MUSCULAR PRESSURE PAIN THRESHOLD AND INFLUENCE OF CRANIOCERVICAL POSTURE IN INDIVIDUALS WITH EPISODIC TENSION-TYPE HEADACHE

LIMIAR DE DOR MUSCULAR À PRESSÃO E INFLUÊNCIA DA POSTURA CRANIOCERVICAL EM INDIVÍDUOS COM CEFALEIA TENSIONAL EPISÓDICA

UMBRAL DEL DOLOR MUSCULAR POR PRESIÓN E INFLUENCIA DE LA POSTURA CRANEOCERVICAL EN SUJETOS CON CEFALEA DE TIPO TENSIONAL EPISÓDICA

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ABSTRACT

Objective:The objective of this study was to analyze the pressure pain threshold (PPT) of the sternocleidomastoid (SCM), suboccipital (SO) and upper trapezius (UT) muscles and the craniocervical posture in individuals with episodic tension-type headache (ETTH). Methods: This study was a cross-sectional, non-randomized study with 60 young adults (77% female) comprising both sexes and an age range of 18-27 years. Individuals were distributed into a control group (G1) and individuals with ETTH (G2). The frequency of headaches per month was recorded. A pressure dynamometer was used to evaluate the PPT. Photogrammetry was used to evaluate the cervical lordosis (CL) and cephalic protrusion (CP). The data were statistically analyzed. Results: There were differences in the PPT, where the UT, SO and SCM muscles presented lower sensitivity to pain, respectively. The SCM muscle presented a lower PPT in G2. The CL and CP angles were significantly lower in G2. Conclusion: Individuals with ETTH exhibited a significantly lower PPT in the SCM and SO muscles than in the UT muscle. Nevertheless, individuals with ETTH presented with the SCM muscle being more sensitive to pain as well as higher CL and CP than individuals without symptomatology.

Keywords: photogrammetry, posture, pain.

RESUMO

Objetivo: Analisar o limiar de dor por pressão (LDP) nos músculos esternocleidomastóideo (ECM), suboccipital (SO) e trapézio superior (TS) e o posicionamento craniocervical em indivíduos com cefaleia do tipo tensional episódica (CTTE). Métodos: Estudo transversal, não randomizado com 60 adultos jovens (77% mulheres), faixa etária entre 18 e 27 anos. Os indivíduos foram distribuídos em um grupo controle (G1) e um com CTTE (G2). A frequência de dores de cabeça por mês foi coletada. Para a avaliação do LDP foi utilizado dinamômetro de pressão. Para avaliação da lordose cervical (LC) e protrusão cefálica (PC) foi utilizada a fotogrametria. Os dados foram submetidos à análise estatística. Resultados: Houve diferenças no LDP, sendo que os músculos trapézio superior (TS), suboccipital (SO) e esternocleidomastóideo (ECM) apresentaram, nessa ordem, menor sensibilidade à dor. O músculo ECM apresentou menor LDP no G2. Os ângulos de lordose cervical e protrusão cefálica foram significativamente menores no G2. Conclusão: Indivíduos com CTTE apresentam LDP significativamente menor nos músculos ECM e SO, nessa ordem, em comparação ao TS e indivíduos com CTTE têm músculo ECM mais sensível à dor, maior lordose cervical e protrusão cefálica do que indivíduos sem sintomas.

Descritores: Fotogrametria; Postura; Dor.

RESUMEN

Objetivo: Analizar el umbral de dolor por presión (UDP) de los músculos esternocleidomastoideo (ECM), suboccipital (SO) y trapecio superior (TS) y el posicionamiento craneocervical en individuos con cefalea de tipo tensional episódica (CTTE). Métodos: Estudio transversal, no aleatorizado de 60 adultos jóvenes (77% mujeres), grupo etario entre 18 e 27 años. Los individuos fueron divididos en un grupo control (G1) y otro con CTTE (G2). Se recolectó la frecuencia de los dolores de cabeza por mes. Para la evaluación del UDP fue utilizado un dinamómetro de presión y para evaluar la lordosis cervical (LC) y la protrusión cefálica (PC) se utilizó la fotogrametría. Los datos fueron sometidos a análisis estadístico. Resultados: Hubo diferencias en el UDP, y los músculos trapecio superior (TS), suboccipital (SO) y esternocleidomastoideo (ECM) mostraron, en ese orden, menor sensibilidad al dolor. El músculo ECM mostró menor UDP en el G2. Los ángulos de lordosis cervical y de protrusión cefálica fueron significativamente menores en el G2. Conclusión: Los individuos con CTTE presentan UDP significativamente menor en los músculos ECM y SO, en ese orden en comparación al TS e individuos con CTTE tienen el músculo ECM más sensible al dolor, mayor lordosis cervical y protrusión cefálica que individuos sin síntomas.

Descriptores: Fotogrametría; Postura; Dolor.

Study conducted at the Departamento de Fisioterapia e Terapia Ocupacional. Faculdade de Ciências e Tecnologias, Universidade Estadual Paulista (UNESP), Marília, SP, Brazil.
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http://dx.doi.org/10.1590/S1808-185120171602162637 Received on 04/16/2016, accepted on 02/15/2017.

INTRODUCTION

Tension-type headache (TTH), which is one of the most frequent complaints in clinical practice,[1] generates high costs and has a considerable impact on society.[2] Analgesic and antidepressant agents, frequently used for treating TTH, aim to inhibit as well as alleviate pain.[3] Understanding the pathophysiology of this type of headache is fundamentally important because it can facilitate the development of more effective treatments, preventing its chronicity[4] and reducing the use and side effects of medications.

The pathogenesis of TTH is still unclear[1]; however, studies have suggested that the involvement of nociceptive inputs from the cervical region is the primary cause of TTH.[5] The peripheral myofascial receptors, the ineffectiveness of the central regulation of pain and segmental structures are involved in the pathophysiology of TTH but are dependent on the frequency of headache and on the particularities of each individual.[6]

The skeletal muscles of the cervical region[7,8] and the craniocervical posture[9] have been the focus of studies aimed at understanding the pathophysiology and therapeutics of TTH. In episodic tension-type headache (ETTH), the main mechanisms involved in the pathogenesis are peripheral[10]; thus, it is extremely important to analyze these variables in individuals with ETTH.

Regarding the muscles in the cervical region, the identification and pressure pain threshold (PPT) of the trigger points are fundamental because reports in the literature[3] have suggested that the direct application of techniques in these muscles is an effective alternative treatment in patients with ETTH. After a systematic review, Abboud et al.[11] reported that there was a significant increase in the number of active trigger points in the upper trapezius, temporal, sternocleidomastoid and suboccipital muscles in individuals with TTH.

In the cervical region, numerous studies[12-16] have found a lower PPT at trigger points in the upper trapezius (UT) muscle in patients with chronic TTH. However, there are few studies[17,18] that analyze the PPT in individuals with ETTH, which is necessary to better understand the functional role of the muscle in the cervical region. In these studies[17,18], the intensity of pain in the trigger points was analyzed in the UT and sternocleidomastoid (SCM) muscles. Still, it is necessary to analyze the PPT in the suboccipital (SO) muscle because of the significant increase in active trigger points in individuals with ETTH.[11]

The craniocervical posture is influenced by the muscles in this region and may aggravate TTE. The position of the cervical column and head has been studied in relationship with temporomandibular disorders, migraines, and cervicalgia.[9] The position of the head can be measured by the angle formed by the line drawn between the tragus and the seventh cervical vertebra and a horizontal line.[19] However, few studies have analyzed this position in individuals with ETTH. Fernández-de-las-Peñas et al.[20] observed that these individuals present significantly greater head protrusion, whereas Sohn et al. [7] found no differences. Therefore, new studies are needed to determine the actual role of cephalic-cervical positioning in patients with ETTH.

Thus, the aim of this study was to analyze the PPT of the SCM, SO, and UT muscles and the craniocervical posture in individuals with episodic tension-type headache (ETTH).

METHODS

In this cross-sectional, non-randomized study, the sample consisted of 60 young adults of both genders, ranging from 18 to 27 years of age, who were evaluated over a period of 30 days. The individuals were divided into two groups, the control group (G1) (n=30) and the ETTH group (G2) (n=30).

In G1, volunteers with good general health status were included. Individuals with neurological or systemic diseases, previously diagnosed psychiatric disorders, cachexia, postural changes in treatment, lesions in the upper limb cingulum, diagnosis of chronic TTH or any other type of headache were excluded from the study. In G2, the same characteristics were adopted as well as the criteria of the International Headache Society[21] to analyze individuals with ETTH. The headache frequency data during the last four weeks were collected.

An algometer was used to evaluate the individuals' muscular PPT, and postural analysis was performed using photogrammetry. To evaluate the PPT in the muscle in the cervical region, a pressure dynamometer (algometer) (Kratos®) was used. The ECM, SO and UT muscles were evaluated bilaterally. For each collection, the algometer was positioned perpendicularly to the point to be evaluated, and crescent pressure was applied on the corresponding muscles until the volunteers reported a pain sensation. The values for the PPT [kilogram-force (kgf)] were recorded using an algometer, and pressure was not applied.

Subsequently, a postural evaluation was performed on the sagittal plane of the volunteers in an orthostatic position, using a digital camera (Sony® Cyber-shot 7.2 megapixels), with a standardized distance (2.8 meters from the center of the camera lens) and height (1.0 meter) for all volunteers. After the photographic recording, the images were submitted to photogrammetry based on the methodology of Iunes et al. [22] to measure the craniocervical posture. The parameters evaluated in the craniocervical posture were cervical lordosis (CL) and cephalic protrusion (CP). Before the photo session, the anatomical points were marked, as suggested by Iunes et al.[22]. The images were then analyzed using the CorelDraw X6® program.

The data were analyzed using descriptive and inferential statistics. The descriptive results were demonstrated according to the distribution of normality in mean, standard deviation (±) (parametric), median, minimum, maximum and quartiles (non-parametric). To analyze the normality of the data, the Kolmogorov-Smirnov test was used. During the PPT analysis, the results were submitted to the Kruskal-Wallis test and the post hoc Dunn's test. For intragroup comparisons, the data were analyzed using the unpaired *t*-test and corrected using the Welch method. A $p \leq 0.05$ was considered to be statistically significant. The statistical analysis was performed using the Instat software (version 3.0, GraphPad, Inc., San Diego, CA, USA).

This study was approved by the Research Ethics Committee of the Faculdade de Filosofia e Ciências de Marília - SP, protocol n° 0506/2012. The individuals were informed about the objectives and procedures of the research, and they signed the informed consent form after their agreement to these objectives and procedures. The subjects were free to decline to participate in the study or withdraw from the study at any time. The confidentiality of the participants was preserved.

RESULTS

Characteristics of the individuals

The sample in each group consisted of 77% females and 23% males. Age was not significantly different between the groups evaluated (G1: 20.1±2.11 years, G2: 20±1.76 years; $p=0.396$ unpaired *t*-test). The frequency of headache (G2) was 6.13±4.41 days/month.

Pressure pain threshold (PPT)

We observed differences in the PPT of the individuals studied ($p < 0.001$), noting that the muscles demonstrated higher (SCM), intermediate (SO) and lower (UT) sensitivity to pain, as shown in Figure 1.

Table 1 presents the mean values of the PPT for the muscles evaluated in both groups. The results of the PPT in the bilateral ECM muscle were significantly lower in G2 than in G1 ($p<0.05$), mainly on the left side. There were no significant differences in the other muscles between both groups.

Angles evaluated using photogrammetry

The data for the evaluated angles are shown in Table 2. The angle CL, unilateral or bilateral, was significantly lower in G2. Regarding CP, the angles were smaller in G2 ($p<0.05$), but without significant difference in the right lateral view.

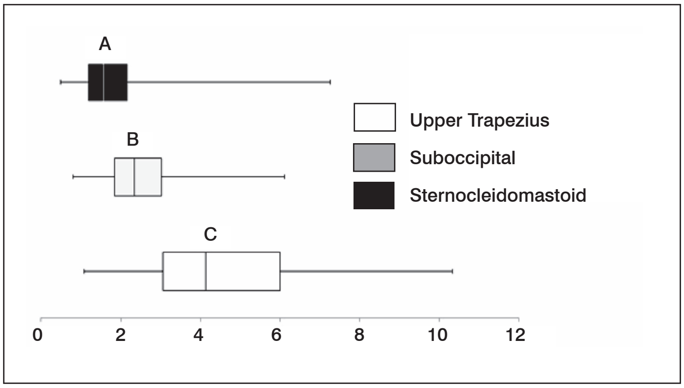

Figure 1. Pressure pain threshold (kgf) of the muscles in the cervical region in the individuals evaluated (n=60). "A," "B," and "C" represent a significant difference, p<0.001, using the Kruskal-Wallis test and post hoc Dunn's test.

Table 1. Pressure pain threshold (kgf) of the muscles in the cervical region, expressed as the mean ± standard deviation values.

Muscles	G1 (n=30)	G2 (n=30)	p
UT	4.69 ±2.18	4.68 ±2.22	0.486
UT right	4.80 ±2.14	4.66 ±2.21	0.399
UT left	4.58 ±2.27	4.69 ±2.27	0.422
SO	2.62 ±0.96	2.40 ±1.05	0.117
SO right	2.49 ±0.89	2.24 ±0.11	0.170
SO left	2.74 ±1.02	2.55 ±0.98	0.233
SCM	1.98 ±1.10	1.60 ±0.93	0.023*
SCM right	2.03 ±1.37	1.63 ±1.05	0.108
SCM left	1.92 ±0.75	1.57 ±0.80	0.041*

*p<0,05, unpaired t-test corrected by the Welch method. UT, upper trapezius; SO, suboccipital; SCM, sternocleidomastoid.

Table 2. Angles of cervical lordosis (CL) and cephalic protrusion (CP), expressed as the mean ± standard deviation values.

Muscles	G1 (n=30)	G2 (n=30)	p
CP	53.81 ±4.57	51.88 ±5.47	0.019*
CP right	55.05 ±4.58	53.31 ±5.50	0.095
CP left	52.58 ±4.28	50.46 ±5.14	0.044*
CL	59.87 ±4.88	51.42 ±8.28	<0.0001*
CL right	59.73 ±4.76	51.45 ±8.28	<0.0001*
CL left	60.00 ±5.08	51.39 ±8.43	<0.0001*

*p<0,05, unpaired t-test corrected by the Welch method.

DISCUSSION

The knowledge of trigger points, the PPT and the craniocervical posture may contribute to the diagnosis, monitoring and treatment of patients with ETTH.[3,11] In this way, we seek to analyze the PPT in the myofascial trigger points and head posture of these individuals.

The PPT was significantly lower in the SCM and SO muscles than in the UT muscle. These muscles are constantly recruited to maintain an interfix balance in this region, where the load is anterior and the force is posterior.[23] The exacerbated activation of these muscles may be associated with the shortening of the muscles evaluated, as suggested by Simons et al.[24], provoking an increase in sensitivity to pain upon pressure. Moreover, this difference can be explained by the fact that these muscles (SCM and SO) are more sensitive, thus presenting a lower PPT, as verified by Soee et al.[25], who found a similar result in the UT muscle in children compared to the temporal muscle.

When compared to the PPT, we observed that G2 presented greater pain perception in the SCM muscle than that of G1. Another study[18] showed a similar result and suggested that the pain sensitivity in this muscle can be used as a parameter in the diagnosis of ETTH. Additionally, Falla et al.[26] revealed hyperactivity and increased SCM fatigue in patients with chronic neck pain, which compliments the hypothesis that this muscle has a greater functional role in cervical control. Sohn et al.[27] found similar results in individuals with ETTH, which justify a higher recruitment of motor units that lead to the early accumulation of muscle by-products with a recruitment of fast motor units (type II fibers). They propose that the management of neck pain can promote alterations in the properties of the fibers, ranging from slow contraction to rapid contraction, which can result in fatigue.

In this context, muscular fatigue may also be a consequence of active psychosocial factors. These factors result in spasm or static muscle contraction with increased pressure in the muscle, consequently reducing blood flow and promoting oxygen deficit.[29,30] Thus, the muscles are induced to contract under anaerobic conditions, promoting accumulation of lactic acid,[28] where changes occur in the types of muscle fibers.[27] Local ischemia resulting from muscle spasm promotes ideal conditions for the release of chemical substances that induce pain.[29]

We observed that the UT and OS muscles did not show significant differences in the PPT between G1 and G2. Soee et al.[25] found a similar result in children with regard to the UT muscle and suggested that the outcomes might be because episodic headache consists of an intermediate stage between the tension-type groups for their chronification.

The results of Fernández-de-las-Peñas et al.[14] corroborate with the hypothesis on chronic TTH, in which it was observed that the UT muscle was significantly more sensitive in these patients. Thus, this explanation would justify the difference found between the groups (G1 and G2) in this study with respect to these muscles. Fernández-de-las-Peñas et al.[30], when evaluating another type of headache, found the same result when the UT and temporal muscles were analyzed. Thus, these results suggest that other muscles have greater primary influence in an early phase of headache than the UT muscle, even in different types.

Regarding the craniocervical posture, we observed increased flexural postures of the head, CL and CP. Fernández-de-las-Peñas et al.[20] observed that these individuals present significantly higher CP, whereas Sohn et al.[7] found no differences. Several studies[18,20] have suggested that a flexor position of the head is related to the shortening of the extensor muscles inserted in the posterior region of the head, such as suboccipital, superior trapezius, and sternocleidomastoid muscles. According to two studies,[7,20] this posture is likely related to the development and accentuation of pain in the TTH. Therefore, we observed a lower PPT in the SCM and the accentuation of CP, simultaneously, in the left hemibody.

Sohn et al.[7] added that other factors may be involved in the flexor posture of the head, such as age, environmental factors, lifestyle, sociocultural factors and especially the higher prevalence of trigger points. Any habitual posture with prolonged contraction, especially abnormal postures, can result in the development and accentuation of pain in the trigger points[7] as well as in the reduction of the PPT in the SCM muscle.

CONCLUSION

In conclusion, individuals with ETTH have a significantly lower PPT in the SCM and SO muscles, compared to the UT muscle. Still, individuals with ETTH present with the SCM muscle being more sensitive to pain, with a higher CL and CP than individuals without symptomatology.

All authors declare no potential conflict of interest related to this article.

CONTRIBUTION OF THE AUTHORS: JSMN and SPV participated in the analysis and discussion of the results, writing of the manuscript as well as the review and approval of the final version. SPV participated in the data collection. AEZSM and CRP participated in the supervision and design of the study, the discussion of the results, and the review and approval of the final version.

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