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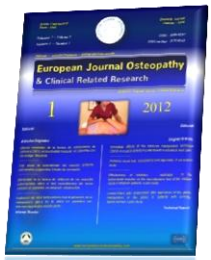

ORIGINAL ARTICLE

Effectiveness of the Suboccipital Muscle Inhibition Technique on the Neurodynamic Test of the Median Nerve in Patients with Whiplash: A Pilot Study

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ABSTRACT

Objectives: We aim to determine the immediate effectiveness of the Suboccipital muscle Inhibition Technique (SIT) in patients with cervical whiplash regarding self-perceived neck pain, grip strength and response of the elbow joint mobility to the neurodynamic test of the median nerve (Upper Limb Tension Test – ULTT-1).

Material and Methods: A randomized, single-blind, clinical trial was carried out in 18 patients (mean age: 30 ± 10.35 years;19-52 years) randomly distributed into two study groups: control (CG;n=9) and experimental (EG;n=9) group. The CG received a placebo technique consisting in a flexion/extension of hip and knee on the opposite side to which the measurement is taken. The EG was submitted to the TIS. Neck pain was measured using Visual Analogue Scale (VAS) scores, the grip strength was determined with a hand dynamometer and the elbow mobility with an universal goniometer.

Results: The EG showed a statistical increase in the elbow goniometry (p = 0.01) compared with the CG. There were no differences between groups in neck pain (p = 0.062) and grip strength (p = 0.067).

Conclusions: The application of the SIT to patients with whiplash improves the response of the elbow joint to the neurodynamic test of the median nerve, although it does not affect neck pain or grip strength.

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INTRODUCTION

Cervical whiplash injury can cause changes in the median nerve function and affect intervertebral discs, muscles, joints and ligaments [1]. Regarding the nervous tissue, it has been found that whiplash injury can damage the cervical nerve roots, the dorsal sensory root ganglia and the spinal cord [2]. On the other hand, the pain of the nervous tissue comes from the connective tissue surrounding the nerve, which is capable of transmitting pain [3]. It has been shown that both pain and changes in somatosensory thresholds may occur as a result of minor injuries on axons and/or of the inflammation of this connective tissue, without showing axonal damage. Therefore, the neuron ability to transmit nerve impulses through the axon remains intact, converting the electromyography in an inappropriate diagnostic test for this type of minor axonal injury [4]. It is worth noting that neurological symptoms can appear without evident nerve fiber damage [5].

The neurodynamic test of the median nerve (ULTT-1) is frequently used to assess the mechanics and physiology of the brachial plexus and median nerve. A pathological response to the neurodynamic test of the brachial plexus or neurodynamic test of the median nerve (ULTT-1) is defined as the reproduction of the patient's symptoms and a decreased joint mobility [4,6] by means of the principle of muscle protection [7-9]. In this sense, Jaberzadeh *et al.* [10] found an activation of the mechanoreceptors of the median nerve before pain was felt, suggesting that the nerve tissue may be implicated, as a contributing factor, in the patient symptoms [11,12]. It has also been reported [14,15] an increase in the algesic response in patients with whiplash after applying a tensile force in the brachial plexus (verifiable using the ULTT [13]). In parallel, an entrapment of the median nerve in the carpal tunnel has been suggested as an associated component to the chronic pain of the arm that occurs in cervical whiplash patients [16].

The irritation of the cervical spine nerve roots can explain many of the symptoms and signs associated with cervical whiplash. Therefore, we aim to perform the technique of inhibition of myofascial tension at this cervical level to try to avoid the spasms of the suboccipital muscles which fix the dysfunction of the occiput-atlas axis [17], as well as to achieve the distension of the dura, closely linked to the suboccipital muscles through the myodural bridge [18-20].

With this pilot study we aim to check if the suboccipital muscle inhibition technique improves the response of the patients with whiplash to the neurodynamic test of the median nerve regarding: (a) the elbow joint mobility, (b) the response to neck pain, and (c) the grip strength of the hand.

MATERIAL AND METHODS

Design

A randomized, single-blind, clinical trial was carried out without relationship between the evaluator and the therapist.

Study Sample

The sample of this pilot study consisted of 18 subjects with a mean age of 30 ± 10.35 (19-52 years), considered adequate for the proposed objectives. The sample was divided into 2 groups: Control Group (CG; n = 9) and Experimental Group (EG; n = 9).

Randomization

The distribution to each of the study groups, control (CG) and experimental (EG) was carried out using a table of random numbers.

Study Protocol

The study was conducted in the same room, between 16 and 20 h, and with a temperature about 20-22 ºC. The protocol for data collection was the following:

1. The patient, diagnosed by an specialist with cervical whiplash grade I or II according to the Quebec Task Force [21], was informed of the objectives of the study and signed the informed consent form if meeting the inclusion criteria.
   The inclusion criteria were the following: (i) adult (over 18 years old), and (ii) positive response to the ULTT-1. Exclusion criteria were the following: (i) neck pain within 3 months prior to this study, (ii) malformations, previous surgery or injury that

prevent the realization of the neurodynamic test, and (iii) neurological and/or rheumatic disorders.

2. The evaluator determines the side of the upper trapezius muscle that shows more severe symptoms, and the ULTT-1 was carried out in such side following the protocol described in previous works [8,10].

3. The evaluator performs an initial assessment of each study variable in patients of both groups (CG and EG). The neck pain was measured using the Visual Analog Scale (VAS). The amplitude of the elbow mobility was determined using a universal goniometer during the ULTT-1. The grip strength was assessed with a dynamometer (JAMAR ®, mod 5030J1, Illinois, USA).

4. Patients from the EG were submitted to the intervention technique. The placebo technique was applied to patients of the CG, and subsequently the evaluator measured again each variable in patients of both groups.

Intervention Technique in the Experimental Group

The suboccipital muscle inhibition technique was performed in patients of the EG during 4 min following the methodology described in previous studies [18,22] (fig.1).

Placebo Technique in the Control Group

The placebo technique was carried out in patients of the CG. This technique consisted in a movement of flexion/extension of hip and knee on the opposite side to which the measurement was taken (fig. 2).

Statistical Analysis

The statistical analysis was performed using the SPSS Windows 18.0 software. The mean, standard deviation and 95% confidence interval (95% CI) were calculated for each variable. The Kolmogorov-Smirnov test showed a normal distribution of all variables. The Student's t test was used for comparison of variables (goniometry of elbow joint, grip strength and self-perceived neck pain) between control and experimental groups. The level of significance used was 0.05.

Figure 1

Suboccipital Muscle Inhibition Technique.

Figure 2

Placebo technique: flexion/extension of hip and knee.

RESULTS

The sample consisted of 18 subjects, 10 women (55.6%) and 8 men (44.4%); CG (n=9) and EG (n=9). The pre-intervention demographic data and variable values (self-perceived neck pain, grip strength and goniometry of elbow) of each group are shown in table 1.

When comparing both interventions between groups we detected a significant improvement in the EG after the intervention, regards to the goniometry of elbow (p=0.010) but not significant increases were detected in neck pain (p=0.062) and grip strength (p=0.067) (table 2). Although these variables (neck pain and grip strength) did not show any significant difference, the p-value is close to the statistical significance in both cases.

DISCUSSION

The suboccipital muscle inhibition technique significantly improves the amplitude of elbow joint during the ULTT-1, although there was not any change in grip strength or self-perceived neck pain. The sustained contraction of the trapezius muscle occurs in subjects with cervical whiplash as a protective mechanism of the cervical roots [23-25].

Thus, muscle activity at this level is justified by the flexor withdrawal reflex, perpetuated by the involvement of the cervical roots. After the whiplash, the constant tension of the trapezius muscle protects the cervical region from suffering from the normal traction of the upper limb weight [10].The fascial intervention at suboccipital level seems to cause an interruption of the gamma loop that perpetuates the trapezius hyperactivity through the influence that the technique exerts on the posterior elongated hole and, thus, on the spinal nerve (cranial nerve XI). On the other hand, the relaxation of the dural system resulting from the suboccipital inhibition [18] provides a greater path of the elbow during the ULTT-1. It is more complex to explain that neck pain does not decrease after the suboccipital muscle inhibition technique. The presence of a central hyperalgesia in the patients is perpetuated by both physical and psychological aspects that enhance pain at central level [26]. Therefore, it seems to be difficult to significantly decrease such an important parameter using a single intervention. Moreover, the cervical whiplash also involves muscle problems, and malfunctions at many levels including ligaments and joints, so therapeutic treatments should include techniques that also impact directly on such levels.

VARIABLE	GROUP		Z
	EXPERIMENTAL	CONTROL	*p*
Age (i) *(years)*	30 ± 11.08	30 ± 10.22	*0.879*
Gender (ii) *(Man, Woman; %)*	44.4% (4/9); 55.6 (5/9)	44.4% (4/9); 55.6 (5/9)	1
Assessed shoulder (ii) *(Right, Left, %)*	55.6 (5/9); 44.4% (4/9)	77.8 % (7/9); 22.2 (2/9)	0.046
Pain (i) *(VAS)*	5.27 ± 1.43	5.88 ± 2.19	0.494
Grip Strength (i) *(Kg/cm²)*	21.91 ± 10.35	21.08 ± 12.12	0.877
Goniometry (i) *(Degrees)*	129.78 ± 12.82	111.11 ± 18.30	0.024 *

Table 1. Pre-intervention values in each group (control and experimental) for each variable. CONTROL: Control Group; EXPERIMENTAL: Experimental Group; Z: Kolmogorov-Smirnov; VAS: Visual Analogue Scale; p: p-value; (i) Data are expressed as mean ± (SD) standard deviation; (ii) Data are expressed as percentage (partial / total); The statistically significant differences were expressed as *p<0.05.

VARIABLE	EXPERIMENTAL	CONTROL	*p*
Pain *(VAS)*	*(- 0.88) ± - 0.85* *(-0.22 / -1.54)*	*(- 0.22) ± - 0.50* *(0.16 / -0.61)*	*0.062*
Grip Strength *(kg/cm²)*	*0.13 ± 1.87* *(1.58 / -1.30)*	*2.47 ± 3.03* *(4.80 / 0.13)*	*0.067*
Goniometry *(degrees)*	*14.33 ± 12.99* *(24.31 / 4.34)*	*(-0.78) ± 8.45* *(5.71 /- 7.27)*	*0.010 **

Table 2. Comparison between groups (control and experimental) for each variable (self-perceived pain, grip strength and goniometry of elbow) from post- to pre-intervention. CONTROL: Control Group; EXPERIMENTAL: Experimental Group; VAS: Visual Analogue Scale; p: p-value; Data are expressed as mean ± (SD) standard deviation (95% Confidence Intervals). The statistically significant differences were expressed as *p<0.05.

Finally, the fascial intervention did not improve the grip strength, although previous works showed that spinal manipulation at different vertebral levels immediately modified this parameter [27,28]. When applying the maximum grip strength is required co-activation of different muscles of the upper limb. The protection mechanism of the trapezius prevents it from further contraction, so that when we apply a slight contraction, it appears that the muscle is unable to do it. However, since our results are close to the statistical significance for both pain and grip strength, we are encouraged to continue the research in this way.

Study Limitations

One of the possible conflict of interest was the financial compensation that patients might expect, since all of them were injured in traffic accidents. The problem was solved using various filters. Therefore, the specialist who initially evaluated the patients, the evaluator and the therapist took into account this aspect, so we understand that it did not have any impact on the results.

In addition, this study could achieve findings of greater clinical significance using a bigger sample size. Similarly, it is necessary to observe the duration of the exerted effect, so that measurements in a medium-long term would be of great interest.

CONCLUSIONS

We show that the suboccipital muscle inhibition technique improves the response of patients with cervical whiplash to the neurodynamic test of the median nerve. However, this technique does not modify the neck pain or the grip strength.

ETHICS RULES

The authors state that this research meets the ethical standards established in the Declaration of Helsinki [29,30], and subsequent revisions.

CONFLICT OF INTEREST

The authors of the manuscript declare no conflict of interest.

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