

# IMMEDIATE AND SHORT-TERM EFFECTS OF UPPER THORACIC MANIPULATION ON MYOELECTRIC ACTIVITY OF STERNOCLEIDOMASTOID MUSCLES IN YOUNG WOMEN WITH CHRONIC NECK PAIN: A RANDOMIZED BLIND CLINICAL TRIAL

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## ABSTRACT

**Objective:** The aim of this study was to assess the immediate and short-term effects of upper thoracic spine manipulation on pain intensity and myoelectric activity of the sternocleidomastoid muscles in young women with chronic neck pain.

**Methods:** A randomized clinical trial was carried out involving 32 women with chronic neck pain (mean age,  $24.8 \pm 5.4$  years) allocated to an experimental group and a placebo group. Three evaluations were carried out: baseline, immediate postintervention, and short-term postintervention (48-72 hours after intervention). Myoelectric activity of the right and left sternocleidomastoid muscles was assessed at rest and during isometric contractions for cervical flexion and elevation of the shoulder girdle. Neck pain intensity was assessed at rest using a visual analog scale. Comparisons of the data were performed using 2-way repeated-measures analysis of variance with the Bonferroni correction. The level of significance was set at  $P < .05$ .

**Results:** A moderate treatment effect on myoelectric activity of the right and left sternocleidomastoid muscles during isometric elevation of the shoulder girdle was found in the experimental group only on the short-term postintervention evaluation ( $d > 0.40$ ). No statistically significant differences were found for any of the variables analyzed in the intergroup comparisons at the different evaluation times ( $P > .05$ ).

**Conclusion:** No statistically significant differences were found in the intragroup or intergroup analyses of the experimental and placebo groups regarding myoelectric activity of the cervical muscles or the intensity of neck pain at rest in the immediate or short-term postintervention evaluations. (*J Manipulative Physiol Ther* 2015;38:555-563)

**Key Indexing Terms:** Neck Pain; Musculoskeletal Manipulations; Electromyography

Neck pain is a public health problem and one of the most common musculoskeletal disorders found in the general population.<sup>1</sup> According to Côté et al,<sup>2</sup> the prevalence of neck pain is higher among young adults and the female sex, with rates of approximately 59% in

women and 41% in men. Moreover, approximately half of these individuals experience chronic, uninterrupted symptoms.<sup>3,4</sup>

According to the International Association for the Study of Pain, neck pain is classified based on the duration of

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symptoms as acute (up to 7 days), subacute (between 7 days and 3 months), or chronic (longer than 3 months).<sup>5</sup> A significant increase in myoelectric activity of the sternocleidomastoid muscle is another important sign of chronic neck pain due to the reduction in myoelectric activity of the deep cervical flexor muscles.<sup>6,7</sup> This increase in myoelectric activity is observed under different conditions: (1) during the craniocervical flexion test,<sup>6-9</sup> (2) during submaximum isometric movements of flexion and extension of the cervical spine,<sup>10,11</sup> and (3) during functional tasks involving the upper limbs<sup>6,12</sup> in which the sternocleidomastoid muscle acts as one of the synergistic muscles of the movement. Therefore, surface electromyography (EMG) is an important tool for the evaluation of neck muscle activity in individuals with chronic neck pain.<sup>7</sup>

Spinal manipulation (high-velocity, low-amplitude thrust) has become one of the most common forms of noninvasive treatment for neck pain.<sup>13</sup> A growing number of randomized clinical trials have demonstrated the effects of cervical and thoracic spine manipulation on such individuals.<sup>14-20</sup> However, the studies cited only report the effect of spinal manipulation on pain intensity and the range of motion of the cervical spine.

In systematic reviews of the literature, Huisman et al<sup>21</sup> and Cross et al<sup>22</sup> report promising results with the use of thoracic manipulation on individuals with neck pain, such as a reduction in pain and the enhancement of joint function in both the short and long terms. Walser et al<sup>13</sup> cites the principle of regional interdependence to explain the effective results of thoracic manipulation in individuals with neck pain. According to this principle, any reduction in mobility of the thoracic spine can lead to pain in the cervical spine and shoulder, which become overused because of the absence of mobility in the upper thoracic segments. Thus, when upper thoracic manipulation restores mobility to the affected segment, a consequent improvement in pain occurs in the previously overused regions.

Risk of serious complication due to neck manipulation, such as vertebrobasilar insufficiency, has been estimated to be 6 out of 10 million (0.00006%).<sup>23</sup> Despite this, Kerry et al<sup>24</sup> indicate that little support for the validity or reliability of pretreatment clinical tests has been found in the literature and also, it is currently impossible to meaningfully estimate the size of the risk of posttreatment complications. Therefore, despite the low degree of risk, upper thoracic manipulation has the potential to offer similar results with reduced risk; but complications of thoracic procedures are not yet known.<sup>25,26</sup> There may be some patients who do not accept cervical spine manipulation well or who are unable to relax the muscles because of fear of the thrusting movement. Thus, upper thoracic manipulation may be a viable alternative for such individuals.

The aim of the present study was to evaluate the immediate and short-term effects of upper thoracic spine manipulation on pain intensity and myoelectric activity of the sternocleidomastoid muscle at rest and during isometric movements of cervical flexion and elevation of the shoulder girdle in young women with chronic neck pain. The hypothesis is that upper

thoracic manipulation promotes immediate reductions in myoelectric activity of the sternocleidomastoid muscle and pain intensity in the neck region.

## METHODS

### Participants

A randomized, blind, clinical trial was carried out in the city of Piracicaba, state of São Paulo, Brazil. Recruitment, data collection, and analysis were performed at the Methodist University of Piracicaba (São Paulo, Brazil) between March 2011 and October 2012. This study received approval from the Human Research Ethics Committee of the university (protocol number 62/11) and is registered in the Brazilian Clinical Trials Registry (RBR-7yxnmv). All participants provided informed consent before their enrollment in the study.

The following were the inclusion criteria: female university students between 18 and 39 years of age, pain or fatigue in the cervical region during activities of daily living or at rest for at least 6 months, and diagnosis of neck pain based on the Neck Disability Index (NDI). Neck disability was assessed using the NDI described by Vernon and Mior,<sup>27</sup> which has been translated and validated for use on the Brazilian population.<sup>28</sup> This questionnaire is made up of 10 items that allow the classification of the severity of neck disability, as follows: absence of disability (0-4 points), mild disability (5-14 points), moderate disability (15-24 points), severe disability (25-34 points), and complete disability (35-50 points).<sup>27</sup>

The following were the exclusion criteria: NDI score less than 5 points; body mass index greater than 25 kg/m<sup>2</sup> because the amount of adipose tissue between the surface of the muscle and electrode can affect the capture of the EMG signal<sup>29</sup>; use of medication that can affect the musculoskeletal system (analgesic, anti-inflammatory, and muscle relaxer); any sign of malignant tumor, inflammatory disease, or infectious condition that contraindicates the use of manual therapy<sup>30</sup>; history of whiplash; history of surgery of the cervical spine; and experience with spinal manipulation in the previous 2 months.<sup>18</sup>

Based on the eligibility criteria, the volunteers were randomly allocated to the experimental and placebo groups at an equal proportion (1:1). Randomization was performed using opaque envelopes to conceal the allocation. The volunteers were blinded to the procedure to which they were submitted (manipulation or placebo). The researcher in charge taking the patient history and performing the EMG and pain intensity evaluations was blinded to the allocation of the participants. The physiotherapist in charge of the interventions was blinded to the aims of the study and the results of the evaluations.

### Outcomes Measures

The primary outcome was myoelectric activity in the sternocleidomastoid muscle at rest, during isometric

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