

## Effects of Cervical Collar and Cervical Traction in Pain and Grip Strength in Patients with Cervical Radiculopathy

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**Abstract:** Different modalities of physiotherapy are often applied in acute CR. The purpose of this study was to examine the effects of intermittent cervical traction and exercise with or without the use of semi-hard cervical collar on pain and grip strength in patients with recent cervical radiculopathy. Thirty one male patients with unilateral recent C7 radiculopathy were divided randomly into two treatment groups. The control group was treated by intermittent cervical traction and neck exercises, while the experimental group was treated with the same as the control group. In addition to the use of semi-hard cervical collar. Radicular cervical pain and grip strength at baseline and at the end of 6 weeks after treatment were evaluated. Results revealed clinically and statistically improvements in pain intensity and grip strength in both groups ( $p < 0.001$ ), with no significant differences between both groups ( $p > 0.05$ ). It could be included that, the addition of semi-hard cervical collar doesn't appears to improve pain intensity and grip strength for patients with recent CR who are already receiving intermittent cervical traction and neck exercises.

**Key words:** Cervical radiculopathy • Traction • Exercises • Cervical collar

### INTRODUCTION

Cervical Radiculopathy (CR) is a common neurological disorders characterized by neck pain radiating to the arm and fingers corresponding to the dermatome involved [1]. It is usually caused by herniated discs or spondylotic changes, affecting many adults in their fourth and fifth decades of life, the most commonly affected nerve roots are C6 and C7 [2]. Generally, degenerative CR with subacute onset has a favourable prognosis during the first six weeks, treatment to accelerate the improvement of pain and function during this period would be highly valuable [3]. Treatment in acute or subacute CR has not yet been studies.

Several interventional strategies are used in the management of CR and range from conservative approaches (including physical treatment) to surgery. A nonsurgical approach is the preferred first line treatment strategy for CR [4]. In 75% of acute cases of CR, patients respond to a conservative treatment which indicates that nonsurgical treatment is the appropriate initial approach for most patients [5].

Physical therapy interventions often used for the management of CR include cervical traction, exercises, immobilization with cervical collar and manual therapy [6].

These modalities may be used singly or in combination, combination of these interventions may result in improved outcomes for patients with CR [7-8].

Cervical traction is frequently employed in treatment of CR [9]. Traction may be applied manually or mechanically and can be applied in various positions and treatment modes (intermittent or static). The evidence to date on the effectiveness of cervical traction is conflicting [10].

Some investigators have advocated the short-term use of immobilization with either a cervical collar or a cervical pillow during sleep. Until now, however, there was no conclusive evidence about benefits of this approach [11].

Grip strength has been widely accepted as an objective index of the functional integrity of upper extremity and physical therapist usually measure it to monitor the success or failure of their treatment programs. Considering the decrease in grip strength in patients with C7 radiculopathy, it is seen that grip strength is an appropriate objective parameter to investigate the effectiveness of different treatment regimes [12].

The purpose of this study was to examine the effects of intermittent cervical traction and exercise, with or without the use of semi-hard collar in patients with recent cervical radiculopathy.

## MATERIALS AND METHODS

**Subjects:** Thirty one male patients with unilateral C7 radiculopathy who had been referred by their physician (neurologist, orthopaedic surgeons and general practitioners) were participated in the study. The inclusion criteria were, male patients ranged in age from 40-55 years, recent CR, with symptoms of less than one month duration, involvement of spinal nerve with a herniated disc and /or intervertebral disc degeneration confirmed by magnetic resonance imaging (MRI) and clinical results. The exclusion criteria were patients with clinical signs of cord compression, patients with a history of surgery or bone-ligament damage to the cervical spine, shoulder diseases (rotator cuff syndrome, capsulitis or inflammatory arthritis), ongoing or recent physical therapy treatment for this episode.

After the initial screening, patients who fulfilled all inclusion criteria signed an informed consent form.

**Study Design:** This was a prospective randomized study performed over the period from September 2009 to May 2010 at different hospitals in Riyadh city (KSA). At the beginning of the study 35 patients with CR were identified, after the exclusion of 4 patients (were only attending 3 physical therapy sessions), 31 were included and randomly assigned to a control group ( $N= 15$ , mean age  $47.56 \pm 5.76$ ) and an experimental group ( $N= 16$ , mean age  $= 47.37 \pm 5.81$ ). Randomization was carried out by drawing lots from the randomization envelope without replacement.

### Instrumentations:

- Visual analogue scale (VAS) for measuring intensity of pain.
- Eltrac B471, mechanical equipment for cervical traction.
- Jamar, model 2A3 hand held dynamometer, for measuring grip strength.

**Treatment:** Patients in the control group were treated with intermittent cervical traction and isometric strengthening exercise, they were also taught to perform home exercises and advised to do the exercise daily. In the experimental group, patients were treated with the same treatment as the control group in addition to wear cervical collar during the day for three weeks and to rest as much as possible. Over the next three weeks, the patients were weaned from the collar and after six weeks, patients were advised to take it off completely. The collar was a semi-hard collar available in different sizes for proper fitting.

Patients in both groups were allowed to use their medical treatment and were asked to avoid taking medication 4 hours prior to treatment session. Patients in each group received 18 treatment sessions (three/week) for six weeks.

Mechanical intermittent cervical traction using (Eltrac B471) were given while each patient was positioned supine. The traction force was started at 7.5 Kg or 10% of the patient's body weight and increased a maximum of 0.5 to 0.9 Kg per session, depending on patient response (i.e., centralization or reduction of symptoms). The cervical spine was placed in approximately 25° of flexion, the on/off cycle time was set to a ratio of 30:10 seconds for 15 minutes in each treatment session. The traction force during the off time was set at 5.4 Kg and the duration and on/off cycle remained the same for all treatments [13].

Exercises included isometric strengthening flexors and extensors neck exercises, subjects were instructed to perform all exercises daily, 25 repetitions each (twice a day). All strengthening exercises were performed to a count of 7 seconds.

**Outcomes Measures:** The primary outcomes were neck pain and arm pain measured using 10 cm visual analogue scale (VAS) on which the subject represents his neck and arm pain along distance of 10 cm, where 0 represents no pain and 10 represents extremely intense pain. The second outcome measures was grip strength using (Jamar, model 2A3), with the patient's position was sitting with shoulder in adduction and neutral position and elbow in 90 degrees flexion while the forearm and wrist were held in neutral position. The subject was instructed to squeeze the hand held dynamometer by his hand as hard as possible and hold it for 5 seconds. No verbal encouragements were offered during the test. Two measurements were made and the highest reading was recorded. Evaluation was performed at the beginning and at the end of the treatment program.

**Data Analysis:** Descriptive statistics (mean  $\pm$  standard deviations) were computed for all the data. The two tailed t-test was used to compare data before and after the end of the treatment program within each group and to detect differences between the both groups. Non-parametric Mann-Whitney U-test was used to compare the measurable parameters of pain and grip strength. The results were considered statistical significant with  $p < 0.05$ . All statistics were calculated by using SPSS program (version 15)<sup>b</sup> for windows.

Table 1: Mean±SD and P value at baseline for age, weight and height in both groups

Variables	Control group	Experimental group	P-value
Age (year)	47.56±5.76	47.37±5.81	0.25*
Weight (Kg)	73.13±6.37	74.32±5.89	0.56*
Height (cm)	169.14±6.95	170.12±5.87	0.78*

\* Non significant

Table 2: Mean ±SD and P value for VAS and grip strength at baseline and post- treatment in both groups

Variables	Control group	Experimental group	P-value
VAS			
Baseline	7.1±1.4	7.32±1.2	0.27*
Post-treatment	1.57±1.4	1.79	± 1 . 5
P-value	0.001**	0.001**	
Grip strength			
Baseline	35.12±5.52	35.34±4.76	0.24*
Post-treatment	43.95±5.12	44.12±4.67	0.33*
P-value	0.001**	0.001**	

\* Non significant; \*\* Significant

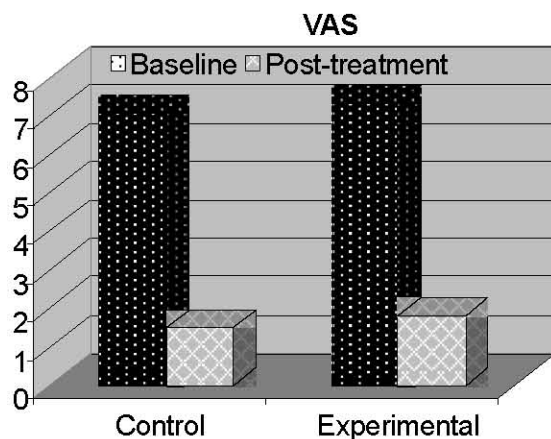


Fig. 1: Mean ±SD for VAS at baseline and post- treatment in both groups.

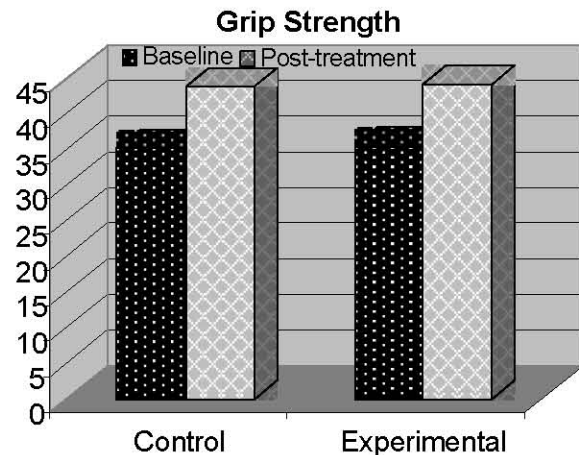


Fig. 2: Mean ±SD for Grip strength at baseline and post- treatment in both groups.

## RESULTS

Demographic characteristics of the control and experimental groups at baseline are summarized in Table 1. No significant difference was seen between the two groups regarding age, height and weight.

Table 2 Summarizes the measurable variables (VAS and grip strength) before and at the end of treatment in both the control and experimental groups. At the beginning of the study, there were no significant differences in all measurable parameters (VAS and grip strength) between the two groups ( $p > 0.05$ ). Results of pain intensity (VAS) showed that there was a significant improvement in pain at the end of treatment in both groups ( $p < 0.001$ ), with no significant difference between the both groups ( $p > 0.05$ ).

The results of grip strength showed significant improvement following treatment in both groups ( $p < 0.001$ ), with no significant differences between the both groups ( $p > 0.05$ ).

## DISCUSSION

This randomized clinical study investigated the effects of exercises and intermittent cervical traction, with and without wearing semi-hard collar, in patients with recent CR. The results indicate that wearing semi-hard cervical collar yielded no additional benefit. Regardless of treatment program, patients with recent CR showed significant improvement in pain intensity and grip strength following 6 weeks treatment by exercises and intermittent cervical traction.

Results of the present study revealed a positive effect of combining intermittent mechanical cervical traction with exercises for recent CR. This effect was observed for neck pain intensity and hand grip strength. In the literature, several types of traction have been examined for the treatment of CR. A three-week protocol with daily vertical intermittent cervical traction combined with wearing of cervical collar and administration of non-steroidal anti-inflammatory drugs (NSAIDs) demonstrated its effectiveness in recent CR (onset within proceeding 2 weeks) in young patients with a cervical herniated disc [14], which come nearly in consistence with our results. However, the latter study can be criticized in view of the small number of patient included in the study (n=4).

Recent CR is more responsive to cervical traction due to the cellular mechanism, that large herniated discs are absorbed more slowly and respond better to traction treatment, especially when initiated early [15]. The effect of cervical traction on treatment of CR suggested that the technique is less effective in chronic CR (i.e, a history of CR over 3 months) [14-16]

Joghataei *et al.* [12] concluded that intermittent cervical traction in the supine position resulted in immediate, short-term improvement in gripping strength after 3 weeks in the case of unilateral C7 radiculopathy. This early effect of spinal traction has been reported in radiographic studies showing a reduction in the size of herniated disc under traction, this is probably related to the creation of negative pressure in the intervertebral disc [17]. Also, intermittent cervical traction led to relief and improved nerve conduction, which may be related to improvement in the blood supply to nerve structures [17-19] This improvement in blood supply could improve the neurological deficit of the affected nerve root, which came in consistent with the present study [19].

The improvement in grip strength after treatment seen in this study could be explained by the physiological changes occurred in both nerve root conduction and circulation, these improvements seem to contribute to the restoration of nerve function early enough to produce immediate effects in neuromuscular performance of hand grip [19]. One randomized clinical trial isolated the effect of intermittent cervical traction, finding that exercise and intermittent cervical traction were superior to exercise (cervical isometric) and ultrasound on the outcome of grip strength after 5 visits in patients with C7 Radiculopathy [12]. However, there were no significant differences between groups at 10 visits (discharge from physical therapy [12].

In literature, the efficacy of cervical collar and physiotherapy in patients with recent CR are rare. The mechanism behind the effect of collar in neck pain could be explained, that a cervical collar causes immobilization of the cervical region decreases mechanical stress which probably reduces foraminal root compression and associated root inflammation, decreases painful spasms by supporting muscles, relaxes the muscle and aids rapid tissue recovery [20].

However, Persson *et al.* [21], did a randomized clinical trial comparing physiotherapy and a hard collar in patients with chronic (more than three months) cervical radiculopathy who were randomized to surgery, physiotherapy or cervical collar, surgery was superior for pain relieve at four months follow-up. At 16 months “follow-up”, no difference existed between the three groups in term of pain, muscle strength, or sensory loss. The difference between our study and that of Persson *et al.*, the target study population in Persson study were chronic patients but in our study, patients were only recent onset with less than one month duration. Our study also used a soft collar because hard collar can cause serious discomfort [22]. One earlier RCT compared 5 treatment modalities-traction, positioning, collar and heat treatment- and found no significant difference in pain and ability to work [23].

## CONCLUSION

The addition of semi-hard cervical collar does not appears to improve pain intensity and grip strength for patients with recent CR who are already receiving intermittent cervical traction and isometric neck exercises.

## REFERENCES

1. Kuijper, B., J.T.J. Tans, R.J. Schimsheimer, B.F.W. Van Der Kallen, A. Beelen, F. Nolle, *et al.*, 2009. Degenerative cervical radiculopathy: diagnosis and conservative treatment: a review. *Eur. J. Neurol.*, 16: 15-20.
2. Wainner, R.S. and H. Gill, 2000. Diagnosis and non-operative management of cervical radiculopathy. *J. Orthopedic and Sports Physical Therapy.*, 30: 728-744.
3. Vinas, F.C., H. Wilner and S. Rengachary, 2001. The spontaneous resorption of herniated cervical discs. *J. Clin. Neurosci.*, 8: 542-6.

4. Nordin, M., E.J. Carragee, S. Hogg-Johnson, *et al.*, 2008. Assessment of neck pain and its associated disorders: results of the Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders. *Spine.*, 33(suppl 4): S101-S122.
5. Rhee, J.M., T. Yoon and K.D. Riew, 2007. Cervical Radiculopathy. *J. Am. Acad. Orthop. Surg.*, 15(8): 486-494.
6. Wolff, M.W. and L.A. Levine, 2002. Cervical radiculopathies: conservative approaches to management. *Phys. Med. Rehabil. Clin. N. Am.*, 13: 589-608.
7. Cleland, J.A., J.M. Fritz, J.M. Whitman and R. Heath, 2007. Predictors of short-term outcome in people with a clinical diagnosis of cervical radiculopathy. *Phys. Ther.*, 87: 1619-1632.
8. Walker, M.J., R.E. Boyles, B.A. Young, *et al.*, 2008. The effectiveness of manual physical therapy and exercise for mechanical neck pain: a randomized clinical trial. *Spine.*, 33: 2371-2378.
9. Murphy, D.R., E.L. Hurwitz, A. Gregory and R. Clary, 2006. A nonsurgical approach to the management of patients with cervical radiculopathy: a prospective observational cohort study. *J. Manipulative. Physiol. Ther.*, 29: 279-87.
10. Peake, N. and A. Harte, 2005. The effectiveness of Cervical Traction. *Physical. Therapy. Reviews.*, 10: 217-229.
11. Dmytriv, M., K. Rowland, T.H. Gavagan and D. Holub, 2010. PT or cervical collar for cervical radiculopathy. *The J. Family Practice.*, 59(5): 269-272.
12. Joghataei, M.T., A.M. Arab and H. Khaksar, 2004. The effect of cervical traction combined with conventional therapy on grip strength on patients with cervical radiculopathy. *Clinical. Rehabilitation*, 18: 879-887.
13. Cleland, J.A., J.M. Whitman, J.M. Fritz and J.A. Palmer, 2005. Manual Physical Therapy, Cervical Traction and Strengthening Exercises in Patients with Cervical Radiculopathy: A Case Series. *J. Orthop. Sports. Phys. Ther.*, 35: 802-811.
14. Constantoyannis, C., D. Konstantinou, H. Kourtopoulos and N. Papadakis, 2002. Intermittent cervical traction for cervical radiculopathy caused by large-volume herniated disks. *J. Manipulative. Physiol. Ther.*, 25: 188-92.
15. Jellad, A., Z. Ben Salah, S. Boudokhane, H. Migaou, I. Bahri and N. Rejeb, 2009. The value of intermittent cervical traction in recent cervical radiculopathy. *Annals of Physical Rehabilitation Medicine.*, 52(9): 638-52.
16. Ola'h, M., L. Molna'r, J. Doba, C. Ola'h, J. Fehe'r and T. Bender, 2008. The effects of weight bath traction hydrotherapy as a component of complex physical therapy in disorders of the cervical and lumbar spine: a controlled pilot study with follow-up. *Rheumatol. Int.*, 28: 749-56.
17. Chung, T.S., Y.J. Lee, S.W. Kang, C.J. Park, W.S. Kang and Y.W. Shim, 2002. Reducibility of cervical disk herniation: Evaluation at MR imaging during cervical traction with a nonmagnetic traction device. *Radiol.*, 225: 895-900.
18. Moeti, P. and G. Marchetti, 2001. Clinical outcome from mechanical intermittent cervical traction for the treatment of cervical radiculopathy: a case series. *J. Orthop. Sports. Phys Ther.*, 31: 207-13.
19. Hattori, M., Y. Shirai and T. Aoki, 2002. Research on the effectiveness of intermittent cervical traction therapy, using short-latency somatosensory evoked potentials. *J. Orthop. Sci.*, 7: 208-16.
20. Unlu, Z., L. Cerrahoglu, A. Aslan, S. Tarhan, 0000. Efficacy of Collar Treatment for Patients with Cervical Spondylosis Complaining of Vertigo. *J. Phys. Ther. Sci.*, 13: 115-120.
21. Persson, L.C., C.A. Carlsson and J.Y. Carlsson, 1997. Long-lasting cervical Radicular pain managed with surgery, physiotherapy, or a cervical collar: a prospective, randomized study. *Spine.*, 22: 751-8.
22. Mazanec, D. and A. Reddy, 2007. Medical management of cervical spondylosis. *Neurosurgery*, 60(11): S43-50.
23. Levine, M.J., T.J. Albert and M.D. Smith, 1996. Cervical radiculopathy: diagnosis and nonoperative management. *J. Am. Acad. Orthop. Surg.*, 4: 305-316.