Title: Effectiveness of static and intermittent cervical tractions in the management of patients with chronic non-specific neck pain: A pilot randomized clinical trial

Authors: Mukhtar NB, MSc, PT,[1] Sabari ZA, BPT,[1] Kaka B, PhD, PT.[1]

[1]Department of Physiotherapy, Faculty of Allied Health Sciences, College of Health Sciences, Bayero University, Kano, Nigeria

Corresponding author: Dr Bashir Kaka, Department of Physiotherapy, Faculty of Allied Health Sciences, College of Health Sciences, Bayero University, Kano, Nigeria
Email: bkaka.pth@buk.edu.ng; Tel: +2348028460237

Vol. 20, No 1 (2019), Available at http://www.njmr.org.ng

Abstract

Background: Physiotherapists commonly employ cervical traction for patients with neck pain. There is a dearth of literature on the effects of static and intermittent cervical traction on pain, range of motion and disability among patients with chronic non-specific neck pain. This study aims to compare the effect of static and intermittent cervical traction on pain, disability and range of motion among patients with chronic, non-specific neck pain.

Methods: Twenty-four participants were randomized into two groups – static and intermittent cervical traction. They were recruited from the Aminu Kano Teaching Hospital and the National Orthopaedic Hospital in Dala-Kano, Kano. Both groups received exercises and infrared treatment, in addition to static or intermittent cervical traction. Outcomes were assessed at the baseline and at the end of six weeks of intervention. Pain was assessed using a Visual Analogue Scale, neck disability through a Neck Disability Index questionnaire and cervical range of motion with a goniometer. Data was analysed using descriptive and inferential statistics, and alpha was set at <0.05.

Results: The mean ages of the participants were 46.00±7.81 and 36.00±15.02 static and intermittent groups respectively. Both groups were comparable at baseline ($p>0.05$). Both static and intermittent cervical traction were effective in reducing the disability ($p=0.011$ and 0.004) and pain ($p=0.003$ and 0.001). There was no significant difference between the groups at six weeks in terms of pain, disability and range of motion ($P>0.05$).

Conclusion and recommendation: Both static and intermittent cervical traction effectively manages chronic, non-specific neck pain and neither is superior to the other.

Key words: Traction; Static traction; Dynamic traction; Neck pain

Introduction

Neck pain is a common disorder among the populace (Côté, Cassidy & Carroll, 1998). The Bone and Joint Decade Task Force on Neck Pain and Its Associated Disorders (2000-2010) describes neck pain as pain located in the anatomical region of the neck, with or without radiation to the head, trunk and upper limbs. It includes the posterior neck region, from the superior nuchal line to the spine of the scapula and the side region down to the superior border of the clavicle and the suprasternal notch (Guzman *et al.*, 2008).

Chronic neck pain is continuous pain of more than six months' duration and is more common in women than in men (Guez *et al.*, 2002). Chronic neck pain is less likely to spontaneously resolve and therefore merits more careful investigation (Cooper, 2006). Non-specific neck pain is discomfort, without a specific underlying disease that causes pain. Symptoms vary with physical activity and over time (Binder, 2007). More than a quarter of cases with chronic symptoms had a history of neck or head trauma and one third of these had sustained a whiplash-type injury (Guez *et al.*, 2002).

There is a variety of literature concerning prevalence studies on neck pain. For instance, Swedish researchers determined that 48% of women and 38% of men in the population reported neck pain (Borghouts, Vondeling & Bouter 1999). Twenty-six to 71 percent (26-71%) of the adult population could recall an episode of neck pain or stiffness in their lifetime (Kay et al, 2005). In Belgium, women (31.48%) suffered more frequently from this symptom than men (18.43%) (Tsakitzidis, 2009). Research conducted on teachers in Kano state (Nigeria) reported neck pain as the most common musculoskeletal discomfort, with 51% prevalence (Shittu *et al.*, 2016). A similar study, conducted among undergraduate students at the University of Ibadan, Nigeria, demonstrated that the lifetime prevalence of neck pain was 34.9%, with an occurrence frequency of 9.8%. Female students tended to have a higher prevalence of lifetime neck pain than males, with respective percentages of 52.8% and 47.2%

Vol. 20, No 1 (2019), Available at http://www.njmr.org.ng

(Ayanniyi, Mbada & Iroko, 2010). A community-based study in northern Nigeria reported the lifetime, one-year and point prevalence of neck pain as 67.9%, 65.9% and 17.0% respectively (Ogwumike *et al.,* 2015).

Neck pain has an economic impact in society, due to visits made to healthcare providers, sick leave, disability and loss of productivity (Gross *et al.,* 2015). Substantive direct and indirect costs for neck disorders can be attributed to visits to health care providers. Chronic neck pain may lead to substantial drugs consumption, absenteeism from work and disability (Borghouts, Vondeling & Bouter, 1999). Whatever the duration of neck pain, it can impair functional capacity and quality of life, and cause worry, anxiety and depression. Consequently, such pain places a heavy burden on individuals, employers and health care services (Guez *et al.,* 2002; Binder, 2007).

Physiotherapy interventions often utilised for the management of neck pain include cervical traction, postural education, exercise and manual therapy, and these are applied to the cervical spine and thoracic spine (Klintberg *et al.,* 2015). Cervical traction is administered through a variety of techniques and is widely used as a therapeutic modality for the treatment of cervical pain and radiculopathy. Several modes of traction have been evaluated for the treatment of neck and radicular pain, resulting from (Gross *et al.,* 2015) cervical spondylosis or herniated disc (HD). Zylbergold and Piper (1985) demonstrated the contribution of intermittent cervical traction to the treatment of cervical diseases in terms of pain and recovery of spinal mobility (flexion and rotation).

A systematic review by Atwal and Caldwell (2005) reported the effects of manipulation, mobilisation, and exercises as a multimodal approach. Another systematic review assessed whether cervical traction, alone or in combination with other treatments, improved pain, function/disability and the global perceived effect for mechanical neck disorders (Graham *et al.,* 2008). Graham *et al.* (2008) and other researchers (Kroeling, Gross & Goldsmith, 2005;

Swezey, Swezey & Warner, 1999; Jellad *et al.*, 2009) reported the effects of intermittent traction, in comparison with control or placebo. The addition of mechanical intermittent traction does not appear to improve outcomes for patients with cervical radiculopathy who were already receiving manual therapy and exercise.

Although many studies have been conducted on cervical traction (Swezey, Swezey & Warner, 1999; Jellad *et al.*, 2009), none of them compared the effect of static and intermittent cervical traction on chronic, non-specific neck pain, disability and range of motions (Jellad *et al.*, 2009), The previous studies did not also specify the type of traction employed (Graham *et al.*, 2008). Therefore, this research aimed to determine the effects of intermittent and static traction on pain, disability and range of motion.

Methods

Design

This is a pilot randomised clinical trial.

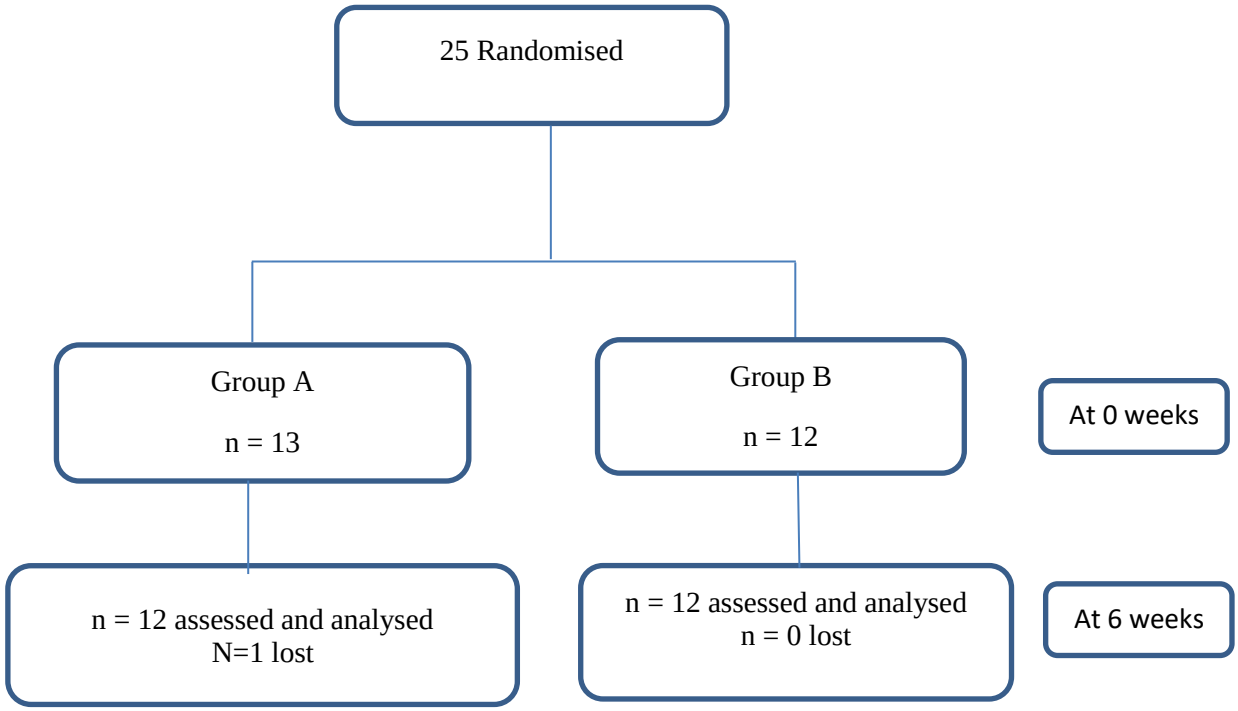
Participants

The participants involved male and female patients, 18 years old and above, with or without radiating pain to the arm, who were attending the physiotherapy clinics at the Aminu Kano Teaching Hospital (AKTH) and the National Orthopaedic Hospital in Dala-Kano (NOHD). They were included if they had chronic, non-specific neck pain with cervical radiculopathy and were attending AKTH and/or the NOHD. Those with neurological neck disorders (e.g. cervical stenosis), traumatic neck pain (e.g. fractures and sprains), malignancies, cerebrovascular insufficiency, infectious diseases (e.g. meningitis or encephalitis), rheumatoid arthritis and/or degenerative disorders (e.g. ankylosing spondylitis) were excluded.

Procedure

Approval for the study was obtained from the ethics committees of AKTH and NOHD prior to the commencement of the research. Study procedure was explained to the participants and consent was obtained. Twenty-four participants were included in the study. An administrator, independent of the study, randomised the participants into two groups (A and B) by opaque paper balloting. The pain, range of motion and disability related to neck pain were measured by a blinded and independent research assistant at the baseline and at the end of six weeks of treatment, as shown in the flow-chart in Figure 1.

Figure 1: ***Trial Flowchart***



Intervention

Participants were divided into A and B groups.

1. Infra-red radiation: This was applied to all participants, who lay in a prone position on the treatment couch. The area was exposed (neck), with 50-75cm between the participant and the modality, depending on patient tolerance, and each session was 15 minutes in length.

2. Neck-strengthening exercises: These exercises were completed by all participants, who were positioned in a comfortable, prostrate position, the neck held in a neutral position and the upper limbs freely placed at the side. Manual resistance was applied to the forehead and the participant was asked to flex the neck for five seconds, with 15 repetitions. The same procedure was applied during neck extension (resistance at the occiput) and side flexions and rotations (resistance at the zygomatic region for left and right respectively).

***Static cervical traction (Group A)*:** Participants in this group were treated with static traction, in addition to infrared radiation and strengthening exercises. An over-the-door traction kit was employed for the static cervical traction. The neck was angled at a 15-degree flexion, while the participant sat comfortably, with 10% of their body weight used. The traction lasted for 15 minutes (Hattori, Shirai & Aoki, 2002).

Intermittent cervical traction (Group B): The participants in this group received intermittent cervical traction, in addition to infrared radiation and cervical strengthening exercises. An over-the-door traction-therapy kit was utilised at the physiotherapy clinic. The neck was angled at a 15-degree flexion, while the participant sat comfortably, with 10% of the body weight used. The traction lasted for 15 minutes, with intermittent traction of two minutes on, 10 seconds off (Hattori, Shirai & Aoki, 2002).

All of the treatments were applied three times a week, for six weeks.

Measurements

Pain

A Visual Analogue Scale (VAS) was employed to measure the pain perception of the participants. The respondent was asked to place a line perpendicular to the VAS line at the point that represented their pain intensity. A ruler was used so that the score was determined by measuring the distance on the 100-mm line, providing a range of scores from 0-100mm. A higher score indicated greater pain intensity. The range comprised: 0-4 no pain, 5-44 mild

pain, 45-74 moderate pain and 75-100 severe pain. The VAS procedure takes less than a minute to complete (Pisters *et al.*, 2010).

Range of motion

Range of motion of participants was assessed using a universal goniometer.

Flexion

Flexion was measured with the participant placed in sitting position, with the thoracic and lumbar spine well supported by the back of a chair. A tongue depressor was held between his or her teeth, for reference. The shoulder girdle was stabilised to prevent flexion of the thoracic and lumbar spine. The centre of the goniometer was placed over the external auditory meatus. The movable arm was perpendicular or parallel to the ground. The distal arm was placed on the base of the nares or parallel to the longitudinal axis of the tongue depressor. The participants were asked to actively flex the neck and the reading was then taken and recorded (University of West, 2009).

Extension

Extension was measured, with the participant in sitting position, with his or her thoracic and lumbar spine well supported by the back of a chair. A tongue depressor was held between the teeth, for reference. The shoulder girdle was stabilised to prevent the flexion of the thoracic and lumbar spine. The centre of the goniometer was placed over the external auditory meatus. The movable arm was placed perpendicular or parallel to the ground. The distal arm was placed on the base of the nares, or parallel to the longitudinal axis of the tongue depressor. Participants were asked to actively extend the neck and the reading was taken and recorded.

Rotation

Neck rotation was measured with participants placed in a sitting position. The thoracic and lumbar spine was well supported by the back of a chair. The cervical spine was at zero degree of flexion, extension, lateral flexion and rotation. The shoulder girdle was stabilised to

prevent the flexion of the thoracic and lumbar spine. The centre of the goniometer was at the cranial aspect of the head. The proximal arm was parallel to an imaginary line between the two acromial processes. The distal arm was placed on the base of the nares, or parallel to the longitudinal axis of the tongue depressor. The participants were asked to rotate the neck to the right and the reading was taken and recorded. The same procedure was used for the left side rotation and recorded.

Right and left side flexion

Right and left side flexion was measured with the participants in a seated position, with the thoracic and lumbar spine well supported by the back of a chair. The centre of the goniometer was placed at the base of the participant's neck, where it joins with the shoulder. The fixed arm of the goniometer was aligned with the mid-line of the participant's head. The proximal arm was placed parallel to an imaginary line between the two acromial processes. The distal arm was placed at the mid-line of the participant's head. The two arms of the goniometer formed a straight line and the central portion showed a reading of 180 degrees. A subtraction of 180 degrees from this value obtained the range of motion of the participant's left, lateral neck flexion. The same procedure was repeated for the right, lateral neck flexion. The participants were asked to flex the neck to the right and left, and the reading was taken and recorded each time.

Neck disability

The neck disability index questionnaire (NDI-Q) was utilised to assess participant disability and was completed by the volunteers. It has a condition specific functional status, with 10 items that include pain, personal care, lifting, reading, headaches, concentration, work, driving, sleeping and recreation. Each section of the NDI was scored with a zero to five rating scale, whereby zero meant "no-pain" and five meant the "worst imaginable pain". All of the points were summed up to a total score. The test was interpreted as a raw score, with a

maximum score of 50.– 0 point or 0: no activity limitations; 5-14: mild; 15-24: moderate; 25-34: severe; and greater than 35, complete activity limitations. A higher score indicated more patient-rated disability (Kaka *et al.*, 2016).

Data analysis

Descriptive statics of frequency, percentage and tables were utilised to summarise the data obtained from the participants. A paired student t-test was used to analyse within-group differences for both the intermittent and static traction groups, while an independent t-test was used to analyse between-group differences. All statistical analyses were performed by a blinded biostatistician using the Statistical Package for Social Sciences (SPSS), version 20, and alpha was set at 0.05.

Results

Sociodemographic

Most of the participants were females 14 (58%) and the volunteers differed in terms of occupation, with most of them either civil servants or business men or women, as shown in Table 1 below.

Table 1. Gender and Occupation of participants

Gender	Frequency	Percentage (%)
Males	10	42
Females	14	58
Occupation		
Civil servant	7	29.2
Housewife	3	12.5
Business person	7	29.2
Teacher	2	8.3
Engineer	2	8.3
Student	3	12.5

Between-group comparison at the baseline

At the baseline, the two groups are comparable for age, BMI, pain, disability and neck range of motion, with no significant difference between them ($p<0.05$), as shown in Table 2.

Table 2. Between group differences in outcomes measured between static and intermittent groups before intervention

Variables	Group A (Mean ± SD)	Group B (Mean ± SD)	T	Df	p- value
AGE	46.00 ± 7.81	36.00 ± 15.02	1.25	8	0.360
BMI	24.61 ± 4.79	20.93 ± 3.27	1.42	8	0.194
VAS	5.40 ± 1.14	5.00 ± 1.58	0.46	8	0.659
NDI	15.40 ± 8.59	19.60 ± 5.23	-0.93	8	0.378
F	42.20 ± 2.78	39.80 ± 10.69	0.49	8	0.640
E	24.60 ± 6.91	29.40 ± 6.31	-1.15	8	0.285
RR	56.60 ± 14.43	62.60 ± 10.69	-0.75	8	0.476
LR	54.20 ± 12.24	62.80 ± 10.62	-1.19	8	0.269
RS	34.80 ± 9.68	30.40 ± 3.58	0.95	8	0.368
LS	32.40 ± 6.19	28.80 ± 7.36	0.84	8	0.427

Key: SD – Standard deviation, df – Degree of freedom, t – test statistics (independent paired t-test),, p-value- statistics significance, BMI – Body Mass Index, VAS – Visual Analog Scale, NDI – Neck disability Index, ROM – Range of Motion, F – Flexion of the neck, E – Extension of the neck, RR – Right Rotation, LR – Left rotation, RS – Right Side flexion, LS – Left Side flexion.

Within-group comparison for group A

This study observed a significant improvement in most of the variables measured ($p<0.05$), in terms of pain, neck disability index and the cervical range of motion, except in extension and left rotation, as shown in Table 3.

Table 3. Within-group differences in outcome measured for static cervical traction group

Variables	Pre intervention (Mean±SD)	Post intervention (Mean±SD)	t	Df	p- value
VAS	5.40 ± 1.14	2.40±1.82	6.71	4	0.003*
NDI	15.40 ± 8.59	4.40 ± 3.21	4.53	4	0.011*
F	42.20 ± 2.78	52.40 ± 6.95	-3.06	4	0.038*
E	24.60 ± 6.91	35.20 ± 8.41	-1.92	4	0.127
RR	56.60 ± 14.43	64.40 ± 11.19	-3.05	4	0.038*
LR	54.20 ± 12.24	65.00 ± 13.62	-2.16	4	0.097
RS	34.80 ± 9.68	49.20 ± 4.92	-3.26	4	0.031*
LS	32.40 ± 6.19	46.40 ± 8.27	-3.09	4	0.037*

Key: SD – Standard deviation, Df – Degree of freedom, t – test statistics (paired t-test), p-value – statistics significance, VAS – Visual Analog Scale, NDI – Neck Disability Index, ROM – Range of Motion, * – ($p<0.05$), F – Flexion of the neck, E – Extension of the neck, RR – Right Rotation, LR – Left rotation, RS – Right Side flexion, LS – Left Side flexion.

Table 4 shows a significant improvement between pre- and post-intervention measures for intermittent cervical traction, in most of the variables measured ($p<0.05$) in terms of pain, neck disability index and cervical range of motions, except in (extension).

Within-group comparison for group B

Table 4. Within-group differences in outcome measured for the intermittent cervical traction group

Variables	Pre intervention (Mean±SD)	Post intervention (Mean±SD)	t	Df	p- value
VAS	5.00 ± 1.58	2.00 ± 1.23	9.49	4	0.001*
NDI	19.60 ± 5.23	8.20 ± 1.30	6.13	4	0.004*
F	39.80 ± 10.69	49.00 ± 8.57	-5.46	4	0.005*
E	29.40 ± 6.31	34.60 ± 10.76	-1.65	4	0.174
RR	62.60 ± 10.69	75.20 ± 9.09	-3.89	4	0.018*
LR	62.80 ± 10.62	70.40 ± 9.61	-3.14	4	0.035*
RS	30.40 ± 3.58	39.20 ± 2.39	-4.43	4	0.011*
LS	28.80 ± 7.36	35.20 ± 7.13	-6.13	4	0.004*

Key: SD – Standard deviation, Df – Degree of freedom, t – test statistics (paired t-test), p-value – statistics significance, VAS – Visual Analog Scale, NDI-Q – Neck Disability Index Questionnaire, ROM-Range of Motion, * – ($p<0.05$), F – Flexion of the neck, E – Extension of the neck, RR – Right Rotation, LR – Left rotation, RS – Right Side flexion, LS – Left Side flexion.

Between-group comparison

Table 5 reveals the two groups were comparable at post-intervention, with insignificant difference in most of the variables measured, except in the neck disability index and right-side flexion ($p<0.05$).

Table 5. Post-intervention between group differences in outcomes measured between static and intermittent groups

Variables	Group A (Mean ± SD)	Group B (Mean ± SD)	t	Df	p-value
VAS	2.40 ± 1.82	2.00 ± 1.23	0.41	8	0.694
NDI	4.40 ± 3.21	8.20 ± 1.30	-2.45	8	0.040*
F	52.40 ± 6.95	49.00 ± 8.57	0.69	8	0.510
E	35.20 ± 8.41	34.60 ± 10.76	0.10	8	0.924
RR	64.40 ± 11.19	75.20 ± 9.09	-1.67	8	0.133
LR	65.00 ± 13.62	70.40 ± 9.61	-0.72	8	0.489
RS	49.20 ± 4.92	39.20 ± 2.39	4.09	8	0.003*
LS	46.40 ± 8.26	35.40 ± 7.13	2.25	8	0.054

Key: SD – Standard deviation, df – Degree of freedom, t – test statistics (independent t-test), p-value – statistics significance, BMI – Body Mass Index, VAS – Visual Analog Scale, NDI – Neck Disability Index, ROM-Range of Motion, * – ($p<0.05$), F – Flexion of the neck, E – Extension of the neck, RR – Right Rotation LR – Left rotation, RS – Right Side flexion, LS – Left Side flexion.

Discussion

The main objective of this study was to compare the effect of static versus intermittent cervical traction in the management of chronic, non-specific neck pain. The mean age of participants was comparable. Most fell within the neck pain prevalence age, as in Hoy *et al.* (2010) – from 35-49 years – with the rest in a range below this, perhaps because such pain

was becoming more prevalent among young adults. There was a female gender preponderance among participants (58%), supported by the findings of Hoy *et al.* (2010). The BMI of participants in both groups was also comparable and within the normal range. Pre-intervention pain measures, the neck disability index, the neck range of motion and the age and BMI of participants for both groups (at baseline) were not significantly different. The findings of this study indicate a significant decrease in pain and disability, and an increase in the range of motion of the neck in both groups.

The findings further revealed that both intermittent and static cervical traction are effective in the management of chronic, non-specific neck pain, which is supported by research undertaken by Zylbergold and Piper (1985), and Jellad *et al.* (2009). It is also similar to the findings of Cleland *et al.* (2005) that cervical manipulation and strengthening exercises for the scapulothoracic and deep flexor muscles in the neck, when combined with cervical traction, showed significant improvement in terms of pain and function at the end of the treatment programme and at the six-month follow-up consultation. The clinical improvement that was witnessed in the participants of this study was similar to that obtained by postural correction exercises and non-steroidal anti-inflammatory drugs treatment (Young *et al.*, 2009). Our finding, which concluded that both intermittent and static cervical traction methods had a significant effect on improvement in neck mobility, is also similar to that of Elnaggar, Elhabashy and Abd El-Menam (2009). The significant reduction between the pre-intervention of neck disability index and post-intervention for cervical traction was also in line with the findings of Savva and Giakas (2013), whose case study of cervical traction on radiculopathy of a 51-year-old woman demonstrated a reduction in disability.

The result of this research revealed a significant difference between pre-intervention and post-intervention pain for the static cervical traction group. This is supported by the work of Borman *et al.* (2008), who reported that continuous cervical traction was effective in the

management of neck pain. According to the present study, there is significant improvement in the cervical spine range of motion, except in extension and right-side flexion. The findings of Jellad *et al.* (2009) reveal the positive impact of a combination of intermittent mechanical or manual cervical traction with a standard rehabilitation programme for recent cervical radiculopathy. Since no study has reported a similar finding, our results may have been influenced by our small sample size.

The contribution of intermittent cervical traction to the treatment of cervical disease, in terms of pain and recovery of spinal mobility (flexion and rotation), is supported by Jellad *et al.* (2009). In addition, Hattori, Shirai and Aoki (2002) have demonstrated that vertical intermittent cervical traction in a sitting position, with 15 degrees of cervical spine flexion, leads to pain relief and improved nerve conduction in spondylotic myelopathy. The finding of Graham *et al.* (2008) supported intermittent traction in comparison with a control or placebo. A retrospective analysis by the scholars Swezey, Swezey and Warner (1999) demonstrated the efficacy of vertical intermittent cervical traction in a sitting position on neck and radicular pain, with an 81% reduction in symptoms – which is similar to our findings.

Although it is pilot study, this research had limitations including small sample size, included only participants with non-specific neck pain, and the absence of automatic, intermittent cervical traction. As such, any interpretation of this result should be undertaken with caution.

Conclusion

The findings of this study reveal that both intermittent and static cervical traction are effective in improving neck pain, the neck range of motion and reduction in disability in patients with chronic, non-specific neck pain. None of the methods of cervical traction were found to be superior in the management of chronic, non-specific neck pain. Intermittent traction kits being costlier, more complicated and most at times require electrical energy may justify its unavailability where this study was carried out and only when it is proven to be

superior to static traction, which our study failed to do then health care facilities may be reluctant in providing it.

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