Therapeutic Efficacy of Cervical Traction in the Management of Cervical Radiculopathy: A Control Trial

Adesola O Ojoawo[1*], Ayo Olabode[1], O Esan[2], Abiodun Badru[3], Sunday Odejide[3], Bose Arilewola[3]

[1]*Department of Medical Rehabilitation, Faculty of Basic Medical Sciences, Obafemi Awolowo University (OAU), Ile Ife. Nigeria.*
[2]*Department of Orthopaedic and Traumatology, OAU,Ile Ife, Nigeria*
[3]*Department of Physiotherapy, OAU Teaching Hospitals Complex, Ile Ife. Nigeria.*

Abstract

Background: Severe pain and disability from cervical disorder is second to that of low back pain in musculoskeletal practice. **Methods:** Forty eight patients who met the inclusion criteria were placed into experimental (n=24) and control (n=24) group randomly. Participants in both groups received massage, cryotherapy and active exercises. Cervical traction was administered to experimental group for 15 minutes, thrice per week for four weeks while the other group served as control. Verbal rating scale (VRS) and Neck Disability Pain Index (NDI) were used as outcome measures. Data were analyzed using descriptive, dependent –t-test and independent-t-test. **Results:** There was a significant improvement in the pretreatment and post treatment pain intensity ($t=10.75$, $p< 0.001$) and neck functional disability ($t=2.42$, $p=0.03$) of participants in experimental group. There was a significant difference ($t=-3.98$, $p=0.006$) in the post treatment pain intensity between the cervical traction and control group. **Conclusion:** It could be concluded that application of continuous cervical traction can significantly reduce pain intensity of patients with cervical radiculopathy.

Key words: Cervical traction, cryotherapy, neck disability index, and verbal rating scale.

Introduction

Cervical radiculopathy forms an important subgroup of neck disorders despite the fact that it is not as frequent as general neck pain, but it has been shown to lead to more severe pain and disability. [1,2,3,4,5,6] Cervical radiculopathy is pain in the distribution of a specific nerve as an outcome of a damage to either or both the dorsal or ventral nerve root. [7] This lesion which may affect sensory and/or motor fibers can present in addition to radicular pain, parasthesia, or motor symptoms, such as muscle weakness in the dermatomal or myotomal distribution of the affected nerve roots. [8] The most commonly affected joints are C6 and C7 nerve roots leading to impairment in cervical range of motion and functional limitation in patients with cervical radiculopathy. [9]

Approximately 14–71% of adults experience neck pain at some points in their lifetime and the 1-year prevalence rate for neck pain in adults ranges from 16 to 75%. [10] The prevalence of neck pain in musculoskeletal practice is second to that of low back pain. [10] In a Canadian epidemiological neck pain study (n = 1133), Côte et al.[11], found that the six month prevalence of neck pain was 54.2%. Guez et al.[12], did a population-based study on the prevalence of neck pain in Northern Sweden (n = 6000) and found that 43% of the population reported neck pain (48% woman and 38% men) and 18% of the population (19% woman and 13% men) had chronic neck pain lasting longer than six months. Marfanya and Rhoda [13] found a prevalence of neck pain of 53.6 % among learners in the Gauteng Province, South Africa. Ayanniyi et al [14] also in their study documented that neck pain was found to be common among Nigerian university undergraduate students and affects females than males. Bolanle et al., [15] and Adegoke et al., [16] in a separate works conducted in South Western State of Nigeria found that the leading work-related musculoskeletal disorder was low back pain, followed by neck pain and indication that neck pain is very prominent among musculoskeletal pain in Nigeria.

The etiology of neck pain is multifactorial and poorly understood. [15] The common factors include poor posture, depression, anxiety, aging, acute injury and occupational or sporting activities which lead to altered joint mechanics, muscle structure or function and can result in mechanical neck pain. [17] Studies stated that the most common cause of mechanical neck pain is zygophyseal joint locking and muscle strain. [17,18]

Cervical traction consists of administering a distracting force to the neck in order to separate the cervical segments and relieve compression of nerve roots by intervertebral disks. Various techniques (supine vs. sitting; intermittent vs. sustained; motorized or hydraulic vs. an over-the-door pulley with weights) and durations (minutes vs. up to an hour) have been recommended for management of cervical radiculopathy. [19] However, a systematic review stated that no conclusions could be drawn about the efficacy of cervical traction because of the poor methodologic quality of the available data. [20] A recent systematic review by Graham et al., [21] also reported that there was moderate evidence to

***Correspondence:** Adesola O Ojoawo; Email: aoojoawo@yahoo.com

support the use of mechanical intermittent cervical traction in the management of neck pain. Cervical traction in addition to other exercises are the major treatment techniques in many facilities in Nigeria physiotherapy clinic but there are paucity of data on its efficacy in Nigerian environment. The study was designed to assess the efficacy of continuous cervical traction on radiating cervical neck pain.

Methods

This study was carried out at Physiotherapy Clinic of the Obafemi Awolowo University Teaching Hospitals Complex, (OAUTHC) Ile Ife, Nigeria. The target population was patients who were referred from the orthopaedic clinic of the hospital diagnosed with non-specific, sub-acute and chronic neck pain radiating to either of the upper limb. Purposive sampling technique was used to recruit 48 patients to participate in the study. Informed consent was obtained from each patient to participate in the study. Ethical clearance for the study was obtained from Ethic and Research Committee of OAUTHC, Ile Ife.

Inclusion criteria were patient with neck pain radiating unilaterally of not less than 6 months duration with no history of vertebro-basilary artery insufficiency. Participants were randomly allocated into experimental and control group, 24 patients for cervical traction (experimental group) and 24 patients to the control group.

The exact treatment technique to be used was explained to participants. Participants were treated 3 times per week. The treatment period for a patient was four weeks after which the total treatment time was estimated from the patient's record. The primary outcome measures were patient reported pain, using verbal rating scale (VRS) and neck disability using neck pain disability index (NDI). Participants were introduced to a 10 point VRS, instructions were given not to over or under estimate the pain and they were asked to point to the number corresponding to his or her pain intensity which was recorded.

Neck disability was assessed using the Neck Disability Index (NDI), which is a commonly utilized outcome measure to capture perceived disability in patients with neck pain. [22] The NDI contains 10 items, seven, related to activities of daily living, two, related to pain, and one, related to concentration. [23] Each item is scored from zero to five and the total score was expressed as a percentage, with higher scores indicating greater disability. The NDI has demonstrated moderate test re-test reliability ($r=0.89$, $p< 0.001$) and has been shown to be a valid ($r=0.70$, $p< 0.05$) health outcome measure in a patient population with cervical radiculopathy. [24,25] During each appointment, subjects in the two groups underwent isometric exercises to the posterior neck muscles for 10 seconds in 10 rounds, ice therapy was applied for 6 minutes and kneading massage for 2 minutes. [26] This made a session of treatment.

The cervical traction group was given cervical traction using the "over the door" cervical traction for 15 minutes in addition to exercise, ice therapy and massage. A strap was affixed under the chin of the patient. This chinstrap was then connected to water bag that is held aloft over a doorway via pulleys that were utilized. The water bag was loaded in kilogramme to 10% of the patient's total body weight according to Akinbo et al.[27] Treatment was administered three times per week for four weeks. Patient response was assessed after each third treatment session using VRS and NDI.

Data analysis

Statistical Package for Social Sciences (SPSS) version 16.0 (SPP Inc., Chicago, Illinois, USA) was used to analyze the data. A p value of <0.05 was considered as statistically significant. Descriptive and inferential statistics were used to organize the data analyzed. Dependent–t-test was used to examine the difference between the pretreatment (1st week) and post treatment (4th week) pain intensity and NDI for each of experimental treatment and control groups. Independent-t-test was used to compare the mean of pre-treatment pain intensity and NDI of experimental treatment and control groups. Independent-t-test was also used to compare the mean of post treatment pain intensity and NDI of experimental treatment and control groups.

Results

The purpose of this study was to assess the effect of continued cervical traction in the management of pain intensity and neck disability of patients with cervical radiculopathy. The result of this study indicates that application of continues cervical traction is beneficial in the management of pain intensity and neck disability of patient with cervical radiculopathy

Table 1 Physical characteristics of participants (N = 48)

	Cervical Traction Grp	Control Grp		
	Mean± SD	Mean ± SD	t	Sig
Age/ Years	51.38 ± 6.5	59.50 ± 2.64	2.75	0.128
Height/m	1.64±0.12	1.65±0.30	9.61	0.011*
Weight/kg	73.12 ±13.04	71.25±5.38	1.47	0.253
BMI	27.99± 7.96	26.02±2.04	3.94	0.075

Key: *Significant at $p < 0.05$. BMI = Body Mass Index

Table 1 presents the summary of physical parameters of participants. There was no significant difference ($p>.05$) between the physical parameters of participants in the experimental and control group except for height ($t=9.61$ $p = 0.011$).

Table 2 Dependent –t-test comparing the pain intensity and neck disability index pre and post treatment for experimental and Control group

		Week 1	Week 4		
		Mean ±SD	Mean ± SD	t	p
Experimental group N= 24	PI	6.87 ± 0.99	2.50± 0.53	10.75	0.001**
	NDI	42.13± 16.86	24.50 ±17.6	2.42	0.03*
Control Group N=24	PI	7.00 ± 0.81	3.75± 0.53	6.78	0.001**
	NDI	55.32± 11.30	21.50 ±5.00	5.47	0.005*

*Key: *Significant at p < 0.05. ** Significant at p < 0.001.*

Presented in Table 2 is the dependent –t-test comparing the pre and post treatment pain intensity and neck disability index for experimental group. In the experimental group, there was a significant difference between the pretreatment and post treatment pain intensity (t= 10.75, p< 0.001) and neck pain disability index (t=2.42, p< 0.03). There was also a significant difference between pre-treatment and post treatment pain intensity (t=6.78, p < .001) and NDI (t= 5.47, p = .005) in the control group.

Table 3 Independent –t-test comparing the pre-treatment pain intensity and NDI of treatment and control group (N= 48)

		Experimental	Control	t	p
Pre-treatment	PI	6.87 ± 0.99	7.00 ±.81	0.147	0.709
	NDI	42.13 ±16.63	55.25±11.23	0.276	0.610
Post-treatment	PI	2.50± 0.53	3.75± 0.53	-3.98	0.006*
	NDI	24.50 ±17.6	21.50 ±5.00	-2.21	0.830

**Significant at p < 0.05.*

Presented in Table 3 is the independent-t-test comparing the pre-treatment pain intensity (PI) and NDI of experimental and control group and post treatment of both groups.
There was no significance difference between the pretreatment value of PI (p=0.709) and NDI (p<0.610) of the 2 groups. However, there was a significant difference between the post treatment pain intensity (t= -3.98, p=0.006) of experimental and control groups.

Discussion

The purpose of this study was to assess the effect of continuous cervical traction in patient with radiating neck pain. The pretreatment pain intensity, neck disability assessment and other physical characteristics of participants in this study revealed that there was no significant difference from the cervical traction and control group. This is an indication that the baseline parameters of the participants were comparable. The present study demonstrated significant improvements in pain and NDI scores over a period of four weeks for the two experimental groups. This was supported by the work according to Radhakrishnan et al., which reported that conservative treatment is generally believed to alleviate symptoms of cervical radiculopathy, at least for the short term but the long-term prognosis remains unknown. [28] This is evidence that massage, exercise and cryotherapy in combination are effective in the management of cervical radiculopathy. The contribution of ice therapy in the relief of pain in this study was supported by the study of Bleakley et al. [29] In addition, Knight and Knight et al., reported that cryotherapy may be most effective when combined with exercise. [30,31] Adequate cooling can reduce pain, spasm, and neural inhibition, thereby allowing for earlier and more aggressive exercises. Algafly and George, concluded in their study that cryotherapy can increase pain tolerance, pain threshold and decrease nerve conduction velocity, the mechanism by which cryotherapy achieves its clinical goal of relieving pain. [32]

The result of this study revealed a significant difference between the pre-treatment pain assessment and 4th week pain assessment for cervical traction group. There was also a significant difference between the pre-treatment NDI and 4th week NDI value. This supported the work of Borman et al., and Gram et al., who found that continuous cervical traction is effective in the management of neck pain.[21,33] During application of traction, there is muscle tension and skin stretching. The rationale for traction is based on mechanical and reflex mechanism. Spinal elongation through an increase of intervertebral space and relaxation of spinal muscles is assumed to be the most important of the proposed mechanisms by which traction could be effective. [34] There was evidence that traction decreases the pressure within the vertebral disks and unloads the structures of the spine by stretching muscles and ligaments.[35] It is probable that traction has an important role in breaking the "circle of pain" in cervical radiculopathy caused by a herniated disk. This cycle begins when nerve roots are compressed by a herniated disk, causing entrapment within the intervertebral foramina. The irritated nerve produces a reflex response to the patient's cervical muscles, causing those muscles to contract. That contraction further narrows the foramina, and the neck pain is increased. Traction helps to relieve the inflammatory reaction of nerve roots by improving the circulation and reducing the tissues swelling. Gentle alteration of stretching and relaxation of the neck soft tissue structures prevents the formation of adhesions of the dural sleeve. [36]

There was a significant decrease in the pain intensity at end of 4th week between the cervical traction group and control group in this study. An indication that cervical traction reduces neck pain better that control. This is in agreement with the finding of Elnaggar et al. [37] Their study compared two different type of cervical traction on neck and arm pain severity, amplitude and latency of H-reflex of flexor carpiradialis muscle, and neck mobility in

patients with C6 and C7 radiculopathy. They concluded that both cervical traction methods had a significant effect on neck and arm pain reduction, a significant improvement in nerve function, and a significant increase in neck mobility. Our finding was also in consistence with work of Voltonen et al. who concluded that traction relieves muscle spasm and significantly decreases electrical activity in the muscles and producing relaxation, which leads to systematic relief of pain. [38] Krause et al, found that traction has been shown to separate the vertebrae, stretch the cervical joint capsules, stretch neck muscles, and open the foramina. [39]

The significant reduction between the pre treatment value of NDI and 4th week treatment for cervical traction was in line with the finding of Savva and Giakas who reported a case study of cervical traction on radiculopathy of a 51 years old woman. [40] They concluded that the application of cervical traction combined with neural mobilization may produce significant improvements in terms of pain and disability in cervical radiculopathy. The widening of disc space during traction may decrease pressure and stretch the anterior and posterior longitudinal ligaments. [39] The widening of the space may result in reducing pressure within the disc space that, in effect, sucks back the herniated nuclear substance and helps to push the herniation back into place by stretching the posterior longitudinal ligament. The end result is that the pressure of irritation on the nerve roots will be relieved hence bringing about reduction in pain intensity. [41,42]

Conclusion

It could be concluded that cervical traction is effective in relieving radiating pain and its associated disability. Inclusion of exercise and cryotherapy could have additional benefit.

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