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Hypoalgesic effects of three different manual therapy techniques on cervical spine and psychological interaction: A randomized clinical trial

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ABSTRACT

Objective: The purpose of this study was to evaluate the extent to which psychological factors interact with a particular manual therapy (MT) technique to induce hypoalgesia in healthy subjects.

Methods: Seventy-five healthy volunteers (36 female, 39 males), were recruited in this double-blind, controlled and parallel study. Subjects were randomly assigned to receive: High velocity low amplitude technique (HVLA), joint mobilization, or Cervical Lateral glide mobilization (CLGM). Pressure pain threshold (PPT) over C7 unilaterally, trapezius muscle and lateral epicondyle bilaterally, were measured prior to single technique MT was applied and immediately after to applied MT. Pain catastrophizing, depression, anxiety and kinesiophobia were evaluated before treatment.

Results: The results indicate that hypoalgesia was observed in all groups after treatment in the neck and elbow region ($P < 0.05$), but mobilization induces more hypoalgesic effects. Catastrophizing interacted with change over time in PPT, for changes in C7 and in manipulation group.

Conclusions: All the MT techniques studied produced local and segmental hypoalgesic effects, supporting the results of previous studies studying the individual interventions. Interaction between catastrophizing and HVLA technique suggest that whether catastrophizing level is low or medium, the chance of success is high, but high levels of catastrophizing may result in poor outcome after HVLA intervention.

Trial registration: ClinicalTrials.gov Registration Number: NCT02782585.

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1. Introduction

Neck pain represents one of the more common and frequent

musculoskeletal pain disorders (Bertozzi et al., 2015b; Castaldo et al., 2014; Vicenzino et al., 1998) and the economic costs are increasing (Bertozzi et al., 2013; Borghouts et al., 1998, 1999; Isgro et al., 2014; Negrini et al., 2013). A recent systematic review has suggested that joint-biased manual therapies (MT) (i.e. joint manipulation and mobilization) have immediate or short-term pain relief effectiveness for mechanical neck pain treatment (Gross et al., 2010), but the superiority of one MT over another has not been demonstrated.

MT techniques applied to the cervical region have effects over

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both local (neck) and distant regions (elbow) in both asymptomatic (Fernandez-de-Las-Penas et al., 2008; Fernandez-de-las-Penas et al., 2007) and symptomatic populations (Bertozzi et al., 2013; Coppieters et al., 2003; Sterling et al., 2001; Vicenzino, 1995; Vicenzino et al., 1996). Neurophysiological mechanisms are hypothesized to explain the results, with effects originating from peripheral mechanisms, spinal cord and supraspinal mechanisms (George et al., 2006; Wright, 1995).

There is also an increasing interest in the study of the role of psychological variables in the treatment success in neck pain (Bertozzi et al., 2015a; Gorka et al., 2016). Psychological variables, such as anxiety catastrophizing or kinesiophobia are related to poor prognosis in the development of pain outcomes and disability in neck pain, with the Fear-Avoidance Model of pain (Vlaeyen et al., 1995) being one of the most tested (Howell et al., 2012). The role of psychological variables in neck pain have also been studied in relation to their interaction with treatment outcomes. A study in physiotherapy practice reported that high kinesiophobia, high catastrophizing and high somatization were predictors of non-recovery in patients with neck, shoulder and arm pain (Karels et al., 2007). Cai and coworkers proposed a clinical prediction rule to identify neck pain patients who were likely to benefit from mechanical cervical traction treatment in which fear avoidance beliefs played an important role (Cai et al., 2011). Hill et al., (2007) reported that catastrophizing and anxiety were independent predictors of longer term (6 months) treatment outcomes in patients with neck pain treated by physical therapy. Furthermore, Verhagen et al., (2010) recently found that increased catastrophizing at baseline increased the chance of recovery after treatment with manual therapy compared to exercise therapy in neck pain patients. In contrast, George et al., (2006), based on correlational analyses, did not find any association between level of fear of pain and anxiety and the immediate effects of spinal manipulation in healthy, asymptomatic subjects. Therefore, we can hypothesize that some psychological factors might influence manual therapy outcomes in neck pain patients, but it is unclear whether the same factors influence outcomes in people without chronic neck pain.

Although many studies have demonstrated the hypoalgesic effects of cervical manipulations and mobilization over cervical spine in pain-free subjects (Fernandez-de-Las-Penas et al., 2008; Fernandez-de-las-Penas et al., 2007; George et al., 2006; Vicenzino et al., 1999), none have demonstrated whether one manual therapy technique is better than other, and also whether the hypoalgesic effects could be induced in subjects without pain. Moreover, it is necessary to investigate the influence of psychological factors on the hypoalgesic effects of the different techniques, in pain-free subjects, who do not have any pain processing mechanism involved in the treated regions.

Therefore our goal with this paper was to evaluate extent to which psychological factors interact with a particular MT technique to induce hypoalgesia in healthy subjects.

2. Methods

2.1. Study design

We conducted a double-blind, controlled trial with healthy subjects. Informed consent was obtained from all participants and procedures were conducted according to the Declaration of Helsinki. The protocol was approved by the Local Ethical Committee (number A07–12.12) and was registered with [ClinicalTrials.gov](http://www.clinicaltrials.gov) (NCT02782585). The study has been registered at Trial registration Current Controlled Trials website. The present document was prepared according to CONSORT publishing guidelines (Johnson and Green, 2009).

2.2. Subjects

This sample was comprised of subjects with no history of neck or back pain (Pillastrini et al., 2016) over the last 3 months and without any previous experience with MT, who responded to study advertisements placed in the University, from October 2010 and June 2011. Subjects were verbally screened for history of neck or back pain and current use of pain relievers. The subjects were examined by an independent researcher before participating in the study to rule out any signs or symptoms originating from the cervical spine. The exclusion criteria consisted of any history of musculoskeletal or rheumatologic conditions, any kind of spinal surgery, dizziness, previous trauma to the cervical spine, and neurologic signs and symptoms. A physiotherapist with more than 12 years of experience in diagnosing and treating patients with musculoskeletal disorders was responsible for the selection of the study sample.

All eligible subjects signed written informed consent before they entered the study. All the eligible subjects who agreed to participate in the present study were randomly assigned an experimental group or the control group. Randomization was performed with closed envelope method using computer generated random-sequence table (GraphPad Software, Inc CA 92037, USA).

2.3. Procedure

The participants in three groups were treated by a physiotherapist with more than 10 years of clinical experience in the management of musculoskeletal disease. The physical therapist was blinded to all data. All outcomes were collected by an external observer blinded to the treatment allocation of the participants. The variables were measured at baseline and after intervention.

Each of the randomly assigned interventions was applied for a standard 5-min period to minimize variation in hypoalgesic effect due to differences related to re-assessment time and treatment dosage. Participants received High velocity, low amplitude (HVLA) or Cervical Lateral glide mobilization (CLGM) or Unilateral Posterior to Anterior mobilization. Subjects were given an explanation about the three different techniques. PPT measures were collected again 5 min after intervention was administered. Subjects were asked to notify the assessor if they experienced any pain.

2.4. Intervention

Each of the techniques used in this study were employed because they have demonstrated a capacity to produce hypoalgesia in the neck in previous studies.

2.4.1. High velocity, low amplitude (HVLA)

This technique was performed with subject in supine position. The technique was applied at C5–C6 vertebral level, because this level has been chosen in other studies (Fernandez-de-las-Penas et al., 2007). The cervical spine was placed in a neutral position. The index finger of the therapist applied a contact over the posterolateral aspect of the zygapophyseal joint of C5. The therapist cradled the subject's head with the other hand. Gentle ipsilateral side flexion and contralateral rotation to the targeted side were introduced until slight tension was perceived in the tissues at the contact point. The HVLA manipulation was directed upward and medially in the direction of the subject's contralateral eye. The therapist monitored for any cavitation or 'popping sound' accompanying the manipulations. If an audible sound was not heard during the first manipulative attempt, the procedure was repeated in the second time (Correll et al., 2016).

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