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Original article

Comparative short-term effects of two thoracic spinal manipulation techniques in subjects with chronic mechanical neck pain: A randomized controlled trial☆

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ABSTRACT

Spinal Manipulation (SM) has been purported to decrease pain and improve function in subjects with non-specific neck pain. Previous research has investigated which individuals with non-specific neck pain will be more likely to benefit from SM. It has not yet been proven whether or not the effectiveness of thoracic SM depends on the specific technique being used. This double-blind randomized trial has compared the short-term effects of two thoracic SM maneuvers in subjects with chronic non-specific neck pain. Sixty participants were distributed randomly into two groups. One group received the Dog technique ($n = 30$), with the subject in supine position, and the other group underwent the Toggle-Recoil technique ($n = 30$), with the participant lying prone, T4 being the targeted area in both cases. Evaluations were made of self-reported neck pain (Visual Analogue Scale); neck mobility (Cervical Range of Motion); and pressure pain threshold at the cervical and thoracic levels (C4 and T4 spinous process) and over the site described for location of tense bands of the upper trapezius muscle. Measurements were taken before intervention, immediately afterward, and 20 min later. Both maneuvers improved neck mobility and mechanosensitivity and reduced pain in the short term. No major or clinical differences were found between the groups. In the between-groups comparison slightly better results were observed in the Toggle-Recoil group only for cervical extension ($p = 0.009$), right lateral flexion ($p = 0.004$) and left rotation ($p < 0.05$).

1. Introduction

Non-specific neck pain (NSNP) is defined as cervical pain without pathogenic and/or pathognomonic signs and symptoms (Childs et al., 2008). It is a common disorder, and may be affecting up to 46–54% of the population (Côté et al., 2000). Also, it has been described as a significant predictor of sickness absence (Kääriä et al., 2012).

It has been suggested that there is no active treatment distinctly superior to any other in the intervention of neck pain (NP) and its associated disorders (Hurwitz et al., 2008; Huisman et al., 2013). With regard to manual therapy, there is moderate quality evidence to support that high-velocity thrust manipulation produces similar positive effects as slow, non-thrust mobilization for pain reduction, patient satisfaction and function improvement in NSNP (Gross et al., 2010).

Spinal manual therapy has been linked with positive changes on pain central processing mechanisms, probably through the stimulation of areas within the central nervous system (Schmid et al., 2008). SM is thought to modify motorneuron excitability (Pickar, 2002) and release tension from the sensitized pathways (Hernández Xumet, 2009). The decrease in nociceptive inputs after SM may positively affect nociception–motor control interactions (Nijs et al., 2012).

Even though cervical SM has been shown to have positive effects on NP (Mansilla-Ferragut et al., 2009; de Camargo et al., 2011),

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there are some perceived risks associated with cervical thrust techniques, such as increased neck pain, headaches, and transient neurological symptoms (Ernst, 2007; Carlesso et al., 2010). But when considering the correlation between NP and restricted mobility in the thoracic spine (Childs et al., 2008), the use of thoracic SM (TSM) has been recommended in individuals with cervical pain (Childs et al., 2008). Positive results in pain relief, neck function, and cervical posture have been reported after TSM (Lau et al., 2011; Puentedura et al., 2011; Ferreira et al., 2013). However, there have been few high quality randomized controlled trials (Gross et al., 2010), which makes difficult to draw definitive clinical conclusions (Cross et al., 2011).

There has been progress recently to develop clinical prediction rules to identify those NP subjects who are more likely to benefit from SM (Cleland et al., 2007a; Saavedra-Hernández et al., 2011). It still remains uncertain which technique is the most effective (Gross et al., 2010). Previous attempts have been made to compare the impact of two SM procedures in subjects with low-back pain (Sutlive et al., 2009). Also, previous studies have compared the effectiveness of TSM versus cervical SM, with or without articular thrust (Puentedura et al., 2011; Masaracchio et al., 2013). However, it has not yet been proven whether or not the effect of TSM depends on the specific technique being used. Therefore, the objective of this study has been to evaluate the immediate and short-term effect of two TSM techniques of high-velocity low-amplitude on functionality of the cervical region, and to compare the differences in outcomes between both techniques.

2. Methods

2.1. Study design

A controlled, randomized, and double-blind clinical trial was carried out. The project was approved by the Institutional Review Board and has been registered in the Australian and New Zealand Clinical Trial Registry with registration number ACTRN12613001000796.

2.2. Randomization

The random sequence was obtained using a randomized number table designed by an external office (www.randomizer.org). An outside collaborator safeguarded the sequence from those participating in the study. The therapist in charge of the treatment was informed of the group allocation of every subject through a sealed opaque envelope.

2.3. Blinding

Each participant received general information about the research (possible risks and benefits) and the ethics aspects related to it. Before randomization, participants were told that a single intervention would be performed. Subjects and evaluators who collected or analyzed data remained unaware of the aims of the study and the treatment allocation group, to ensure participant blinding and outcome assessor blinding respectively (Chess and Gagnier, 2013). The clinician performing the TSM techniques did not participate in the assessment protocol.

2.4. Sample size

Sample size calculation was made taking into account a one-tailed hypothesis (subjects in both groups were expected to improve), an allocation ratio between-groups of 1:1, a large effect size ($d = 0.8$), an alpha value of 0.05 and a 90% power (Gpower 3.1.2®, Kiel University, Germany). Twenty-eight subjects per group were necessary to complete the study.

2.5. Participants

Subjects with a medical diagnosis, by a consulting physician, of chronic NSNP, with or without pain radiating to the head, trunk and/or limbs (Guzman et al., 2008), were selected from the database of the principal researcher's clinic. Of 73 individuals who responded to the invitation, 9 were excluded (Fig. 1 – flowchart). Sixty-four subjects between 18 and 60 years (37 ± 10.33) were randomly distributed in two groups. Four subjects were excluded from the analysis phase (Fig. 1). The study was conducted according to the ethical principles of the Helsinki Declaration. The data collection took place for 5 months (May–September 2012).

The inclusion criteria were: (a) aged between 18 and 60 years; (b) a minimum of a 3-month history of NSNP (Lin et al., 2013). No minimum intensity of pain was specified; (c) NP not to be due to any known cause, such as fracture or infection (Côté et al., 2008); (d) cervical pain was present with increased pain on one of the following criteria; with maintained posture, with movement and/or with palpation of the spinal muscles; and (e) perceived discomfort with joint pressure (van Schalkwyk and Parkin-Smith, 2000). Criteria for exclusion were: (a) current use of any medication which might interfere with SM; (b) the presence of any inflammatory disease (Côté et al., 2008); (c) any neurological conditions; (d) any bone pathology or history of tumors; (e) whiplash injury; (f) having received SM in the previous 2 months (Lau et al., 2011); (g) two or more positive signs of compressed nerves (changes in sensation, myotomal weakness in the arms, or alteration in deep tendon reflexes) (Puentedura et al., 2011); (h) previous spinal surgery; (i) any contraindication to SM (González-Iglesias et al., 2009a); and (j) subjects who did not achieve cavitation after two thrust attempts.

2.6. Evaluators

A physiotherapist with 9 years experience and who had received training in the assessment tools, performed the evaluations before the intervention, immediately afterward, and in the short term (20 min after intervention). The treatment in both groups was carried out by another physiotherapist with 8 years experience in the use of SM techniques (interventionist training) (Chess and Gagnier, 2013).

2.7. Outcome measures

2.7.1. Pressure algometry

The pressure pain threshold (PPT) is the minimum amount of pressure needed to evoke discomfort or pain (Fischer, 1987). To measure PPT, an analogue pressure algometer (Baseline®, FEI Inc., White Plains, NY, USA) was used. With the subject seated, PPT was assessed over the spinous process of the fourth cervical and thoracic vertebrates (C4 and T4), and over the area described for the location of tense bands in the upper trapezius (UT) muscle (Travell et al., 2001). The mean of three measurements was taken as the reference value (Heredia-Rizo et al., 2013). Pressure algometry has proven to be valid and has a high inter-examiner reliability, 0.91 (95% CI 0.82–0.97) (Chesterton et al., 2007). The minimum detectable change (MDC) to report a true difference in the UT muscle in subjects with NP has been determined in 47.2 kPa = 0.48 kg/cm^2 (Walton et al., 2011).

2.7.2. Cervical mobility

Cervical mobility was measured using the Cervical Range of Motion Basic (CROM-device®) tool (Performance Attainment

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