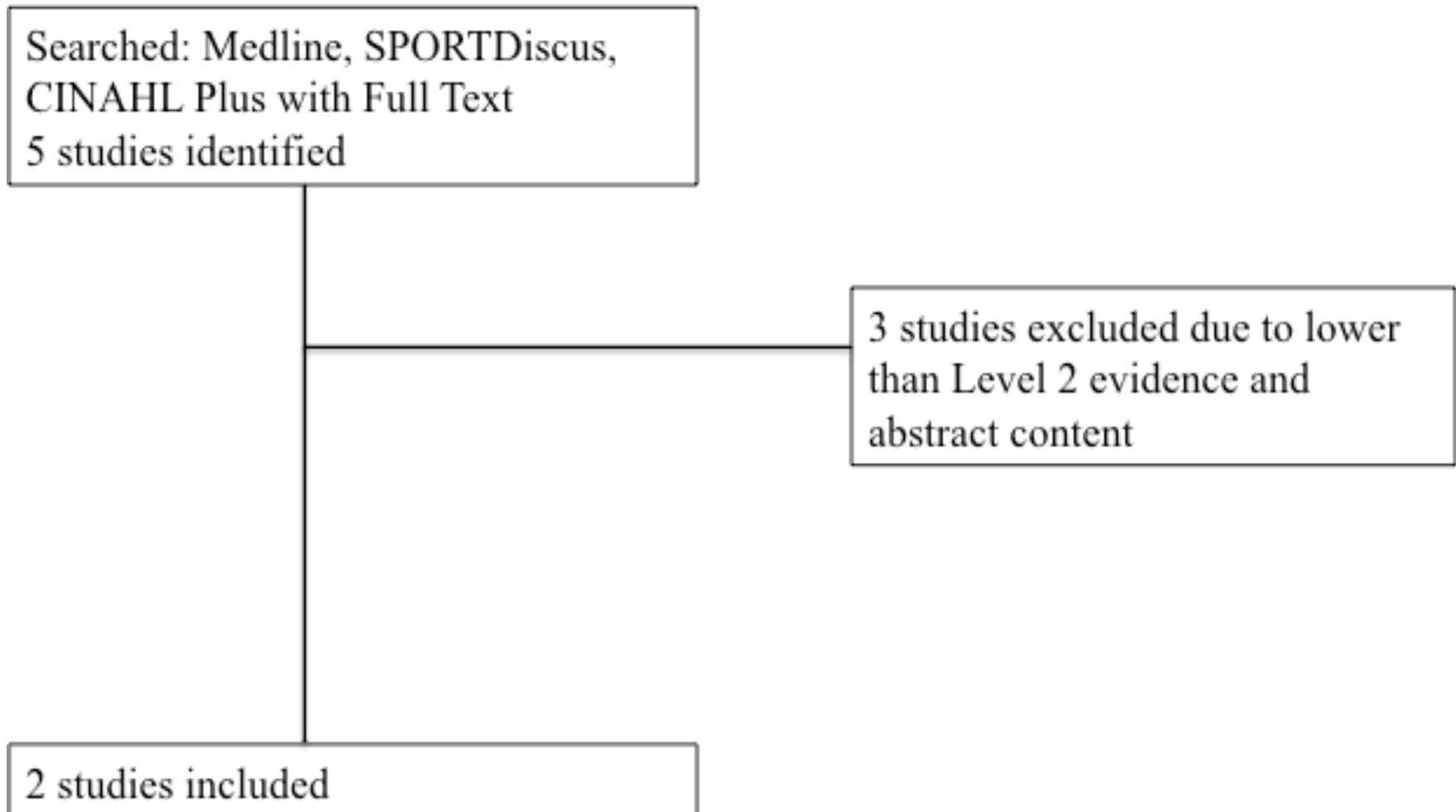


Figure 1. Summary of Search History and Included Studies

Table 1 Characteristics of Included Studies

<p>Study Authors</p>	<p>Fritz, Julie M. Thackeray, Anne Brennan, Gerard P. Childs, John D.</p>	<p>Young, Ian A. Michener, Lori A. Cleland, Joshua A. Aguilera, Arnold J. Snyder, Alison R.</p>
<p>Study Title</p>	<p>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</p>	<p>Manual therapy, exercise, and traction for patients with cervical radiculopathy: a randomized clinical trial</p>
<p>Study Participants</p>	<p>Patients (n=86) with neck pain and radicular symptoms and >10 on the Neck Disability Index (NDI). Patients were divided into three groups</p> <p>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)</p> <p>Mechanical Traction Group (n=31) Demographics and baseline values include, Mean</p>	<p>Patients with unilateral neck pain and parasthesia; Met 3 out of 4 Clinical Prediction Rule for CR (n=81)</p> <p>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)</p>

	<p>(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)</p> <p>Over-Door Traction Group (n=27)</p> <p>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)</p>	<p>Sham Traction Group (n=36)</p> <p>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)</p>
<p>Inclusion/Exclusion Criteria</p>	<p>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</p> <p>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</p>	<p>Inclusion: Patients between 18-70 years old, unilateral upper-extremity pain, paresthesia, or numbness, 3 of 4 test of clinical prediction rule positive.</p> <p>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</p>

<p>Intervention Investigated</p>	<p>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.</p> <p>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.</p> <p>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</p>	<p>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.</p> <p>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)</p>
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	<p>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.</p>	<p>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.</p>
Outcome Measures	<p>The Neck Disability Index, the 11 point neck pain numeric intensity scale, and 11 point arm pain numeric intensity scale.</p> <p>All measures were assessed at baseline, 4-weeks, 6-months, and 12-months.</p>	<p>The Neck Disability Index, Patient-Specific Functional Scale, Numerical Pain Rating Scale, Body Diagram, Fear Avoidance Belief Questionnaire, and Satisfaction rating.</p> <p>All measures were assessed at baselines, 2-weeks, and 4-weeks.</p> <p>The Global Rating of Change Scale was assessed at 2 weeks and 4 weeks.</p>
Results	<p>Mechanical traction with exercises resulted in lower pain for patients with cervical radiculopathy,</p>	<p>There were no significant differences between experimental group and sham group at 2-weeks</p>

primarily at long-term follow-ups.

4 weeks

The results indicated significant difference in neck pain intensity 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 Assessment ($p=0.31$), 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 Assessment ($p=0.38$), Fear Avoidance Belief Questionnaire Work ($p=0.87$), Satisfaction Rating ($p=0.83$) and Global Rating of Change Scale ($p=0.65$)).

	<p>significance differences between groups.</p> <p>12 months</p> <p>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.</p>	
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.