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● *Original Contribution*

EFFICACY OF THERAPEUTIC ULTRASOUND IN PAIN AND JOINT MOBILITY IN WHIPLASH TRAUMATIC ACUTE AND SUBACUTE PHASES

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Abstract—To determine if ultrasound (US) is effective in reducing pain and mobility limitation in the treatment of traumatic cervical sprain, we performed an experimental study. The sample comprised 54 diagnosed subjects with a mean age of 36.54 y (standard deviation = 12.245), assigned by simple random selection to an experimental group with ultrasound treatment and a control group with placebo ultrasound. Treatment consisted of 10 sessions of an ultrasound treatment protocol, followed by 15 sessions of a protocol identical for both groups without ultrasound. The variables assessed were pain and joint mobility. There was no significant difference ($p > 0.05$) between groups in the first 10 sessions of treatment. However, there was a statistically significant difference ($p < 0.05$) between groups on the pain variable, 20 days after completion of the US. High-active ultrasound treatment is more effective than placebo in reducing pain. (E-mail: carmen.ruizmolinero@uca.es) **© 2014 World Federation for Ultrasound in Medicine & Biology.**

Key Words: **Ultrasonic therapy, Whiplash injuries, Pain, Mobility limitation.**

INTRODUCTION

Post-traumatic cervical sprain caused by whiplash is the most common injury in traffic accidents (Pujol et al. 2003; Represas Vázquez 2005). This pathology is complicated by the disorders associated with it. Studies performed on cadavers (Combalía et al. 2001; Yoganandan et al. 2001) enumerate anatomical lesions that may occur as a result of whiplash, such as involvement of the facet joints, intervertebral discs, muscles and ligaments of the atlas–axis region of the cervical vertebrae.

The factors causing some symptoms to persist are often unknown. The pain caused by tissue damage stimulates stress, which prevents muscle relaxation and joint mobility (Combalia et al. 2001; Holm et al. 2007, 2008a; Pujol et al. 2003; Yoganandan et al. 2001). Symptoms are disabling with respect to work and activities of daily living (Gómez-Conesa and Valbuena Moya 2005; Holm et al. 2008b). The mean recovery time is 2–3 months. This pathology is therefore costly to the health care system and employers (Korthals de Bos et al. 2003) and a source of pain for the patient, who does not recover rapidly and therefore cannot return to work immediately.

The course of treatment for the injured is twofold: pharmacology and physiotherapy. Among the physiotherapy measures recommended by specialized manuals for the treatment of pain, inflammation and stiffness is ultrasound (US) (Binder 2007; Simons and Travell 2005; Verhagen et al. 2007). For 60 years, ultrasound has been used for the treatment of pain and impaired joint mobility in musculoskeletal injuries. There are studies (Robertson 2007; Robertson and Baker 2001; Robertson et al. 2006; Watson 2007, 2008; Wong et al. 2007) that argue that US is the most widely used electrophysical agent in current clinical practice by physiotherapists. However, there is great controversy over its effectiveness. One reason for this controversy is the methodological quality of published studies (Brosseau et al. 2013; Ebadi et al. 2011; Robertson 2007). Some authors (Baysal et al. 2006; Brosseau et al. 2004; Casimiro et al. 2002; Watson 2007, 2008) support the efficacy of ultrasound in reducing pain and increasing joint mobility. Watson (2007, 2008) states that when US is used at an "effective" dose, it has the ability to achieve significant therapeutic benefit beyond a placebo effect. The fact that

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incorrect doses result in minimum or no improvement does not justify the elimination of ultrasound as a therapy. Among the researchers who deny the effectiveness of US are Childs (2007), Santamano et al. (2009) and Seco et al. (2011); Robertson (2007) and Robertson et al. (2006) state that there is still little evidence of the clinical effectiveness of ultrasound in the treatment of pain resulting from musculoskeletal injuries. However, authors differ greatly over what they consider to be the correct dose. We found few publications that focus on ultrasound and traumatic cervical sprain.

In the light of this controversy, our aim was to examine the effectiveness of US in the treatment of pain and decreased joint mobility in the acute and subacute phases of post-traumatic cervical sprain. We hypothesized that the use of US in treatment in the acute and subacute phases of traumatic cervical sprain reduces pain and increases joint mobility.

METHODS

Patients

Our work is an analytical, prospective, experimental study, with blinding of patients and blind assessor, in two parallel groups, held from January 4, 2010 until January 2, 2012. Subjects were divided into two groups depending on the type of treatment received: the experimental group (E) received the usual treatment protocol as well as US therapy, and the control group received US standard treatment plus placebo.

The study population was composed of patients diagnosed with post-traumatic whiplash grades I and II who came for treatment at a private physiotherapy center in the city of Cadiz. Figure 1 is a flow chart of the study. The sample comprised 54 subjects (27 in each group), with an average age of 36.54 y (standard deviation [SD] = 12.245, range: 18–55). There were 34 women and 20 men.

To be included in the study, subjects had to be between 18 and 55 y old; be diagnosed with post-traumatic whiplash resulting from a traffic accident (grade I or II); and have an injury in the acute or subacute phase. Patients who had been previously treated in other physiotherapy centers; had a pacemaker; had undergone laminectomy; had another associated traumatic pathology (such as a fracture); had any type of degenerative bone disease or neurologic impairment; or had been diagnosed with psychological problems, such as anxiety and depression, before the accident were excluded. Also excluded were subjects whose accident had occurred more than 15 d earlier, subjects who had worn a collar longer than 7 d and subjects whose post-traumatic cervical sprain was not their first.

A non-probabilistic sampling row was used. The distribution of subjects to the two treatment groups was performed using sex-stratified randomization, and the allocation sequence was blinded through the use of sealed envelopes. During the study no patient was lost or dropped out.

Variables

Four variables were used in our study: (i) an independent variable (the application of US therapy or US placebo [Binder 2007; Yeung et al. 2006]); (ii) the dependent variable pain measured with the visual analogue scale (VAS) and algometer at four points (two in the trapezius muscle and two in the levator scapular muscle [Guevara-López et al. 2005; Simons and Travell 2005; Suissa et al. 2001]); the dependent variable joint mobility as assessed with an inclinometer (flexion, extension, right and left side bending and right and left rotation); and (iv) an improvement index, calculated as the difference between the level of pain or mobility registered before treatment or pre-test and that computed after treatment or post-test.

Ethics

This research met the standards of the Helsinki Declaration in its latest review of 2008, Law 15/1999 on Protection of Personal Data, and received approval from the ethics committee of the University of Seville. Patients were informed orally and in writing about the procedure to be carried out and signed an informed consent form to participate in the study.

Techniques and instruments for data collection

Registry computerized medical records were used to collect demographic and clinical information on the patients. The VAS and algometer (Commander Algometer, JTECH Medical Industries [ZEVEX], Salt Lake City, UT, USA) were used to measure pain. Joint range was measured with the Baseline Bubble inclinometer (Enterprises, Irvington, NY, USA).

For ultrasound, we employed the Megasonic 212P (Electromedicarin, Carim Group, Barcelona, Spain), a portable device for continuous ultrasound therapy and TENS therapy. It is equipped with a self-balancing head control for accurate ultrasonic wave emission. We used the largest head (6 cm^2) for treatment of the upper trapezius area (Simons and Travell 2005).

Interventions included ultrasound therapy, massage and exercise.

Procedure

A physiotherapist appraiser assessed the patients' pain using the VAS and algometer before starting the 1st (pre-test), 6th (post-test 5) and 11th (post-test 10)