



Original article

Inclusion of thoracic spine thrust manipulation into an electro-therapy/thermal program for the management of patients with acute mechanical neck pain: A randomized clinical trial

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Abstract

Our aim was to examine the effects of a seated thoracic spine distraction thrust manipulation included in an electrotherapy/thermal program on pain, disability, and cervical range of motion in patients with acute neck pain. This randomized controlled trial included 45 patients (20 males, 25 females) between 23 and 44 years of age presenting with acute neck pain. Patients were randomly divided into 2 groups: an experimental group which received a thoracic manipulation, and a control group which did not receive the manipulative procedure. Both groups received an electrotherapy program consisting of 6 sessions of TENS (frequency 100 Hz; 20 min), superficial thermotherapy (15 min) and soft tissue massage. The experimental group also received a thoracic manipulation once a week for 3 consecutive weeks. Outcome measures included neck pain (numerical pain rate scale; NPRS), level of disability (Northwick Park Neck Pain Questionnaire; NPQ) and neck mobility. These outcomes were assessed at baseline and 1 week after discharge. A 2-way repeated-measures ANOVA with group as between-subject variable and time as within-subject variable was used. Patients receiving thoracic manipulation experienced greater reductions in both neck pain, with between-group difference of 2.3 (95% CI 2–2.7) points on a 11-NPRS, and perceived disability with between-group differences 8.5 (95% CI 7.2–9.8) points. Further, patients receiving thoracic manipulation experienced greater increases in all cervical motions with between-group differences of 10.6° (95% CI 8.8–12.5°) for flexion; 9.9° (95% CI 8.1–11.7°) for extension; 9.5° (95% CI 7.6–11.4°) for right lateral-flexion; 8° (95% CI 6.2–9.8°) for left lateral-flexion; 9.6° (95% CI 7.7–11.6°) for right rotation; and 8.4° (95% CI 6.5–10.3°) for left rotation. We found that the inclusion of a thoracic manipulation into an electrotherapy/thermal program was effective in reducing neck pain and disability, and in increasing active cervical mobility in patients with acute neck pain.

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Keywords: Neck pain; Spinal manipulation; Thoracic spine; Electrotherapy

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1. Introduction

Approximately 25% of all outpatient physical therapy visits consist of patients with symptoms involving the neck region (Jette et al., 1994). It has been found that nearly half of the individuals with neck pain will experience debilitating symptoms (Gummeson et al., 2006). Over a third of patients with neck pain will develop chronic symptoms lasting more than 6 months (Cote et al., 2004), and nearly a third who experience a first time onset of neck pain will continue to report continued healthcare utilization for their symptoms at a 10-year follow-up (Enthoven et al., 2004).

Physical therapists utilize a number of interventions in the management of neck pain including joint manipulation (non-thrust and thrust), exercises, massage, thermo-therapy or electrotherapy (American Physical Therapy Association, 2001). However, robust evidence to support the use of many of these therapeutic strategies for neck pain is lacking (Kjellman et al., 1999; Gross et al., 2000; Hoving et al., 2001). The Philadelphia Panel Clinical Practice Guidelines concluded that many commonly used interventions for patients with neck pain lack sufficient evidence to justify their clinical use (Brosseau et al., 2001). Recently, evidence has begun to emerge for the use of manual procedures directed at the thoracic spine for patients with mechanical neck pain (Cleland et al., 2005, 2007a,b; Fernández-de-las-Peñas et al., 2004, 2007a). Cleland et al. (2005) found that thoracic thrust manipulation results in immediate improvements in neck pain at rest as measured by the visual analogue scale, compared to patients receiving a placebo manipulation. Further, it has also been found that at short-term follow-up patients receiving thoracic manipulation exhibit superior outcomes to patients receiving non-thrust techniques (Cleland et al., 2007a).

The importance of investigating the effectiveness of thoracic spinal manipulation is necessary considering the fact that the thoracic spine is the region of the spine most often manipulated, despite the fact that more patients complain of neck pain (Adams and Sim, 1998). Further, decreased mobility in the thoracic spine has been shown to be related to the presence of neck pain symptoms (Norlander et al., 1996, 1997; Norlander and Nordgren, 1998), so it is possible that manipulation of the thoracic spine may alter the biomechanics of the cervical region and decrease mechanical stress. Finally, it has previously been identified that either cervical mobilization (Vicenzino et al., 2001) or manipulation (Fernández-de-las-Peñas et al., 2007b) induces an activation of descending inhibitory mechanisms; hence, thoracic spine thrust manipulations may also result in a reduction of neck symptoms.

It should be noted that the aforementioned studies solely investigated the effects of thoracic thrust manipulation (with the exception of one study which used range of motion exercise). More often physical therapists use

a multi-modal treatment approach (exercise, manual therapy, electro-therapy, etc.) in the management of neck pain which may include thrust techniques directed at the thoracic spine. To date only one study has investigated the effects of thoracic spine manipulation incorporated into a physical therapy management program. Fernández-de-las-Peñas et al. (2004) reported that patients with whiplash-associated disorders receiving thoracic thrust manipulation as a component of a physical therapy program experienced a greater reduction in symptoms than subjects whose physical therapy did not include manipulation. To date no studies have explicitly investigated the effects of thoracic manipulation when it is added to a program including electro-therapy and thermal agents in patients with mechanical neck pain.

Hence, the purpose of this study was to examine the effects of a seated thoracic distraction manipulation when added to a program including electrotherapy/thermal modalities on neck pain, disability, and cervical mobility.

2. Materials and methods

2.1. Subjects

Forty-five patients, 20 males and 25 females, between 23 and 44 years of age (mean 34; SD 4 years) with acute mechanical neck pain referred by their primary care physician to a physical therapy clinic participated in this study. For the purpose of this study mechanical neck pain was defined as generalized neck or shoulder pain with mechanical characteristics (including symptoms provoked by neck postures, neck movement, or palpation of the cervical musculature) of less than 1 month in duration. Exclusion criteria included the following: (1) contra-indication to manipulation; (2) history of whiplash or cervical surgery; (3) diagnosis of cervical radiculopathy or myelopathy; (4) diagnosis of fibromyalgia syndrome (Wolfe et al., 1990); (5) having undergone spinal manipulative therapy in the previous 2 months; or (6) less than 18 or greater than 45 years of age. The patient history for each patient was solicited from their primary care physician to assess the presence of any exclusion criteria or “red flags” (e.g. infection, osteoporosis).

This study was supervised by the Escuela de Osteopatía de Madrid (EOM). The research project was approved by the local human research committee (EOM). All subjects signed an informed consent prior to participation in the study.

2.2. Procedure

Patients completed self-report measures and received a standardized history and physical examination by an

experienced manual physical therapist. Demographic data included age, gender, past medical history, location, nature and onset of symptoms. At the first visit, patients reported their level of neck pain and completed the Northwick Park Neck Pain Questionnaire (NPQ). Cervical mobility was assessed by an assessor blinded to the treatment allocation of the patients.

2.3. Outcome measures

Neck pain was assessed with an 11-point numerical pain rate scale (Jensen et al., 1999) (NPRS; range 0 = no pain, to 10 = maximum pain). The Spanish version of the NPQ was used to assess subjects' perceived level of disability as a result of their neck pain (Gonzalez et al., 2001). The NPQ is a self-administered questionnaire that includes 9 sections on typical daily activities that may be affected by the patient's neck pain: intensity, sleeping, numbness, duration, reading, television, carrying, work, social role, and driving. Each section is scored on a scale from 0 to 4, with 4 representing the greatest disability, and the total score is obtained by summing the scores for the 9 sections (possible score 0–36) (Leak et al., 1994). Cervical range of motion was assessed with a cervical goniometer (Performance Attainment Associates), which has been shown to be a reliable method of measurement (Jordan, 2000) with an intra-tester reliability (ICC) ranging from 0.7 to 0.9, and an inter-tester reliability ranging from 0.8 to 0.87 (Peolsson et al., 2000). Neck mobility was assessed in a relaxed sitting position. All subjects were asked to sit comfortably on a chair with both feet flat on the floor, hips and knees positioned at 90° angles, and buttocks positioned against the back of the chair. The goniometer was placed on the top of the head. Once the goniometer was set in the neutral position, the patient was asked to move the head as far as possible in a standard fashion: forwards (flexion), backwards (extension), right lateral-flexion, left lateral-flexion, right rotation, and left rotation. Three trials were recorded for each type of movement, and the mean was employed in the analysis. This method of assessment has been described elsewhere in detail (Fernández-de-las-Peñas et al., 2006).

Outcome measures were captured at baseline and 1 week after discharge from physical therapy by an assessor blind to group assignment. One week after discharge of the last session, patients again completed the 11-point NPRS and the NPQ.

2.4. Allocation

Following the baseline examination, patients were randomly assigned to receive the electrotherapy/thermal program with or without thoracic spine manipulation. Concealed allocation was performed by using a computer-generated randomized table of numbers created

prior to the beginning of the study. Individual, sequentially numbered index cards with the random assignment were prepared. The index cards were folded and placed in sealed opaque envelopes.

2.5. Treatment

Both groups received 6 sessions of a standard electrotherapy/thermal program during 3 consecutive weeks. The thoracic thrust manipulation was applied once per week for the 3 consecutive weeks and only in the experimental group. Patients were blinded to the treatment allocation group, without revealing that the inclusion of a specific intervention (thoracic spine manipulation) was being evaluated. The adequacy of subject blinding was assessed by a post-questionnaire.

2.6. Electrotherapy/thermal program

There is no consensus regarding the most effective program for the management of acute mechanical neck pain (Brosseau et al., 2001). A Cochrane Review found that the evidence for treatment of neck pain by different forms of electrotherapy is either lacking or conflicting (Kroeling et al., 2005). Nevertheless, Chiu et al. (2005) found that the application of transcutaneous electrical nerve stimulation (TENS) combined with other physical approaches was effective for improving neck muscle strength, neck pain and perceived disability. In the present study, the standardized program included the application of superficial thermo-therapy and electro-therapy as follows: an infrared lamp (Philips System, 250 W), located 50 cm distant from the patient's neck, was applied for 15 min. After superficial thermo-therapy, TENS (Uniphy phyaction 782) with a frequency of 100 Hz and 250 ms stimulation was applied for 20 min using two 4 × 6 cm electrodes placed bilaterally to the spinous process of C7 vertebra.

2.7. Thoracic spine thrust manipulation

Patients in the experimental group received a seated thoracic spine “distraction” manipulation once per week for 3 consecutive weeks as follows. The patient was seated with the arms crossed over the chest and hands passed over the shoulders. The therapist placed his or her upper chest at the level of the patient's middle thoracic spine and grasped the patient's elbows. Gentle flexion of the thoracic spine was introduced until slight tension was felt in the tissues at the contact point between the therapist's chest and patient's back. Then, a distraction thrust manipulation in an upward direction was applied (Fig. 1) (Gibbons and Tehan, 2000). Since the manipulation was applied when a tension was felt in the tissue at the contact point, cavitation often occurred at the end of range (motion barrier). During

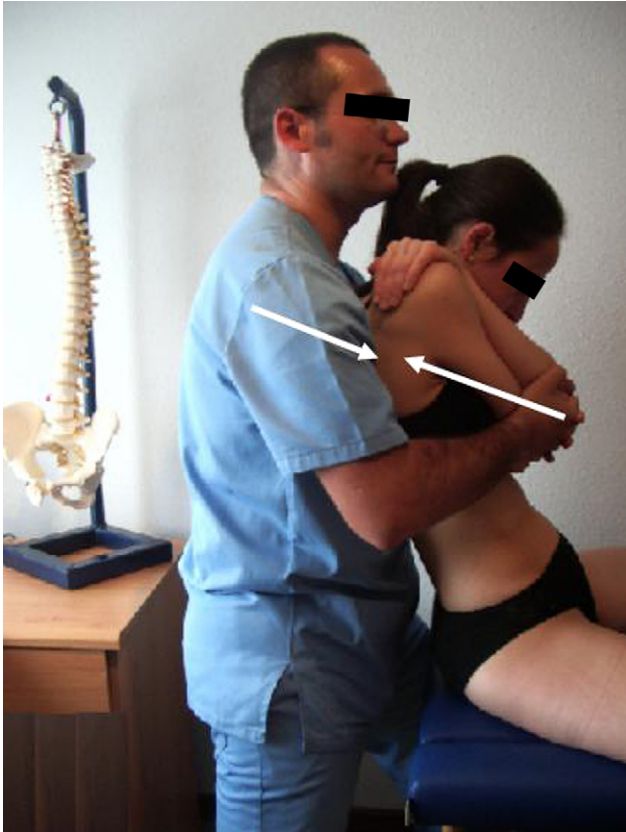


Fig. 1. Thoracic spine thrust manipulation.

the manipulation the therapist listened for a cracking or popping sound. If no popping was heard on the first attempt, the therapist repositioned the patient, and performed a second manipulation. A maximum of 2 attempts were performed on each patient. This procedure was the same as that employed in previous studies addressing the effectiveness of thoracic spine thrust manipulation in patients with mechanical neck pain (Cleland et al., 2007a,b).

2.8. Sample size determination

The sample size and power calculations were performed using Spanish software (Tamaño de la Muestra, 1.1©). The calculations were based on detecting differences of 1.13 units in a 11 numerical pain rate scale at post-data, assuming a standard deviation of 0.69 (data taken from Cleland et al., 2005), a 2-tailed test, an alpha level of 0.05, and a desired power of 80%. These assumptions generated a sample size of 20 subjects per group.

2.9. Statistical analysis

Data was analysed with the SPSS package (version 13.0). A normal distribution of quantitative data was

assessed by means of the Kolmogorov–Smirnov test ($P > 0.05$). Baseline features were compared between groups using independent t -tests for continuous data, and χ^2 tests of independence for categorical data. A 2-way repeated-measures analysis of variance (“ANOVA”) with group (experimental or control) as between-subject variable and time (pre–post test measurements) as within-subject variable was used to analyse the effects of the interventions. Separate ANOVAs were performed with pain (NPRS), disability (NPQ) and neck mobility as the dependent variables. We used intention-to-treat analysis with subjects analysed in the group to which they were allocated. Between-group effect sizes were calculated using the Cohen d coefficient (Cohen, 1988). An effect size greater than 0.8 was considered large, around 0.5 was moderate and less than 0.2 was small. The statistical analyses were conducted at a 95% confidence level. A P value less than 0.05 was considered as significant.

3. Results

The total number of subjects screened, reasons for ineligibility and drop out can be seen in Fig. 2. Twenty-three patients, 10 men and 13 women, age 23 to 42 (mean age: 34 ± 5 years) were assigned to the experimental group; and 22 patients, 10 men and 12 women, age

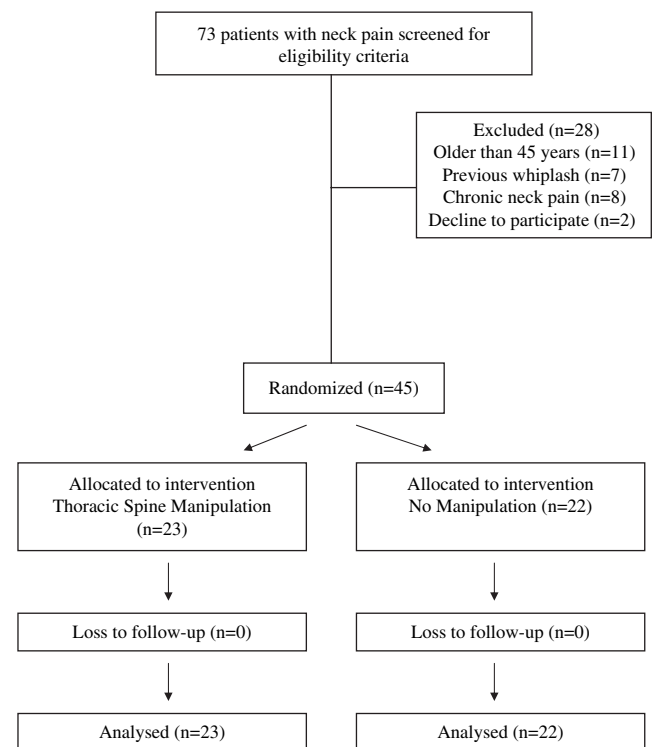


Fig. 2. Flow diagram of subject recruitment throughout the course of the study.

24–44 (mean 34 ± 6 years) formed the control group. No significant differences were found for gender ($P = 0.7$), age ($P = 0.9$), neck pain intensity ($P = 0.4$), perceived disability ($P = 0.4$), cervical range of motion ($P > 0.1$), or duration of symptoms ($P = 0.5$) between groups, so both groups were comparable in all respects at the start of the study. Baseline data of each group are detailed in Table 1.

3.1. Neck pain and perceived disability assessment

The 2-way repeated-measures ANOVA found a significant group \times time interaction for both pain intensity ($F = 28.3$; $P < 0.001$) and disability ($F = 28.3$; $P < 0.001$). Subjects receiving thoracic spine manipulation experienced greater reductions in both neck pain, with a between-group difference of 2.3 points (95% CI 2–2.7) on the NPRS, and disability, with between-group differences of 8.5 points (95% CI 7.2–9.8) in the NPQ. Further, large between-group effect sizes ($d > 1$) were found for both NPRS vs. time ($d = 1.8$) and NPQ vs. time ($d = 1.75$) in favour of the experimental group.

3.2. Active cervical range of motion assessment

The analysis of variance found a significant group \times time interaction for all cervical motions: flexion ($F = 45.4$; $P < 0.001$); extension ($F = 66.4$; $P < 0.001$); right ($F = 39.5$; $P < 0.001$) and left ($F = 27.2$; $P < 0.001$) lateral-flexion; right ($F = 28.9$; $P < 0.001$) and left ($F = 22.2$; $P < 0.001$) rotation. Patients receiving thoracic thrust manipulation experienced greater increases in all cervical motions with between-group differences of 10.6° for flexion (95% CI 8.8 – 12.5°); 9.9° for extension (95% CI 8.1 – 11.7°); 9.5° for right lateral-flexion (95% CI 7.6 – 11.4°); 8° for left lateral-flexion (95% CI 6.2 – 9.8°); 9.6° for right rotation (95% CI 7.7 – 11.6°); and 8.4° for left rotation (95% CI 6.5 – 10.3°). Again, large between-group effect sizes were also found for all

neck movements ($1.5 < d < 1.7$) in favour of the thoracic spine manipulation group. Table 2 summarizes pre–post intervention data for each outcome in both groups, and Table 3 shows the comparison of pre–post changes in either group.

Finally, in the post-study questionnaire, none of the participants accurately reported which group they believed they were allocated to.

4. Discussion

The results of our study demonstrated that patients with acute mechanical neck pain receiving an electro-therapy/thermal program plus thoracic thrust manipulation experienced a significantly greater reduction in pain and disability as well as an increase in cervical mobility compared to a group that received electrotherapy/thermal only. The effect sizes were large for all of the dependent variables assessed in favour of the thoracic spine thrust manipulation group. Additionally, it should be noted that between-group differences for pain achieved by the thoracic spine thrust manipulation group was not only statistically significant but also clinically meaningful as it exceeded the minimum clinically important difference (MCID) on the NPRS, identified as 2 points (Childs et al., 2005). Although the MCID for the NPQ has not been reported (Pietrobon et al., 2002), within-group improvements were significantly greater for subjects in the experimental group.

The current results further substantiate the findings of previous studies (Cleland et al., 2005; Fernández-de-las-Peñas et al., 2004, 2007a), all of which demonstrated that thoracic thrust manipulation resulted in changes in pain, disability and cervical mobility in different populations of patients with neck pain. While the effect sizes in this study were large, they could have potentially been greater if the inclusion criteria had included a specific subgroup of patients who are likely to exhibit a rapid and dramatic improvement from thoracic manipulation (Cleland et al., 2007a). Cleland et al. (2007a) recently developed a clinical prediction rule with 6 variables from patients with mechanical neck pain. This study identified 6 predictor variables (symptom duration < 30 days, no symptoms distal to the shoulder, looking up does not aggravate symptoms, Fear-Avoidance Beliefs Physical Activity subscale score < 12 , decreased upper thoracic spine kyphosis (T3–T5), and cervical extension $< 30^\circ$). If 3 of the 6 variables were present, the probability of experiencing a successful outcome improved from 54% to 86% (+LR 5.5). In the present study, patients with acute (less than 30 days) neck pain were included, so our patients presented with at least 1 of the predictors identified by Cleland et al. (2007a).

The physiological mechanism associated with the benefits of thrust manipulation is beyond the scope of

Table 1
Demographic features of both groups at the beginning of the study

	Control group	Experimental group
Gender (male/female)	10/12	10/13
Age (years)	34 ± 6	34 ± 5
Duration of symptoms (days)	17 ± 5	18 ± 6
Neck pain at rest (NPRS)	53.6 ± 6.3	55.6 ± 8.7
Cervical flexion (degrees)	44.7 ± 5.3	45.6 ± 4.3
Cervical extension (degrees)	58.8 ± 5.6	59.1 ± 8.1
Left lateral-flexion (degrees)	40.2 ± 4.5	39.1 ± 4.6
Right lateral-flexion (degrees)	39.4 ± 4.9	36.2 ± 5.1
Left rotation (degrees)	57.8 ± 5.4	59.2 ± 6.4
Right rotation (degrees)	56.1 ± 6.6	55.8 ± 7.3
Northwick value (degrees)	27.1 ± 2.7	27.8 ± 3.1

Values are expressed as mean \pm standard deviation.

Table 2
Within pre–post values of both groups for each outcome measure

	Control group			Experimental group		
	Pre-intervention	Post-intervention	<i>P</i> value	Pre-intervention	Post-intervention	<i>P</i> value
Neck pain at rest	5.37 (0.6)	4.3 (0.8)	<0.001	5.6 (0.9)	2.3 (1)	<0.001
Cervical flexion	44.7 (5.3)	45.6 (5.4)	NS	45.6 (4.3)	57.2 (5.8)	<0.001
Cervical extension	58.8 (5.6)	60.1 (4.8)	<0.01	59.1 (8.2)	70.3 (8.6)	<0.001
Left lateral-flexion	40.2 (4.5)	41.6 (4.4)	<0.01	39.1 (4.6)	48.5 (5.5)	<0.001
Right lateral-flexion	39.4 (4.9)	41.0 (4.2)	<0.001	36.2 (5.1)	47.2 (5.6)	<0.001
Left rotation	57.8 (5.4)	58.4 (5.1)	NS	59.2 (6.4)	68.2 (6.3)	<0.001
Right rotation	56.1 (6.6)	56.3 (5.9)	NS	55.8 (7.4)	65.6 (7.8)	<0.001
Northwick value	27.1 (2.7)	22.9 (2.9)	<0.001	27.8 (3.1)	15.2 (4.1)	<0.001

Values are expressed as mean \pm standard deviation; NS, non significant ($P > 0.05$).

the present study and remains to be fully elucidated. Further, both biomechanical and neuro-physiological (either segmental or central) mechanisms have been suggested. For instance, the biomechanical link between the cervico-thoracic spine and neck pain described by Norlander et al. (1996, 1997) may be one reason why thoracic spine manipulation is beneficial for patients with neck pain. It is also possible that spinal manipulative therapy has inherent qualities that can alter the biomechanics of the treated region (thoracic spine), and it is likely that those segments are bio-mechanically related to the cervical region. One mechanism could be that the manipulative procedure may induce a reflex inhibition of pain or reflex muscle relaxation by modifying the discharge of proprioceptive group I and II afferents (Pickar, 1999). It is also plausible that thrust manipulation decreases pain and spasm while increasing mobility through changes in muscle electrical activity (Shambaugh, 1995); reduced muscle spasm (Johansson and Sojka, 1991) or increased inter-segmental joint play subsequent to a spinal manipulation (Cassidy et al., 1992; Norlander et al., 1997, 1998). Further, mechanical stimulus induced by the manipulative procedure may also alter concentrations of inflammatory mediators (Sambajon et al., 2003), or trigger segmental inhibitory mechanisms (Wall, 2006). Finally, activation of descending inhibitory pathways may explain the decreased cervical symptoms after the application of a manipulation in

another region (Fernández-de-las-Peñas et al., 2007b). Nevertheless, it seems that more than 1 mechanism likely explains the effects of spinal manipulative therapy (Pickar, 2002), and there is insufficient evidence to claim a major role for either peripheral or central mechanisms. Future research is clearly necessary to determine if mechanisms by which manipulation exerts its effects are either mechanical or neuro-physiological or both.

Traditional manual therapy philosophies have focused on using a biomechanical approach to assessing joint dysfunction followed by treatment based on biomechanical theoretical constructs (Jull and Moore, 2002). It is often believed that manual therapists must accurately identify a segmental impairment through careful palpation of vertebral movement or alignment and, once identified, treat the particular impairment by applying a specific amount of force to a single segment in a specific direction. However, all patients in the experimental group received the identical thrust manipulation regardless of the clinical presentation. While this may seem counter-intuitive to some philosophies, based on the lack of evidence to support the use of the biomechanical models, and substandard levels of reliability with palpation techniques (Cleland et al., 2006), we selected to deliver 1 specific technique to all patients. Based on our results, we cannot say whether patients treated with a particular thrust technique selected by the physical therapist would have had better outcomes. However,

Table 3
Inter-group comparison of the changes (pre–post scores) between both groups

	Pre-post values of the control group (%; CI)	Pre-post values of the experimental group (%; CI)	Values of <i>F</i> and <i>P</i>
Neck pain at rest	9.4 (95; 7.2–11.4)	32.8 (95; 29.9–35.8)	$F = 183.1$; $P < 0.001$
Cervical flexion	0.9 (95; -0.2–1.9)	11.6 (95; 10.0–13.1)	$F = 135.4$; $P < 0.001$
Cervical extension	1.2 (95; 0.4–2.2)	11.2 (95; 9.6–12.8)	$F = 126.4$; $P < 0.001$
Left lateral-flexion	1.4 (95; 0.5–2.4)	9.5 (95; 7.9–11.1)	$F = 77.2$; $P < 0.001$
Right lateral-flexion	1.5 (95; 0.5–2.6)	11.1 (95; 9.4–12.7)	$F = 99.4$; $P < 0.001$
Left rotation	0.6 (95; -0.5–1.6)	8.9 (95; 7.4–10.6)	$F = 82.2$; $P < 0.001$
Right rotation	0.2 (95; -1.3–1.6)	9.8 (95; 8.4–11.2)	$F = 98.9$; $P < 0.001$
Northwick value	4.1 (95; 3.4–4.8)	12.6 (95; 11.4–13.8)	$F = 166.1$; $P < 0.001$

Values are expressed as mean (95% confidence interval). *P* values come from the interaction value of the ANOVA test for time (pre, post) and group (control, experimental).

Kent et al. (2005) observed that in studies investigating the effectiveness of manual therapy in the management of low back pain in which the clinician had no choice of which techniques to use, the outcomes in the short-term were superior to studies in which the clinicians were allowed to select which techniques to use for each particular patient.

A limitation of this study includes the short-term follow-up of 1 week only. Future studies should seek to investigate the long-term benefits of thoracic thrust in patients with acute neck pain. Further, future clinical trials should investigate the effectiveness of different thoracic thrust manipulation techniques to determine which is the most efficacious. It should also be recognized that all patients were recruited at 1 physiotherapy clinic, so the patients may not be representative of the general population with neck pain. Future studies should consist of multi-centre trials with long-term follow-up. It is possible that the cracking or popping sound during the thoracic manipulation could have created a placebo effect on those patients allocated to the experimental group. Nevertheless, this situation is difficult, if not impossible, to control in a manipulation study. Finally, physical therapy programs for the management of mechanical neck pain usually include other modalities (e.g. exercise, mobilizations, muscle energy, etc.) rather than only electrotherapy or thermal agents, so future studies including other physical therapy interventions are recommended.

5. Conclusion

We found that the inclusion of thoracic manipulation combined with a standard electrotherapy/thermal program results in significantly greater reductions in neck pain and disability as well as increases in neck mobility in the short-term in patients with acute mechanical neck pain. Our findings suggest that when treating young adults with acute mechanical neck pain clinicians should consider the findings of this trial in their decision-making. Future studies are needed to investigate the long-term effects of thoracic spine thrust manipulation in patients with neck pain.

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