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Fisioterapeuta

O EFEITO DA ELETROACUPUNTURA NO TRATAMENTO DA DOR MUSCULAR

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Orientadora: Profa. Dra. Maria Beatriz Duarte Gavião

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RESUMO

A eletroacupuntura é um recurso bastante utilizado na prática clínica para alívio da dor muscular, apesar do restrito número de pesquisas avaliando sua efetividade. Desta forma, este trabalho inclui dois capítulos, sendo o primeiro intitulado *Electroacupuncture and the muscle pain threshold: a review,* no qual foi realizada a revisão crítica da literatura, com o objetivo de verificar a efetividade da eletroacupuntura no tratamento da dor muscular. As bases de dados pesquisadas foram ISI, Pubmed, Scielo, Scopus, Cochrane, Bireme de 1977 a Janeiro de 2010 para artigos contendo as palavras chave *electroacupuncture* AND *muscle* AND *pain.* Apesar dos estudos avaliados apresentarem diferenças metodológicas, o que dificultou a comparação entre os resultados, todos consideraram que a EA é eficaz no tratamento da dor miofascial. Nenhum dos estudos considerou a influência do ciclo menstrual na avaliação do limiar de dor, nem mesmo o efeito obtido durante o tratamento, apresentando-o apenas antes e após todas as sessões. O segundo capítulo intitula-se *Electroacupuncture for myofascial pain in the upper trapezius muscle*, que teve como objetivo avaliar longitudinalmente os efeitos da EA no tratamento da dor miofascial da parte superior do músculo trapézio, por meio da Escala Visual Analógica, da algometria digital, da eletromiografia de superfície e do questionário de qualidade de vida SF-36. Os resultados mostraram que a EA foi efetiva no alívio da dor miofascial do músculo trapézio. Foi observado tanto efeito imediato após cada aplicação da EA como também efeito cumulativo especialmente a partir da terceira sessão. A fase pré-menstrual e menstrual parece estar relacionada ao aumento no limiar de dor observado na sexta. Concluiu-se que a EA foi eficaz no alívio da dor miofascial na amostra avaliada.

Palavras chave: dor muscular, músculo trapézio, eletroacupuntura.

ABSTRACT

The electroacupuncture is a commonly used resource for pain relieving, despite the restrict number of studies evaluating its effectiveness. This work includes two chapters, the first *Electroacupuncture and the muscle pain threshold: a review*, consisted of a literature critical review regarding the effectiveness of electroacupunture on the muscular pain treatment. The electronic database researched was ISI, Pubmed, Scielo, Scopus, Cochrane, Bireme from 1977 to January 2010, for articles containing the key words *electroacupuncture* AND *muscle* AND *pain*. Although the methodological differences raise difficulties to the analysis of their results, all the evaluated articles considered the method as efficient. Neither regarded the menstrual cycle influence at the pain threshold, nor the effect obtained along the treatment, presenting only the before and after the entire treatment effect. The second chapter, *Electroacupuncture for myofascial pain in the upper trapezius muscle*, purposed to evaluate the effects of electroacupuncture as a treatment to the upper trapezius myofascial pain on a longitudinal study. The efficacy of the treatment was evaluated in terms of pain intensity using the visual analog scale (VAS), the pressure pain threshold (PPT) by algometry, electromyography (EMG) and the SF-36 questionnaire. The occurrence of influencing factors in the sessions was monitored as was the menstrual cycle of each participant. It was observed both immediate and cumulative effect specially after the third session. The menstrual phase seems to be related to the increase of pain threshold observed on the sixth session. The EA was shown to be a reliable method for pain relief in the trapezius muscle at the evaluated sample.

Key words: Muscular pain, Trapezius muscle, electroacupuncture.

SUMÁRIO

INTRODUÇÃO

A síndrome da dor miofascial é a causa mais freqüente de dor muscular persistente e caracteriza-se pela presença de pontos gatilho (Pgs), que são nódulos hipersensíveis à compressão, presentes em bandas musculares tensas e palpáveis (Simons *et al.*, 1999) . Além dos sintomas sensoriais, a alteração da sensibilidade e a presença de dor referida, dor manifestada distante ao ponto da palpação e que diferencia a dor miofascial da fibromialgia, há normalmente a presença de sintomas motores como rigidez e fraqueza muscular. Sintomas autonômicos como coriza, lágrima, alteração da temperatura, sudorese e arrepio também podem estar presentes. O Pg é classificado como ativo se o padrão de dor referida estiver presente espontaneamente, e latente quando for reproduzido à palpação (Lavelle, 2007; Simons *et al.*, 1999) .

Para diagnóstico preciso da dor miofascial, a intensidade e o limiar e da dor à pressão são variáveis de importância. Para avaliação da intensidade da dor, a escala visual analógica (EVA), que consiste de uma escala graduada com os extremos correspondentes à classificação “sem dor” e “pior dor possível”, tem se mostrado efetiva quando comparada a outros instrumentos para mensuração da dor (Jensen *et al.* 1999) . O uso do algômetro, equipamento usado para avaliar a sensibilidade da dor à pressão, é considerado método objetivo para medir o limiar de dor e que possibilita medidas confiáveis em indivíduos com síndromes de dor musculoesquelética e em indivíduos assintomáticos (Visscher *et al.*, 2004) .

Outro método bastante utilizado para investigação clínica e cinesiológica da tensão muscular é a eletromiografia (EMG). A EMG é definida como estudo da função muscular pela averiguação do sinal elétrico que emana de um músculo

em atividade (Basmajian & De Luca, 1985). Tem sido aplicada para avaliar diferentes parâmetros, tais como relaxamento neuromuscular (Shin *et al.*, 2004; Voerman *et al.*, 2004; Labyt *et al.*, 2006), fraqueza muscular (Hjortskov *et al.*, 2005; Nie *et al.*, 2007) e atividades de unidades motoras (Lochynsky *et al.*, 2007; Saboisky *et al.*, 2007).

A dor crônica pode influenciar a qualidade de vida de indivíduos sintomáticos, os quais podem apresentar traços de ansiedade e tensão, desesperança ou depressão (Simons *et al.,* 1999). Para verificar esta influência tem se utilizado o Inventário de qualidade de vida SF-36 que consiste da avaliação de oito domínios: capacidade funcional, aspectos físicos, aspectos emocionais, intensidade da dor, estudo geral da dor, vitalidade, aspectos sociais e saúde mental. Este instrumento foi traduzido para o português e as propriedades psicométricas testadas e validadas (Ciconelli *et al.,* 1999).

A acupuntura tem sido usada como uma alternativa aos tratamentos convencionais para dor muscular e é definida como a estimulação de determinados pontos no corpo, pela inserção e manipulação de agulhas, com o objetivo de atingir efeitos desejáveis. A eletroacupuntura inclui a passagem de uma corrente elétrica de baixa freqüência e alta intensidade, de caráter analgésico, pois tem a finalidade de estimular os nociceptores musculares, que por sua vez ativam o sistema antinociceptivo endógeno (Okeson, 2006). Por essa razão é esperado que a eletroacupuntura apresente eficácia maior no alívio da dor em relação à acupuntura manual (Ulett *et al.* 1998, Wan *et al.* 2001).

Desta forma um dos objetivos deste trabalho foi realizar uma revisão crítica da literatura considerando os trabalhos que avaliaram o tratamento de

dores musculares com a eletroacupuntura. Outro objetivo foi avaliar os efeitos da eletroacupuntura no tratamento da dor miofascial do músculo trapézio.

CAPÍTULOS

Esta dissertação está baseada na Resolução CCPG UNICAMP/002/06 que regulamenta o formato alternativo para teses de Mestrado e Doutorado e permite a inserção de artigos científicos de autoria ou coautoria do candidato. Por se tratar de pesquisa envolvendo seres humanos, o projeto de pesquisa deste trabalho foi submetido à apreciação do Comitê de Ética em Pesquisa da Faculdade de Odontologia de Piracicaba, tendo sido aprovado com o número de protocolo 088/2008 (Anexo 1) . Sendo assim, esta dissertação é composta de 2 artigos, conforme descrito abaixo:

ARTIGO 1

Electroacupuncture for muscle pain: a review.

ARTIGO 2

Electroacupuncture for myofascial pain in the upper trapezius muscle.

ARTIGO 1

ELECTROACUPUNCTURE FOR MUSCLE PAIN: A REVIEW

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Abstract

The electroacupuncture is commonly used for pain relieving. This article aimed to verify, by a literature critical review, the effectiveness of electroacupuncture as a treatment of the muscular pain. The electronic database researched was ISI, Pubmed, Scielo, Scopus, Cochrane, Bireme from 1977 to January 2010, for articles containing the key words *electroacupuncture* AND *muscle* AND *pain*. The inclusion criteria were clinical trials concerning the treatment of muscle pain and evaluating muscle pain threshold in humans, in which at least one group has received EA. Studies were excluded if the musculoeskeletal pain were related to a neurological disease, or when EA was applied in the same time or session with other techniques not included in Chinese Medicine. Five studies were selected. Although all the evaluated articles considered the method as being efficient, the results should be interpreted with caution due to the methodological differences found between them. Concerning the pain threshold, there is no literature that considerate gender and the influence of menstrual cycle on the pain threshold. The methods of evaluation mostly used were the Visual Analog Scale (VAS) for intensity and frequency of pain, and the digital algometry, for the pressure pain threshold (PPT). With regard the body region that received treatment, one did not mention the location of the volunteer's pain and the other four presented shoulder pain and neck and head pain. The evaluation of EA effectiveness compared with other methods for the treatment of muscular pain was observed in some articles. The use of EA associated with other methods of the Chinese Medicine was also observed. Nonetheless, some of these studies do not provide enough conclusions about the effect of an isolated method. Although all studies

are in agreement about the good results with the use of EA on the treatment of muscular pain, there is a need of more strictness methods to reaffirm its effectiveness.

Introduction

Muscular pain is often attributed to a myofascial pain disorder (Travell and Simons), which has been reported to vary from 30% to 93% depending on the subspecialty practice and setting. This disorder is characterized by the presence of tender, firm nodules called trigger points (MTrPs) (Wheeler, 2004) and have been defined as hyperirritable spots located in taut bands of skeletal muscle or fascia. They are painful on compression and can give rise to characteristic referred pain, motor dysfunction, and autonomic phenomena (Simons *et al.*, 1999).

The treatment of myofascial pain disorders requires that symptomatic trigger points and muscles are identified as primary or ancillary pain generators. Acupuncture has been used as an alternative to more traditional treatments for musculoskeletal pain, such as mechanical, thermal and chemical treatments, which neurophysiologically or physically denervate the neural loop of the trigger point, to reduce pain and to solve temporary the muscular overcontraction (Wheeler, 2004). Acupuncture is defined as the stimulation of a certain point or points on the body, by the insertion of needles, to achieve a desirable effect. It is thought to prevent or modify the perception of pain or to alter physiologic functions, including pain control for the treatment of certain diseases or dysfunctions of the body (Stux, 1995). The Acupuncture needles can be stimulated manually or electrically. The electroacupuncture (EA) includes the passage of an electrical

current through the needle (Koski *et al.*, 2009) and is purported to be more effective in relieving pain than manual acupuncture (Ulett *et al.* 1998, Wan *et al.* 2001, Kim *et al.*, 2006). Studies investigating EA mechanisms of action have revealed that endogenous opioid peptides in the central nervous system mediate the analgesic effects produced by this treatment, supporting the hypothesis that balance and harmonious energy flow along meridians were restored (Walling, 2006).

Nowadays, although acupuncture is widely used in clinical practice very little research has been performed regarding electroacupuncture effectiveness on musculoeskeletal pain in humans. In this way, the aim of this study was to review the literature verifying if the EA is effective on musculoskeletal pain threshold.

Methods

We undertook a review of literature to identify if EA is effective to relief musculoskeletal pain.

Search

A systematic search was performed. The following electronic databases were sequentially searched: ISI (since 1985), Pubmed (since 1977), Bireme (since 1982), Cochrane (since 1992), Scopus (since 1977). The search terms used were: electroacupuncture AND muscle AND pain.

Two authors (MA, CR) scrutinized the titles and abstracts (where available) of the identified papers. The inclusion criteria were: clinical trials concerning the treatment of muscle pain and its evaluation regarding the muscle pain threshold

in humans, in which at least one group has received EA. Only articles in English, Spanish or Portuguese were included into the review.

Studies were excluded if the musculoeskeletal pain was related to neurological diseases, or when EA was applied in the same time or session with other techniques not included in Chinese Medicine.

For each study, the following details were extracted: type of muscle pain, design, sample size, muscle group treated, intervention, measurement of pain threshold and results.

Results

From 96 identified as potentially eligible for inclusion only nine met our inclusion criteria. Two studies were excluded due to the musculoskeletal pain were related to neurological disease (Inoue *et al.*, 2008; Zhang *et al.*, 2008), and other two were excluded because the EA was associated to others techniques not included into Chinese Medicine (Sugimoto *et al.* 1995; Yeung *et al.* 2003)

Five papers were included in this review, which have been strictly in accordance with the inclusion criteria (Nohama, Silvério-Lopes 2009; He *et al.*, 2004; Xue *et al.*, 2004; List *et al.*, 1992; Lundeberg, 1984).

Description of included clinical trials

The chart 1 shows a summary of the clinical trials included in this review.

Discussion

Treated region

All the studies involved subjects with chronic pain for more than 6 months or for more than 30 days during a year. In four studies, the volunteers had muscle pain in head and neck region (Nohama, Silvério-Lopes, 2009; He *et al.* 2004, Xue *et al.* 2004, List *et al.* 1992). One study (Lundeberg, 1984) involved chronic muscle pain without description of its specific region, turning difficult the data interpretation, despite the results had been favorable.

Gender

Four of the selected studies included both man and women volunteers. Only one had exclusively females (He *et al.* 2004), but did not take into account the menstrual cycle and its relation to the pain threshold. The influence of the menstrual cycle on pain has been investigated, and controversial results have been found. A link between mechanical sensitivity of the masticatory muscles and fluctuation of the ovarian hormones was observed in healthy subjects (Cimino *et al.*, 2000). In fact, the pain intensity of the these muscles was higher at the menstrual phase, while the intake of oral contraceptive was associated with decreased levels of reported pain (Vignolo *et al.*, 2008), suggesting the importance of menstrual cycle in studies about pain. Recently, it was demonstrated in experimental induced pain subtle menstrual-cycle effects in normal menstruating women and women taking monophasic oral contraceptives, and sex difference were found to be low (Kowalczyk *et al.*, 2009). Nevertheless, changes in hormone

levels during the menstrual cycle can lead to changes in pain responsivity as normal menstruating women had trends for better discrimination in menstrual phases when estradiol levels were highest (Kowalczyk *et al.*, 2009). In this way, the influence of ovarian cycle should be considered in the studies about muscular pain.

Study designs

All studies were comparative and properly randomized. One of them was double-blinded (He *et al.*, 2004) and another two were single blinded (Xue *et al.*, 2004; Nohama P, Silvério-Lopes SM, 2009). In sham-controlled clinical studies, the needle insertion points were 5 to 10 mm (Xue *et al.*, 2004) and 10 to 40 mm (He *et al.*, 2004) away from the correct acupoint location and maintained at superficial levels to minimize stimulation. Nohama and Silvério–Lopes (2009) compared four different frequencies of EA with acupuncture without electric stimulation.

For List *et al.* (1992) the control group was composed by patients who were waiting for treatment of craniomandibular disorders but were not exposed to placebo condition. In Lundeberg (1984) study the pain reducing effect of EA, vibratory stimulation, TENS and placebo was observed in patients suffering from myalgia. Placebo treatment was performed using sugar pills and patients were told that they were receiving a new very potent analgesic medication. Moreover, the value of the placebo group was demonstrated in a randomized, double-blind, placebo-controlled study about effects of EA upon experimental pain in healthy human volunteers, using placebo needle protocol (Barlas *et al.*, 2006). Authors above found reliable results on comparing control and placebo groups with

experimental ones. In fact, the respective designs are usually a good way to exclude or minimize the individual characteristics that may influence the results. On the other hand, further studies should be considering others parameters carefully, for example, selection parameters and treatment dosages (Casimiro *et al.*, 2005; Green *et al.*, 2005), in order to obtain more consistent results.

Chart 1 - Summary of the studies characteristics

First author	Pain	Study design	Intervention	Measurements	Results
Lundeberg, 1984	Chronic myalgia non specified (subjects with pain)	Open label, randomized, crossed over, controlled, one year followed up study. 16 males and 20 females	4 groups of 9 subjects EA, Vibratory stimulation, TENS, Placebo One session of each treatment, washout of 4 days between each session	VAS before and after each session	All tested treatments were equally effective on the pain relief and better than placebo
List, 1992	Craniomandibular disorders (CMD) symptoms	Open, randomized, controlled 110 subjects, 23 males and 87 females.	Grupo A Traditional Acupuncture - First 2 sessions EA - 6 or 8 sessions: (2-Hz, 30' intensity necessary evoke muscular contraction: IG4, E36 and traditional acupuncture points according to the individual pain 30 minutes per week. Grupo B occlusal splint Grupo C (control) (waiying for treatment) Baseline – 1 mês + 6 a 8 semanas de tratameto Follow up 6 and 12 months	VAS Subjective evaluation of pain	Both acupuncture and occlusal splint therapy reduced the symptoms as compared with the control group in which the symptoms remained essentially unchanged. Acupuncture gave better subjective results than the occlusal splint therapy.
He (2004)	Chronic pain in the neck and shoulders and related headache	Blind, randomized and sham-controlled trial 24 females (20 to 50 years old) 6 months and 3 years follow up	EA, acupuncture and ear acupressure 10 sessions in 3 or 4 weeks EA points? F =5 Hz, 30' Sham EA: 10-40 mm distal to real acupoints, no voltage Ear acupressure points 4-6 mm below to real points	Algometry VAS	Significant pain relief. These effects seemed long lasting since the results differed systematically between the subjects treated and the controls even 3 years after treatment

Chart 1 continued

Xue (2004)	Tension-type headache	Randomized, single-blinded, crossover Group A 13 ♀ 7 ♂ - phase I - EA - phase II - Sham EA Group B 13 ♀ 7 ♂ - phase I - Sham EA - phase II EA 2 sessions/week – 4 weeks washout between phases – 2 weeks follow-up - 3 months	EA in distal points, 4 groups according to Chinese diagnosis. Sham EA: 5-10 mm far from the acupuncture point	Headache (frequency and duration) and pain intensity: - VAS - Mechanical pain threshold (algometry) Quality-of-Life: - Headache disability index (HDI) - Sickness impact profile (SIP)	Significant improvement at the end of phase I for group A, but not for group B Significant differences for both groups between baseline and phase II, and baseline and follow-up No significant differences between the groups at the end of follow-up
Nohama (2009)	Neck pain due to muscular tensions	Blind, randomized 66 males and females 18-53 years old (33.67±9.97 years), 89.5% female and 10.5% male Groups: A (EA - 2500Hz, n=13) B (EA 2Hz, n=13) C (EA 1000Hz, n=13) D (EA 100Hz, n=13) E (Acupuncture, n=14)	One session of 20 minutes and after a rest period of 10 minutes Points: B10 (tianzhu), VB21 (jianjing, TA15 (tianliao), IG4 (hegu) and ID3 (houxi)	Algometry Heart rate VAS	- Degree of pain Significant Improvement in all groups (VAS) - Heart rate - no differences between groups - Algometry – intra-individual evaluation – advantages for Group A, followed by Group D

Intervention

The evaluation of EA effectiveness compared to other methods for the treatment of muscular pain was observed in some articles. The use of EA associated with other methods of the Chinese Medicine was also observed. He *et al.* (2004) used EA and acupressure to treat their subjects. List *et al.* (1992) associated EA and traditional acupuncture in CMD patients having pain in masticatory muscles. Lundeberg (1984) verified the effect of EA, vibratory stimulation, TENS and placebo upon the myalgia in several treatment groups, alternating the sequence of method applications. Some authors have been using EA and other methods of the Chinese Medicine, since the acupuncture is a clinical intervention that allows the interaction of different modalities. For example, Yip and Tse (2004) showed that 8-sessions of acupoint stimulation followed by acupressure with aromatic lavender oil were an effective method for short-term low back pain relief. Nonetheless, some of these studies do not provide enough conclusions about the effect of isolated method.

Xue *et al.* (2004) had chosen to treat tension-type headache with EA on distal acupoints only, according to the Traditional Chinese Medicine (TCM), which has not been usually considered in EA studies. It is common to find acupuncture or EA protocol applied to treat diagnosed pathologies into an occidental model, as done by List *et al.* (1992), who defined the acupuncture points individually in accordance with the respective tender regions upon palpation, i.e., points coincident with masticatory muscle trigger points. Further research is needed to determine whether addition of a distal acupuncture point enhances the efficacy of pain reduction produced by stimulation of a local craniomandibular acupoint in

TMD pain conditions (La Touche *et al.*, 2010). Moreover, more studies according to TCM and occidental research models should be developed, with the aim to provide their validity, reproducibility and effectiveness.

Lundeberg (1984) compared 4 types of treatment - EA, vibratory stimulation, TENS and placebo – during 4 sessions and groups cross over randomized. All the methods were equally effective and clearly superior to placebo. Nevertheless, the treated region was not discriminated, thus the external validity could not be confirmed.

Nohama and Silvério-Lopes (2009) verified the influence of the different stimulating frequency in analgesia induced by EA for neck pain compared with a group with acupuncture alone (without electrical stimulation). Despite the fact that the treatment was restricted to a single session, they recommend electroacupuncture application at a frequency of 2500Hz and 100Hz for analgesia of neck pain due to muscular tension because these frequencies demonstrated the highest individual efficiency in the algometry evaluation. Even though that is an important result, the efficacy of recommended parameters should be evaluated in long follow-up periods.

Pain evaluation

The authors included in this review used the Visual Analogical Scale (VAS) to measure pain intensity in different times during the researches. Lundeberg (1984) and Nohama and Silvério-Lopes (2009) used it before and after the treatment, whereas List *et al.* (1992) asked the volunteers to graduate their pain, using the VAS 3 times a day (morning, noon and afternoon) during the period of

treatment. He *et al.* (2004) identified the intensity of muscular pain during treatment (before each session) and 6 months and 3 years after the treatments. Xue *et al.* applied VAS in the beginning of the baseline period and at the end of each of the phase I, phase II, and 3-months follow- up periods. In this way, the VAS has been showed to be a reliable instrument for pain intensity measurements, as demonstrated by recent studies (Lei *et al.*, 2008; Dhillon, 2008; Sutbeyaz *et al.*, 2009).

The PPT was evaluated with a digital algometer in 3 of the 5 included articles (Nohama and Silvério-Lopes (2009), He *et al.* 2004, Xue *et al.* 2004). Despite the similarity between the treated regions, while Nohama and Silvério-Lopes chose to fix 6 evaluated points properly described in each upper trapezius, He *et al.* (2004) measured the PPT on 28 trigger points divided bilaterally on the neck and shoulders. In the Xue *et al.* study the algometer was applied on points at the frontal, suboccipital, posterior cervical, masseter and temporalis muscle, bilaterally. Although the results have shown a significant increase of the PPT in the evaluated muscles,the respective procedures of PPT evaluation, for example the increasing pressure velocity, should be better described in order to allow reproducibility. Notwithstanding, the algometer allows intra-individual and reliable measures of pain threshold to pressure in patients with a variety of musculoskeletal pain syndromes and in asymptomatic subjects (Visscher *et al.*, 2004).

Conclusion

There is very little literature concerning EA on the treatment of muscular pain and the results of the selected articles in this review should be interpreted with caution due to the differences in designs and parameters. Gender was not considered in studies concerning EA treatment for muscular pain, indicating the needs to be taken in account the ovarian cycle in further studies.

Traditional acupuncture or acupressure has been associated with EA. In these cases, the independent effectiveness of the EA can be misinterpreted.

Although all studies results are in agreement about the good results with the use of EA on the treatment of muscular pain, there is a need of more strictness methods to reaffirm its effectiveness in clinical conditions.

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ARTIGO 2

Electroacupuncture for myofascial pain in the upper trapezius muscle

Running title: Electroacupuncture for myofascial pain*

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Abstract: The aim of this study was to evaluate the effect of the electroacupuncture (EA) as a treatment of myofascial pain in the trapezius muscle. Twenty females who were 18 to 40 years old (mean age: 24.3±5.88 years), with a body mass index from 19 to 25 kg/m^2 (22.33±0.56 kg/m^2), a regular menstrual cycle and presenting with at least one myofascial trigger point in the upper trapezius participated in the study. Nine EA sessions were scheduled. Needles were inserted at the accupoints GB20, GB21, LV3, LI4, and at "ashi points". A mixed current of 2 Hz and 100 Hz was applied alternatively every 5 seconds for 30 minutes. The efficacy of the treatment was evaluated in terms of pain intensity using the visual analog scale (VAS), the pressure pain threshold (PPT) by algometry, electromyography (EMG) and the SF-36 questionnaire. The occurrence of influencing factors in the sessions was monitored as was the menstrual cycle of each participant. After EA application, there was a significant improvement in VAS and PPT in most of the sessions and after the entire treatment (P<0.0001). EMG of the right trapezius during contraction increased significantly, and the SF-36 domains' "role-physical" and "bodily pain" improved (P<0.05). The EA was shown to be a reliable method for pain relief in the trapezius muscle.

Perspective: This article presents a positive evaluation of an EA protocol of nine sessions for myofascial pain in the upper trapezius. The EA analgesic effect was observed in most of the sessions, and there was a cumulative effect after the seventh and eighth session for the left and right trapezius, respectively.

Key words: Myofascial trigger point, electromyography, visual analog scale, pressure pain threshold, SF-36

Introduction

Muscular pain is often attributed to a myofascial pain disorder[22], with a reported incidence that varies from 30% to 93% depending on the subspecialty practice and setting. The disorder is characterized by the presence of tender, firm nodules called trigger points (MTrPs).[34] These points have been defined as hyperirritable spots located in taut bands of skeletal muscle or fascia that are painful on compression and can give rise to characteristic referred pain, motor dysfunction, and autonomic phenomena.[22]

Myofascial pain is a regional myogenic disorder characterized by hypersensitive local areas and palpable taut bands, called trigger points (MTrPs).[34] These points are latent, when the spontaneous pain is not present, causing motor dysfunction such as rigidity and weakness, or are active when spontaneous pain at the site of the abnormal muscle or referred pain is present.8[7,22]. Referred pain due to palpation is characterized by the recognition of the pain previously experienced (distant to the palpated site) and is one of the most important available diagnostic criteria when palpable findings, such as the presence of taut bands and hypersensitive nodules, are also present.[8]

Epidemiological studies suggest that myofascial pain syndrome, which includes the presence of MTrPs, is an important musculoskeletal dysfunction[9,29] and has been appointed as the main cause of headache and neck pain. More recently, Fernandez-de-las-Penas *et al.*[7] observed that active MTrPs are more common in subjects presenting with mechanical neck pain than in healthy controls, but 70% of individuals with pain and 50% of the controls showed active or latent MTrPs in the trapezius muscle.

For an accurate diagnosis of myofascial pain, the pressure pain threshold (PPT) and pain intensity are important variables. The algometer, equipment used to assess pain sensitivity to pressure, is considered an objective method to accurately measure the PPT in subjects with musculoskeletal pain syndromes, as well as in healthy people.[32] To assess the intensity of pain, the VAS, a graduated scale with the extremes corresponding to the classification "no pain" and "worst pain possible", has proven to be effective when compared to other instruments used to measure pain.[14]

Another method commonly used for clinical and kinesiology research of muscle tension is electromyography (EMG). EMG is defined as the study of muscle function by capturing the electrical signal emanating from a working muscle.[21] It has been applied to the evaluation of different parameters such as muscle relaxation,[17,28,33] muscle weakness[12,23] and activities of motor units.[19,26]

Persistent pain can influence the quality of life of symptomatic patients, which may have traces of anxiety and tension, hopelessness or depression.[22] The SF-36 questionnaire investigates this influence through the evaluation of eight domains: physical functioning, role-physical, role-emotional, pain intensity, general health, vitality, social function and mental health. This instrument was translated into Portuguese, and its psychometric properties were tested and validated.[3]

Electroacupuncture (EA), which uses electric current of low frequency (below 1000 Hz) and high intensity, is among the techniques used for the treatment of myofascial pain. It is applied at specific skin sites called acupuncture points in order to stimulate muscle nociceptors, which in turn activate the endogenous antinociceptive system.[16]

Within this context, this study aimed to analyze the effect of electroacupuncture in the treatment of MTrPs in patients with chronic pain due to myofascial dysfunction of the upper trapezius muscle, evaluating pain intensity using VAS, pressure pain threshold by pressure algometry, EMG and quality of life using SF-36.

Materials and Methods

This research was conducted at the laboratory of Electromyography, Department of Morphology, Piracicaba Dental School, University of Campinas, Piracicaba, SP, Brazil. The Research Ethical Committee of the Dental School approved the project (protocol 088/2008).

Subjects

The study included 20 females from Piracicaba city who were 18 to 40 years old (mean age 24.95±5.88 years), with a body mass index ranging from 19 to 24 kg/m^2 (22.33±0.56 kg/m^2), at least one trigger point in the upper trapezius muscle, local or referred persistent pain for at least six months, and regular menstrual cycles controlled by the use of oral contraceptive. Exclusion criteria included accentuated postural abnormalities, fibromyalgia syndrome, cervical radiculopathy, systemic disease or therapeutic interventions for physical myofascial pain within the past month before the study, evident cognitive impairment or communication difficulties, pregnancy, chronic pacemaker or electronic implants. The continuous use of medications to treat headache and muscular pain was also an exclusion criterion.

Instrumentation

The equipment used for the EA was the EL608 model NKL (ANVISA 80191680002). The needles used were Dong-Bang (Korea), made of stainless steel, individually wrapped, sterile, disposable, and were 0.25 mm in diameter and 30 mm in length.

In order to assess the intensity of myofascial pain the Visual Analog Scale (VAS) was used. The scale consists of a horizontal line 10 centimeters in length, with extremes corresponding to the classification "no pain" (zero) and "maximum pain" (ten).

The electromyographic signals of the right and left upper trapezius were recorded using ADS1200 Lynx equipment with 8 channels, a gain variable from 1 to 16000, a sampling frequency of 2000 Hz for each channel, a band-pass filter of 20-500Hz and a PCI A/D conversion with 14-bit resolution, where signals were scanned and then stored in a computer. The electrodes used were disposable passive bipolar electrodes made of Ag/AgCl, in double circular format with 1 cm inter-electrode distance (manufactured by Hal Indústria e Comércio Ltda, São Paulo, SP, Brazil) and a gain of 20 times. The reference electrode (ground) was positioned in the notch of the sternum of volunteers to remove noise from the acquisition. Signal visualization and processing were performed with AqDAnalysis software. The EMG values were expressed by root mean square (*rms*).

The PPT was measured using a DDK/20 digital algometer (Kratos Industrial Equipment), containing a bar with a flat circular tip with 1 cm diameter.

Quality of life was assessed by the SF-36, a questionnaire consisting of 36 questions to be answered by the volunteer, which evaluates eight different

aspects: physical functioning, role-physical, bodily pain, role-emotional, general health, vitality, social functioning and mental health. This questionnaire was translated into Portuguese and its psychometric properties were tested and validated.[3]

An additional data form (ADF) consisted of questions to be answered by volunteers before the beginning of the sessions and aimed at monitoring any influencing factors between sessions such as headache, neck and shoulder pain, trauma, medication use and other stressor conditions that could influence the results.

Procedures

The diagnosis of MTrP was based on the five criteria described by Simons *et al.*[22] and Gerwin *et al.*[8]: (1) presence of a palpable taut band in a skeletal muscle; (2) presence of a hypersensitive tender spot in a taut band; (3) local twitch response elicited by the snapping palpation of the taut band; (4) reproduction of the typical referred pain pattern of the MTrP in response to compression; and (5) spontaneous presence of the typical referred pain pattern and/or recognition of the referred pain as familiar. If the first four criteria were satisfied, the MTrP was considered to be latent. If all of the aforementioned criteria were present, the MTrP was considered to be active.[8,22] The volunteer remained in the prone position during the examination, as suggested by Simons *et al.*[22]

Upon detection of MTrPs in the upper trapezius and inclusion in the sample according to the inclusion and exclusion criteria, the volunteers were asked to

sign the consent form. All nine sessions were scheduled at the evaluation date and all of them were scheduled at the same time of the day in order to minimize differences in noise from the EMG acquisition.

Each volunteer received two sessions weekly, and the scheduled sessions is shown at Figure 1.

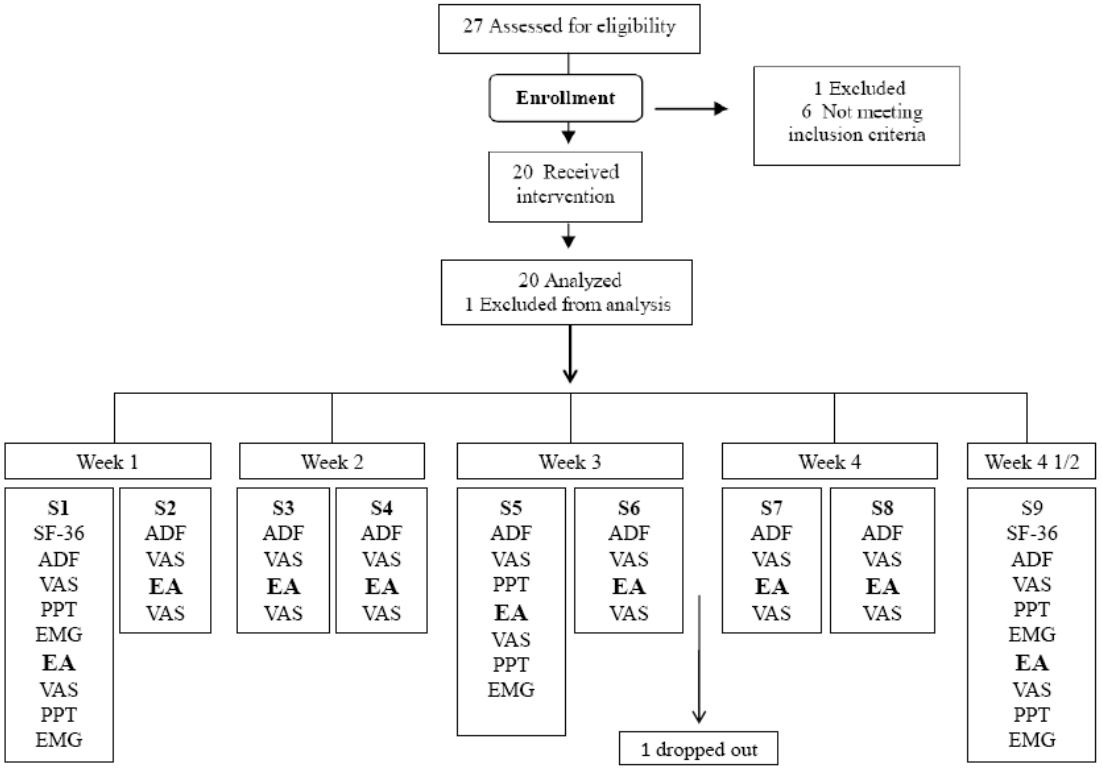

Figure 1 - Enrollment of participants and study design

S= session; ADF= additional data form; VAS= visual analog scale; PPT= pressure pain threshold; EMG=electromyography; EA=electroacupuncture.

In the first session, the volunteer answered both the ADF and the SF-36 questionnaires. At this time, they were asked to grade the intensity of pain (VAS).

Further testing was performed to assess PPT with the digital algometer on the upper trapezius, midway between the seventh cervical vertebra and the tip of the acromion bilaterally. The method was first demonstrated on the forearm, so the volunteers could familiarize themselves with the equipment[13] and the feeling of pressure was exerted on the trapezius which was measured in kgf. The pressure value indicated by the algometer at the time the volunteers reported pain was registered. The procedure was repeated three times, and the mean value was considered.

EMG electrodes were placed in the upper trapezius muscle midway between the seventh cervical vertebra (C7) and acromion.[30] The exam was conducted with the subject seated in a chair at rest and in isometric contraction. The volunteer was asked to maintain the trapezius muscle at rest for six seconds and after that to undertake the raising of the shoulders, keeping this position in isometric contraction for six seconds, prompted by an adequate verbal command. The volunteers had been previously trained to perform the required tasks. Each task, "rest" and "contraction", was requested three times (with a minute interval) and the mean *rms* values were used.

After the initial recording of data, the EA was then applied. The patient was positioned sitting in a chair. Needles were inserted bilaterally in the following points: half distance between the spinous process of the seventh cervical vertebra (C7) and acromion (GB21), below the occipital bone in the depression between the beginning of aphophyses sternocleidomastoid and trapezius muscle (GB20), in the

back of the hand next to the midpoint of the second metacarpal bone in the thumb abductor muscle (LI4), on the back foot in the depression distal to the proximal corner between the first and second metatarsal bones (LV3)[1] and directly in the region of the MTrPs (maximum of four needles). GB21 and GB20 are local accupoints indicated to treat neck and shoulder pain, IG4 and LV3 are distal accupoints indicated in lots of painfull conditions, presenting analgesic effects and IG4 is described to have a good effect for the treatment of head and neck pain [1,4,25]. The equipment was programmed in accordance with the following parameters: alternating frequency F1 = 2Hz, T1 = 5 seconds, F2 = 100 Hz, T2 = 5 seconds; total time: 30 minutes; intensity: maximum supported by the patient without pain. EA was performed in the same manner in all sessions.

After the application of EA, a second assessment of the pain intensity (VAS) and PPT (digital algometer) was performed. The volunteer was again subjected to the exam of surface EMG as described above.

Statistics

The assumptions of equality of variances and normal distribution of errors were checked for all tested variables (Shapiro-Wilk test). In addition, symmetry was quantified by skewness statistic and the respective values greater than 2 in absolute terms were treated as non-symmetric. The student's t-test for paired data was used when the assumption of normality was verified. Non-parametric tests were applied for data with non-normal distribution. The Wilcoxon signed rank test was applied to non-normal symmetric data and the sign test to non-symmetric data. Furthermore, repeated measure analysis of variance with mixed model was

applied to compare the fixed effect of the session, Tukey-Kramer was used as *post-hoc*. Effect of volunteer was treated as random. A model was estimated by REML and with an autoregressive matrix of covariance. For this analysis, the data before the EA application in each session, as well as after the EA application were considered. The level of significance was set at 5%. The analyses were performed using the SAS program (The SAS System, release 9.1.3 - SP 4. SAS Institute Inc., Cary, NC, USA, 2002).

Results

Twenty-seven subjects were originally interviewed for participation in this study. Three of them were not included in the sample and only 24 were evaluated. From these 24, 4 did not present with MTrPs. Thus, a total of 20 volunteers participated in this study. One subject dropped out due to a car accident after the sixth session. All volunteers were diagnosed as having latent MTrPs bilaterally, and all analyses of each side were conducted separately. The mean number of MTrPs found in the right upper trapezius during the first evaluation was 2.05± 0.15 and was 2.45±0.24 in the left upper trapezius. The mean value of how long they had been suffering pain at the moment of the evaluation was 5.55±0.86 years. All volunteers were right-handed, the mean sample age was 27.3±1.09 years old, and the medium body mass index was 22.33±0.56 kg/m^2.

Intensity of pain

A reduction in pain intensity was observed in the upper trapezius muscle on both sides after all nine sessions (P <0.0001). At sessions 1 to 5 and sessions 8 and 9 the intensity of pain was significantly lower after the EA on both sides (P <0.05). In session 6, only the left trapezius showed statistically significant improvement after EA (P = 0.012), and in session 7, there was not a significant difference after EA (Figures 2 and 3).

The comparisons among sessions showed that significant improvement in pain intensity occurred in session 7 in relation to the first three sessions, before and after EA application, with the exception of the right trapezius in which the improvement was significant in session 8. These improvements were maintained until the end of the treatment.

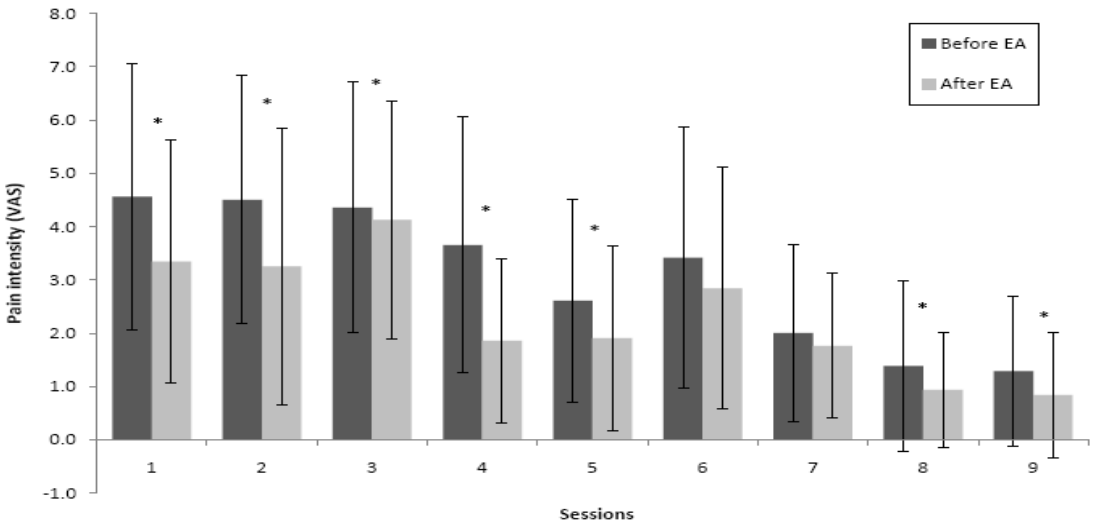

Figure 2. Means and standard deviations for pain intensity (VAS) in the upper right trapezius muscle. * Indicates significant differences before and after EA treatment in each session according to the appropriate statistical test for paired data (P<0.05)

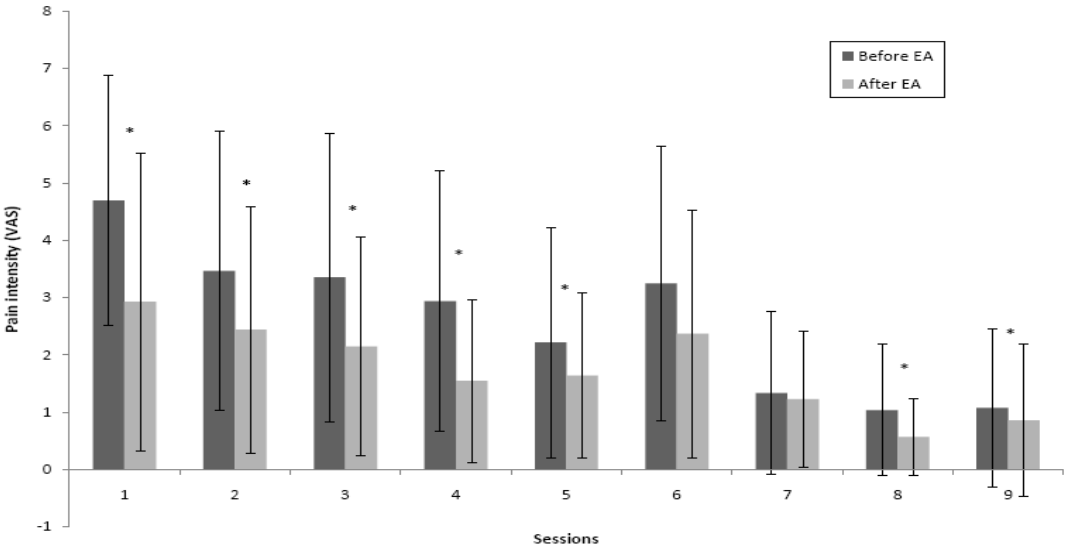

Figure 3. Means and standard deviations of pain intensity (VAS) in the left trapezius muscle.
*Indicates significant differences before and after EA treatment in each session according to the appropriate statistical test for paired data *(P*<0.05).

EMG

There was no statistically significant difference in electromyographic activity of the right (4A) and left (4B) upper trapezius muscle at rest. A statistically significant increase in the EMG values of the right trapezius during isometric contraction was observed at the end of treatment (*P*=0.032) (Figure 4C). The left trapezius almost showed a significant increase in the EMG values, but the test failed to detect a significant difference at a level of 5% (p=0.0506). However, the left trapezius showed a significant increase in the respective *rms* values during isometric contraction before and after the EA in the ninth session (*P* =0.0468) (Figure 4D).

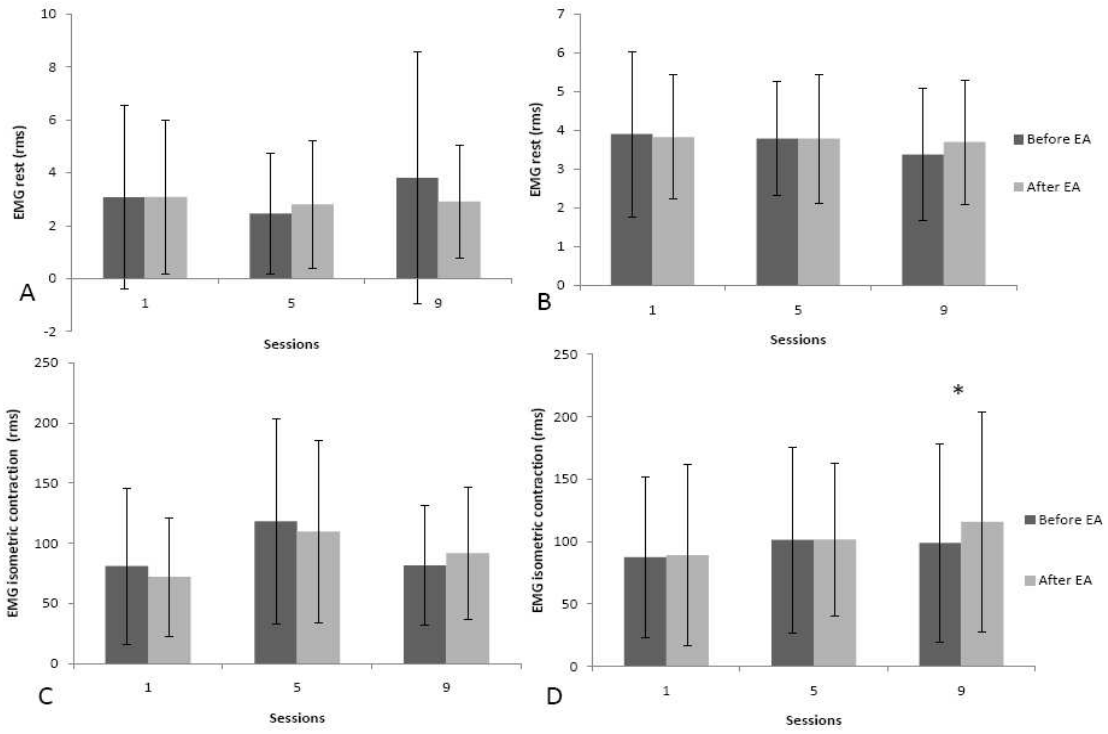

Figure 4. Means and standard deviations for EMG during rest in the right (A) and left (B) upper trapezius. Means and standard deviation for EMG during isometric contraction in the right (C) and left (D) upper trapezius according to a statistical test for paired data.

*Indicates significant differences before and after EA treatment in each session ($P<0.05$).

Pain pressure threshold

The PPT increased significantly on both sides after the end of the treatment ($P<0.0001$), and after EA in each measured sessions (1, 5 and 9; $P<0.0001$; Figure 5)

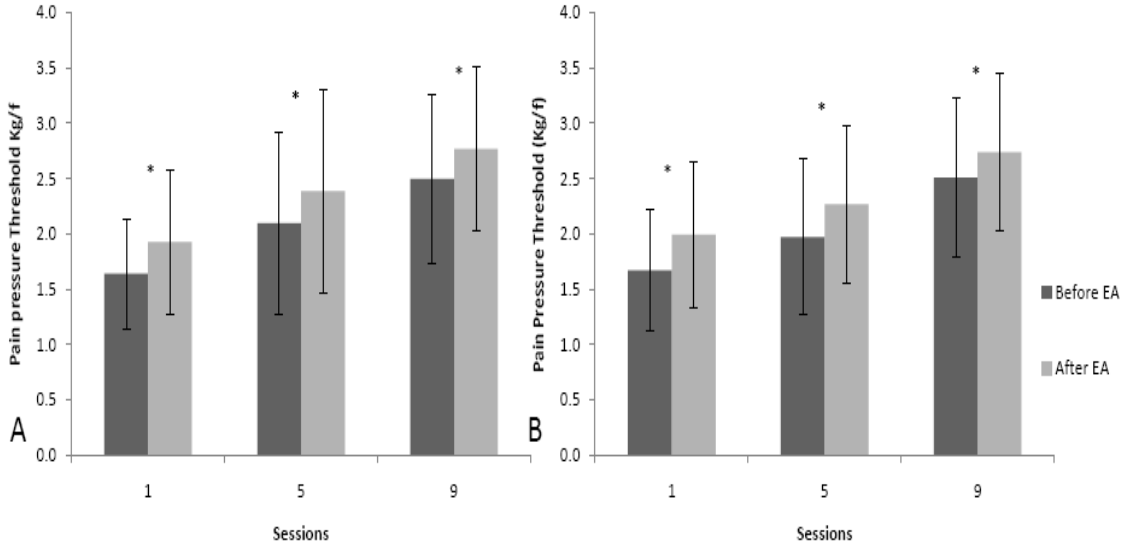

Figure 5. Means and standard deviations for PPT in the upper right (A) and left (B) trapezius muscle according to statistical analyses for paired data.

* Indicates significant differences before and after EA treatment in each session ($P>0.05$).

Quality of life (SF-36)

Statistically significant improvements were observed in the following domains: role-physical ($P<0.05$) and bodily pain ($P<0.05$) (Figure 6).

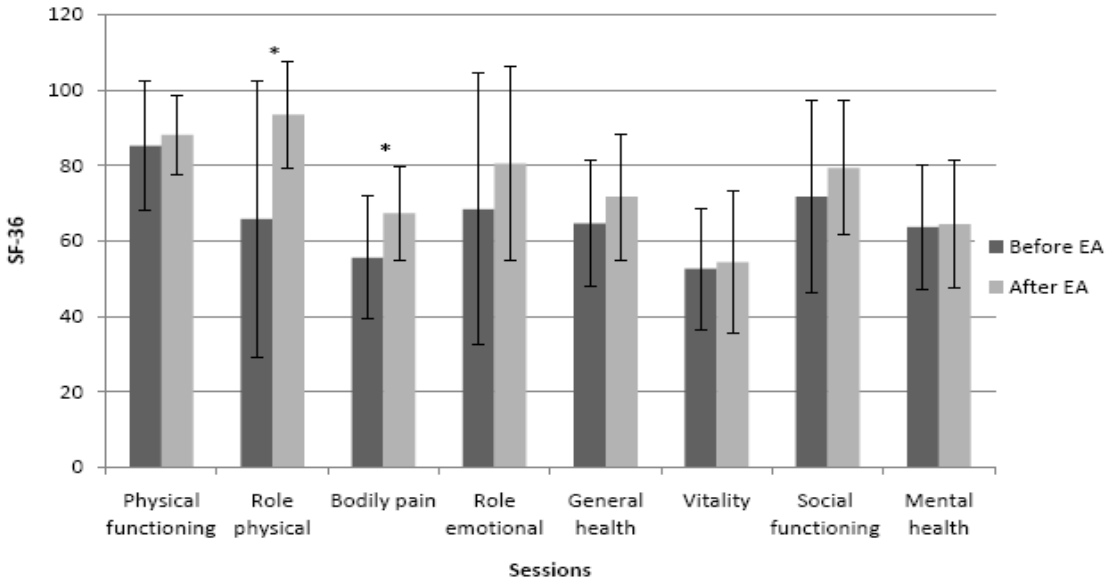

Figure 6. Means and standard deviations for the eight domains of the SF-36 questionnaire.

* Indicates significant differences before and after EA treatment according to statistical analyses for paired data (P>0.05).

Additional Data Form (ADF)

Overall, there was an improvement concerning the clinical data from the ADF (Figure 7). The reductions in the use of medications and the incidence of headache and pain in the trapezius between sessions are indicative of this improvement. At the sixth session, there was an increase in influencing factors (family problems, problems in employment or academic examinations, and others) and also in the number of volunteers who were in the menstrual phase of their menstrual cycle.

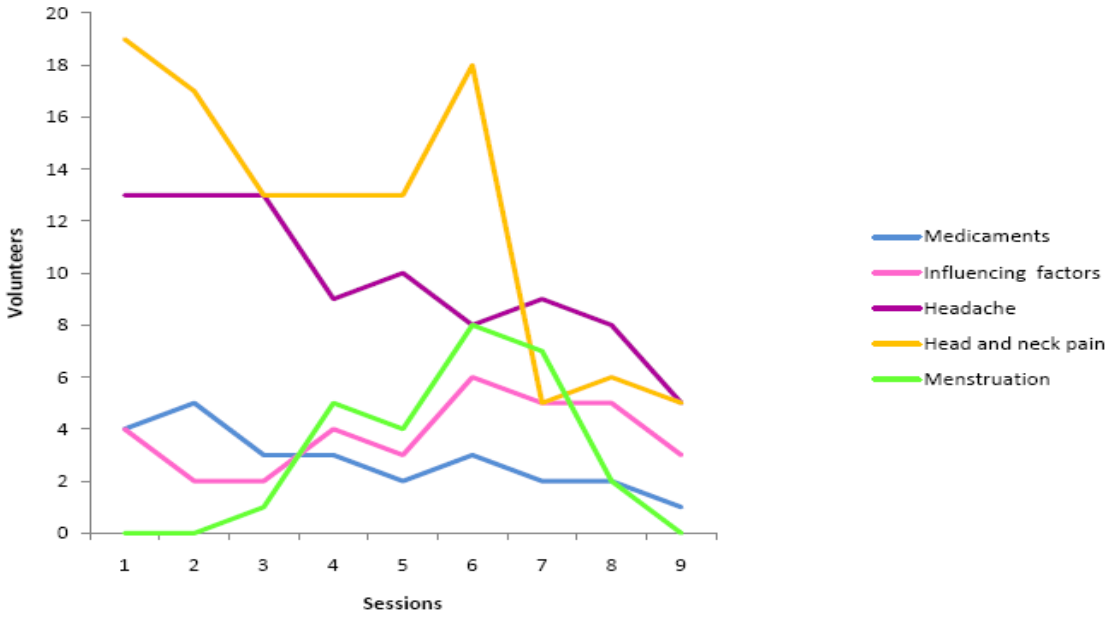

Figure 7. Number of volunteers that reported the use of medications, influencing factors, headache, neck and shoulder pain during the week before the session or that were at the menstrual phase of their menstrual cycle in each session.

DISCUSSION

Intensity of pain

In the most of the sessions, the volunteers showed a significant decrease in pain intensity after EA application. The effect of the treatment on pain was successful, since the VAS values showed a significant decrease in sessions 7 to 9 compared to the initial sessions (Figures 2 and 3). These findings corroborate those of previous studies in which subjects were assessed after one[20,24] or several

sessions of EA.[11,18,35] The maintenance of the pain improvement after EA was not observed in the right trapezius between one session and the next, especially at the beginning of treatment. In general, after the third session, the analgesic effect was maintained until the next session, suggesting a cumulative effect of EA. In the left trapezius, this effect was observed from the beginning of treatment. Concerning muscular pain, no other study has evaluated both the analgesic effect of EA in each session and the effect after the entire treatment. However, there was a recurrence of pain in both sides at the sixth session, as shown in Figures 8 and 9. It can be speculated that this worsening of pain may be related to the menstrual cycle of the volunteers (at the sixth session, 30% of the volunteers were at the follicular phase). It is known that pain threshold may be influenced by the phase of the menstrual period.[13,31] With this knowledge in mind, the first and last sessions were conducted with volunteers at the same stage of their cycle.

The volunteers were questioned about the timing of the menstrual cycle during the first interview so that the assessment and initiation of treatment did not occur during the premenstrual phase or during menstruation. The treatment period was distributed over four and a half weeks. The last session was conducted in the same menstrual phase as the first one. Additionally, all volunteers were using contraception medication, enabling greater certainty regarding the calculation of the phase of the menstrual cycle in each session. Moreover, in the sixth session, there was also an increase in the use of medications by volunteers, as well as an increase in influencing factors (such as family problems, problems in employment or academic examinations) and pain in the neck and shoulder, which may have influenced the recurrence of pain at that time.

EMG

At rest, there was no significant difference between *rms* values either in each session or in the whole treatment. This finding was likely due to the presence of only latent MTrPs. Chou *et al.*[2] observed a significant reduction in the upper trapezius EMG signal during rest after dry needling of the MTrP. The differences in results in relation to this study are probably due to the type of MTrP being treated but may also be due to the technique applied. Chou *et al.*[2] treated active MTrPs with *rms* values at rest close to 7 μv and obtained values close to 3 μv after the dry needling, which is very close to those obtained in the current study before treatment. Indeed, the data provided by EMG at rest were not reliable for detecting respective muscle alterations, despite the fact that the pain had been clinically observed.

Beyond pain, muscles with MTrPs generally present associated symptoms as muscular weakness. Although the measurement of force was not carried out during the current study, the increase in the electrical activity observed during the sustained contraction of right trapezius after treatment with EA could indicate an improvement of muscle function and an effective action of EA in the treatment of myofascial pain. Although the left trapezius muscle did not demonstrate similar results as the right trapezius, the lack of a significant increase in EMG values should be carefully interpreted. Since the p-value was very close to the significance level, it should not be completely discarded as an effect without any relevance, especially when associated with other clinical criteria that presented significant results. Thus, it should be better explored in the future. Moreover, all volunteers were right-handed, so the right side was considered less prone to

muscle fatigue (EMG) than the left.[6] The extended preferential use of a muscle can induce changes in the muscle fiber membrane and its regulatory properties, justifying the difference in behavior.[6] Perhaps these changes interfered with muscle recovery, justifying the respective behavior observed in this study.

There have been no studies that have evaluated the effect of EA on the relief of muscle pain by EMG analysis, but it has already been demonstrated that myoelectric activity of the upper trapezius muscle during contraction in subjects with pain showed lower *rms* values when compared to the normal controls.[15,27]

Pain threshold to pressure by algometry

There was an increase in the PPT after all evaluated sessions (1, 5 and 9) and also after all treatment sessions were complete. This result indicates lower pain sensitivity to pressure, demonstrating the effectiveness of EA. There was no recurrence of pain as observed in the intensity of pain, which may have occurred as a result of the sessions in which the data were evaluated. The recurrence of pain did not occur in the same session in which the PPT was evaluated. Other studies that involved the treatment of muscle pain with EA found similar results after 1 treatment session[24] and after 10 treatment sessions[11]. However, there are no studies that have assessed PPT both in each session and after the completed treatment.

Quality of life

As expected, there was improvement in the quality of life of the volunteers after treatment with EA for myofascial pain. This improvement occurred especially

in the domains "Role-Physical" and "Bodily Pain". Díaz Arribas *et al.*[5] used the same questionnaire to assess the effectiveness of a therapy technique to treat lower back pain and also noted an improvement in quality of life of the volunteers after 15 sessions and improvement in pain (VAS), in terms of "physical components" and "mental elements". The two areas with significant improvement in the present study belong to the "physical components". It is possible that the absence of the influence of pain symptoms in the other SF-36 domains occurred due to the shorter treatment period and the lower number of sessions compared to Díaz Arribas *et al.*[5] No improvement in the quality of life (SF-36) after six sessions of EA in a pilot study for the treatment of chronic pain was recently found, due to no significant improvement in pain.[36] Moreover, the volunteers' MTrPs in the present study were latent, and consequently did not incapacitate them and did not influence all SF domains despite the clinical improvement.

Study Limitations

In our study, the parameters for the EA equipment were adjusted in the same way for all volunteers. Therefore, all volunteers received the same stimulus. A change in stimulus in accordance with individual needs would likely provide analgesic effects in a shorter amount of time. In future studies, this adjustment as well as a longer follow-up could be taken into account. On the other hand, as this study was not blinded for the examiner, the same stimulus for all volunteers could minimize possible bias.

Although the small sample was a potential limitation, the improvement obtained with EA was sufficient to consider the efficacy of EA on pain in the trapezius muscle clinically significant.

Considering further studies, the monitoring of the force performed by volunteers during isometric contraction using a load cell could improve the EMG data collection, since it offers a way to perform reliable evaluations concerning their maximum effort, allowing more consistent data analysis.

Large randomized placebo-controlled trials involving different types of pain are necessary to reaffirm the effect of the EA.

Acknowledgments

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CONCLUSÕES

Os resultados encontrados na revisão crítica da literatura mostraram que:

1. A literatura disponível a respeito dos efeitos da eletroacupuntura no tratamento da dor muscular é escassa e a variabilidade metodológica sugere que os resultados sejam interpretados com cautela.
2. O gênero e o ciclo menstrual não têm sido considerados em estudos de eletroacupuntura e dor muscular, sendo variáveis de importância a serem incluídos em futuros estudos.
3. Torna-se necessário que estudos com maior rigor metodológico e com períodos de acompanhamento adequados, sejam desenvolvidos para que a efetividade da EA possa ser reafirmada em condições clínicas.

Os resultados encontrados na amostra estudada mostraram que:

1. A eletroacupuntura foi eficiente no alívio de dor miofascial da parte superior do músculo trapézio na amostra estudada, considerando a melhora no quadro álgico demonstrada pela EVA, o algômetro digital e o questionário de qualidade de vida SF-36;
2. Durante a contração isométrica observou-se aumento da atividade eletromiográfica, denotando melhora da dor miofascial após o tratamento pela eletroacupuntura
3. Estudos com longos períodos de acompanhamento, após o término do tratamento, devem ser conduzidos a fim de verificar a manutenção dos resultados obtidos.

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APÊNDICE 1

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO

Nº registro no CEP 088/2008

ESTUDO: **"Avaliação da eletroacupuntura no tratamento da dor miofascial na parte superior do músculo trapézio"**

Você está convidado a participar da pesquisa acima citada a ser desenvolvida pelos pesquisadores Maria Fernanda Montans Aranha e Profa. Dr. Maria Beatriz Duarte Gavião. O documento abaixo é um Termo de Consentimento Livre e Esclarecido que contém todas as informações necessárias sobre a pesquisa que será realizada. As informações contidas neste Termo, bem como a apresentação e a obtenção do consentimento, serão realizadas por nós, pesquisadores responsáveis pela pesquisa. Sua colaboração neste estudo será de muita importância, mas se desistir a qualquer momento, isso não lhe causará nenhum prejuízo .

Eu, abaixo assinado, concordo de livre e espontânea vontade, em participar como voluntário do estudo **"Avaliação da eletroacupuntura no tratamento da dor miofascial na parte superior do músculo trapézio"**. Declaro que obtive todas as informações necessárias fornecidas pelos pesquisadores responsáveis, bem como todos os eventuais esclarecimentos quanto às dúvidas por mim apresentadas.

Estou ciente de que:

I) Objetivo da pesquisa:

O estudo tem por objetivo tratar a dor do músculo trapézio pela eletroacupuntura. Serão avaliadas as possíveis alterações na intensidade da

sensação dolorosa, na atividade eletromiográfica bem como na qualidade das atividades de vida diária antes e depois do tratamento.

II) Justificativa para a realização da pesquisa:

A realização deste estudo pode fornecer novas informações em relação ao tratamento da dor miofascial contribuindo não apenas com a prática clínica mas também com posteriores estudos relacionados ao assunto.

III) Procedimentos:

- Para a realização da pesquisa, todos os voluntários preencherão uma ficha de avaliação contendo dados pessoais e questões relacionadas a sua saúde e atividade de vida diária antes do início, e ao final do tratamento. Em cada sessão deverão preencher a ficha de acompanhamento que consiste de questões a serem respondidas pelas voluntárias que visam acompanhar eventuais ocorrências entre as sessões, como cefaléia, dor cervical, traumas, uso de medicação e outras situações adversas influenciadoras. Antes e depois de cada sessão será solicitado ao voluntário que aponte em uma linha horizontal de 10 cm a intensidade da dor sentida no momento, sendo o início da linha o mínimo de dor e o final da linha o máximo de dor. Antes da primeira, da quinta e da nona sessão a sensação dolorosa será registrada com um aparelho que indica a máxima pressão que pode ser exercida no músculo. Neste momento, a pressão registrada no algômetro se refere ao valor de limiar de dor à palpação. Antes e

depois da primeira, da quinta e da nona sessão será feito o registro da atividade muscular do trapézio pela Eletromiografia de superfície, com eletrodos fixados à pele sobre o músculo. Este exame não provoca dor, nem choque. Uma coleta será realizada com o paciente sentado, em repouso, e outra na mesma posição elevando os ombros. A Eletroacupuntura seguirá os padrões de segurança recomendados pelos Atlas tradicionais de acupuntura, com o uso de materiais esterilizados ou descartáveis.

- Durante o período da pesquisa, os voluntários devem manter apenas o tratamento proposto, sendo feito o relato na ficha de dados complementares a eventual administração de medicamento.

- Cada voluntário será convocado a comparecer ao Laboratório em dias e horários pré-estabelecidos, de modo a não comprometer suas atividades diárias. Para cada sessão, estima-se um tempo aproximado de 60 minutos, aumentando para uma hora e meia nas sessões em que houver o exame de Eletromiografia (primeira, quinta e nona sessões). Na primeira avaliação serão agendadas as próximas 9 sessões (2 por semana) considerando a disponibilidade do voluntário para as sessões de acordo com o dia e o tempo de duração da respectiva sessão.

- As sessões deverão acompanhar todo o ciclo menstrual, iniciando na primeira semana após a menstruação ou na seguinte. O voluntário deve estar ciente de que essa é uma condição importante para a obtenção dos dados relativos à sua condição bem como se comprometer a seguir o agendamento comparecendo as sessões previamente agendadas.

IV) Possibilidade de participação em grupo placebo:

Não há grupo placebo neste estudo.

V) Métodos alternativos:

Existem outros métodos para o tratamento de dor miofascial. A realização desta pesquisa se faz necessária para a obtenção de dados científicos sobre os efeitos da eletroacupuntura no manejo clínico deste tipo de dor.

VI) Desconfortos e risco previsíveis:

Não há riscos previsíveis para a aplicação da Eletroacupuntura bem como na aplicação da Escala visual Analógica, do questionário de qualidade de vida SF-36 e dos exames de algometria e eletromiografia, pois:

- A Eletroacupuntura quando realizada por profissional habilitado com técnica adequada, como propõe a metodologia deste projeto, não causa quaisquer efeitos colaterais negativos.
- O exame de algometria pode causar algum desconforto, porém não oferece nenhum risco previsível na aplicação.
- A Escala visual analógica, o questionário de qualidade de vida SF-36, bem como o exame de eletromiografia de superfície além de não serem exames invasivos não provocam nenhum incômodo e não oferecem riscos previsíveis.

VII) Benefícios e vantagens diretas ao voluntário:

É possível que haja melhora da dor dos sujeitos após o tratamento com a Eletroacupuntura.

VIII) Acompanhamento e assistência ao sujeito:

O acompanhamento e a assistência serão dados pelos pesquisadores responsáveis, para sanar qualquer necessidade relacionada à pesquisa.

IX) Contato com o pesquisador responsável:

O contato com um dos pesquisadores responsáveis ou CEP poderá ser feito através de telefone ou endereço presente no fim deste termo de consentimento.

X) Garantias:

- Quaisquer dúvidas serão esclarecidas antes, durante após o desenvolvimento da pesquisa, entrando em contato com os pesquisadores ou com o CEP.
- Tenho a liberdade de desistir ou de interromper a colaboração neste estudo no momento em que desejar, sem qualquer penalidade de qualquer natureza, mediante o contato com um dos pesquisadores responsáveis.
- Fica garantido o sigilo de dados confidenciais ou que, de algum modo possam provocar constrangimentos ou prejuízos a minha pessoa, preservando sempre minha integridade e identidade.
- A participação neste projeto não me acarretará qualquer custo ou ganho financeiro com relação aos procedimentos efetuados com o estudo, portanto, gastos com transporte serão ressarcidos.

- Não há riscos previsíveis para a realização desta pesquisa. Entretanto, se por ventura houver qualquer dano causado durante a realização dos exames, os pesquisadores tomarão medidas para repará-los.
- Receberei uma cópia deste Termo de Consentimento Livre e Esclarecido.

Nome:_____Data de nascimento: _____/_____/_____

Endereço:_____Telefone: _____

Identidade (RG) :_____ CPF: _____

Assinatura: _____ Data: _____/_____/_____

Pesquisadoras responsáveis:

Profa. Maria Beatriz Duarte Gavião

e-mail: mbgaviao@fop.unicamp.br

Maria Fernanda Montans Aranha

e-mail: mfma@fop.unicamp.br

Av. Limeira, 901

Telefone: (19) 2106-5330

Em caso de dúvida quanto aos seus direitos como voluntário de pesquisa, entre em contato com o Comitê de Ética em Pesquisa da FOP . Av. Limeira, 901 Telefone: (19) 2106-5349 e-mail: cep@fop.unicamp.br www.fop.unicamp.br/cep

APÊNDICE 2

FICHA DE AVALIAÇÃO

Data da avaliação:

Nome:

Telefone:

Endereço:

Horários agendados:

Profissão:

Lado predominate:

Data da última menstruação:

1) História

1.1) Freqüência, localização e gatilhos da sua dor?

1.2) Sintomas associados à dor?

1.3) Qualquer história familiar

2) Avaliação física:

2.1) Alterações posturais?Quais?

2.2) Critérios de inclusão:

Idade:

IMC:

Dor local ou referida há quanto tempo?

Ciclo menstrual regulado por uso de medicamento?

2.3) Critérios de exclusão:

Alterações posturais acentuadas

Fibromialgia?

Sindrome da fadiga crônica?

Radiculopatias?

Doenças sistêmicas?

Intervenção terapêutica física pra dor miofascial no ultimo mês?

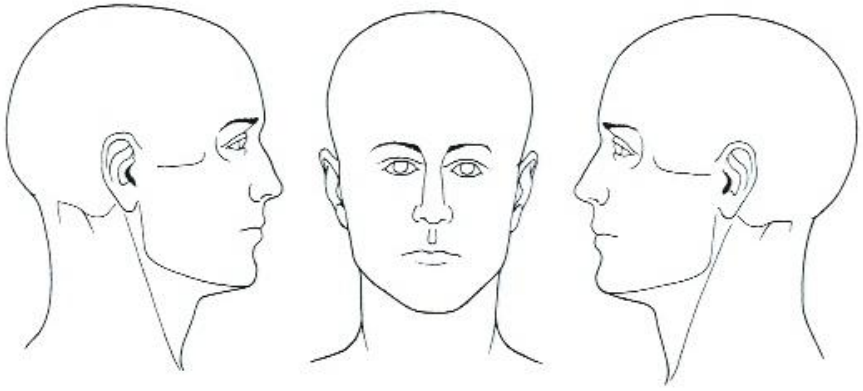
Gestante?

Marca passo ou implantes metálicos?

Medicamentos de uso continuo?

2.4) Palpação do músculo trapézio

Localização da dor/número de Pontos gatilho



Simons *et al.*, 1999

APÊNDICE 3

Ficha de dados complementares

Nome: _____

Data:_____

Durante esta semana:

1) Você se contundiu ? Qual local foi lesionado?
2) Houve necessidade da ingestão de medicamentos? Quais? Em que dosagem?
3) Vivenciou alguma situação importante, positiva ou negativa?
4) Teve cefaléia?
5) Teve dor no cervial ou no ombro?

APÊNDICE 4

Fotos

EVA

Sem dor _____ **Máxima dor**

Figura 1. Escala Visual Analógica utilizada na mensuração da intensidade de dor na parte superior do músculo trapézio com dor miofascial antes e após tratamento com a eletroacupuntura.

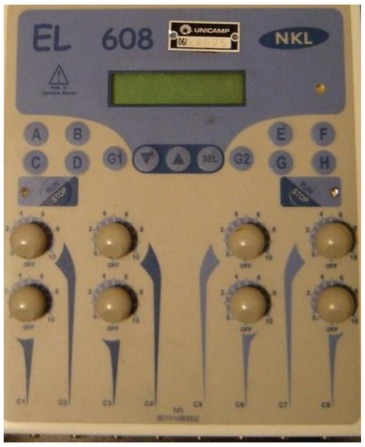


Figura 2. Eletroestimulador modelo EL608 da NKL utilizado nas sessões de eletroacupuntura para o tratamento da dor miofascial da parte superior do músculo trapézio.

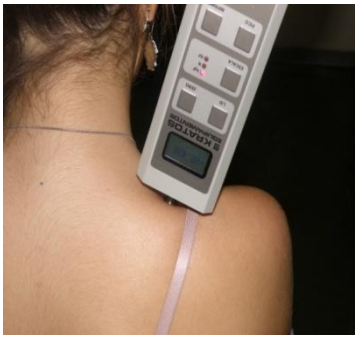


Figura 3. Algômetro digital utilizado e localização da pressão para a mensuração do limiar de dor à pressão na parte superior do músculo trapézio antes e após tratamento da dor miofascial com eletroacupuntura.

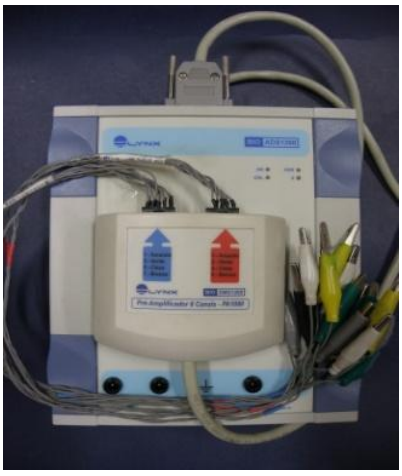


Figura 4. Eletromiógrafo Lynx com oito canais de aquisição utilizado para o exame de EMG de superfície da parte superior do músculo trapézio antes e após o tratamento para dor miofascial com a eletroacupuntura.

Figura 5. Eletrodos passivos com formato duplo circular fixados à meia distância da sétima vértebra cervical e o acrômio para a realização do exame de EMG de superfície da parte superior do músculo trapézio antes e após o tratamento da dor miofascial com a eletroacupuntura.

COMITÊ DE ÉTICA EM PESQUISA
FACULDADE DE ODONTOLOGIA DE PIRACICABA
UNIVERSIDADE ESTADUAL DE CAMPINAS

CERTIFICADO

O Comitê de Ética em Pesquisa da FOP-UNICAMP certifica que o projeto de pesquisa "**Avaliação da eletroacupuntura no tratamento da dor miofascial na parte superior do músculo trapézio**", protocolo nº **088/2008**, dos pesquisadores **MARIA FERNANDA MONTANS ARANHA e MARIA BEATRIZ DUARTE GAVIÃO**, satisfaz as exigências do Conselho Nacional de Saúde – Ministério da Saúde para as pesquisas em seres humanos e foi aprovado por este comitê em 13/08/2008.

The Ethics Committee in Research of the School of Dentistry of Piracicaba - State University of Campinas, certify that the project "**Evaluation of electroacupuncture on the myofascial pain treatment of the upper trapezius muscle**", register number **088/2008**, of **MARIA FERNANDA MONTANS ARANHA and MARIA BEATRIZ DUARTE GAVIÃO**, comply with the recommendations of the National Health Council – Ministry of Health of Brazil for research in human subjects and therefore was approved by this committee at 13/08/2008.

Prof. Pablo Agustin Vargas
Secretário
CEP/FOP/UNICAMP

Prof. Jacks Jorge Júnior
Coordenador
CEP/FOP/UNICAMP

Nota: O título do protocolo aparece como fornecido pelos pesquisadores, sem qualquer edição.
Notice: The title of the project appears as provided by the authors, without editing.

ANEXO 2

Questionário SF-36

Nome:

Data:

SF-36 PESQUISA EM SAÚDE ESCORE

Instruções: Esta pesquisa questiona você sobre sua saúde. Estas informações nos manterão informados de como você se sente e quão bem você é capaz de fazer suas atividades de vida diária. Responda cada questão marcando a resposta como indicado. Caso você esteja inseguro em como responder, por favor, tente responder o melhor que puder.(circule uma)

1. Em geral, você diria que sua saúde é:

.Excelente..... 1

.Muito boa..... 2

.Boa..... 3

.Ruim..... 4

.Muito ruim..... 5

2. Comparando a um ano atrás, como você classificaria sua saúde em geral, agora?

.Muito melhor agora do que há um ano atrás..... 1

.Um pouco melhor agora do que há um ano atrás..... 2

.Quase a mesma de um ano atrás..... 3

.Um pouco pior agora do que há um ano atrás 4

.Muito pior agora do que há um ano atrás 5

3. Os seguintes itens são sobre atividades que você poderia fazer atualmente durante um dia comum. Devido a sua saúde, você tem dificuldade para fazer essas atividades? Neste caso, quanto? (circule um número em cada linha)

Atividades	Sim Dificulta Muito	Sim Dificulta um pouco	Não Não dificulta de modo algum
a. Atividades vigorosas, que exigem muito esforço tais como correr, levantar objetos pesados, participar em esportes árduos	1	2	3
b. Atividades moderadas, tais como mover uma mesa, passar aspirador de pó, jogar bola, varrer a casa	1	2	3
c. Levantar ou carregar mantimentos	1	2	3
d. Subir vários lances de escada	1	2	3
e. Subir um lance de escada	1	2	3
f. Curvar-se, ajoelhar-se ou dobrar-se	1	2	3
g. Andar mais de um quilômetro	1	2	3
h. Andar vários quarteirões	1	2	3
i. Andar um quarteirão	1	2	3
j. Tomar banho ou vestir-se	1	2	3

4. Durante as últimas 4 semanas, você teve algum dos seguintes problemas com o seu trabalho ou com alguma atividade diária regular, como consequência de sua saúde física?(circule uma em cada linha)

	Sim	Não
a. Você diminui a quantidade de tempo que se dedicava ao seu trabalho ou a outras atividades?	1	2
b. Realizou menos tarefas do que gostaria?	1	2
c. Esteve limitado no seu tipo de trabalho ou em suas atividades?	1	2
d. Teve dificuldades de fazer seu trabalho ou outras atividades (p. ex: necessitou de um esforço extra) ?	1	2

5. Durante as últimas 4 semanas, você teve algum dos seguintes problemas com o seu trabalho ou outra atividade regular diária, como consequência de algum problema emocional (como sentir-se deprimido ou ansioso)? (circule uma em cada linha)

	Sim	Não
a. Você diminui a quantidade de tempo que se dedicava ao seu trabalho ou a outras atividades?	1	2
b. Realizou menos tarefas do que gostaria?	1	2
c. Não trabalhou ou não fez qualquer das atividades com tanto cuidado como geralmente faz?	1	2

6. Durante as últimas 4 semanas, de que maneira sua saúde física ou problemas emocionais interferiram nas suas atividades sociais normais, em relação a família, vizinhos, amigos ou em grupo?(circule uma)

.De forma nenhuma..... 1

.Ligeiramente..... 2

.Moderadamente..... 3

.Bastante..... 4

.Extremamente..... 5

7. Quanta dor no corpo você teve durante as últimas 4 semanas?(circule uma)

.Nenhuma..... 1

.Muito leve..... 2

.Leve..... 3

.Moderada..... 4

.Grave..... 5

.Muito grave..... 6

8. Durante as últimas 4 semanas, quanto a dor interferiu com o seu trabalho normal (incluindo tanto o trabalho, fora de casa e dentro de casa) ?(circule uma)

.De maneira alguma..... 1

.Um pouco..... 2

.Moderadamente..... 3

.Bastante..... 4

.Extremamente..... 5

9. Estas questões são sobre como você se sente e como tudo tem acontecido com você durante as últimas 4 semanas. Para cada questão, por favor, dê uma resposta que mais se aproxime da maneira como você se sente. Em relação as úlitmas 4 semanas.(circule um número para cada linha)

	Todo tempo	A maior parte do tempo	Uma boa parte do tempo	Alguma parte do tempo	Uma pequena parte do tempo	Nunca
a. Quanto tempo você tem se sentido cheio de vigor, cheio de vontade, cheio de força?	1	2	3	4	5	6
b. Quanto tempo você tem se sentido uma pessoa muito nervosa?	1	2	3	4	5	6
c. Quanto tempo você tem se sentido tão deprimido que nada pode animá-lo?	1	2	3	4	5	6
d. Quanto tempo você tem se sentido calmo e tranqüilo?	1	2	3	4	5	6
e. Quanto tempo você tem se sentido com	1	2	3	4	5	6

muita energia?						
f. Quanto tempo você tem se sentido desanimado e abatido?	1	2	3	4	5	6
g. Quanto tempo você tem se sentido esgotado?	1	2	3	4	5	6
h. Quanto tempo você tem se sentido uma pessoa feliz?	1	2	3	4	5	6
i. Quanto tempo você tem se sentido cansado?	1	2	3	4	5	6

10. Durante as últimas 4 semanas, quanto do seu tempo a sua saúde física ou problemas emocionais interferiram com as suas atividades sociais (como visitar amigos, parentes, etc.) ?(circule uma)

.Todo o tempo..... 1

.A maior parte do tempo..... 2

.Alguma parte do tempo..... 3

.Um pequena parte do tempo..... 4

.Nenhuma parte do tempo..... 5

11. O quanto verdadeiro ou falso é cada uma das afirmações para você?(circule um número em cada linha)

	Definitivamente verdadeiro	A maioria das vezes, verdadeiro	Não sei	A maioria das vezes, falsa	Definiti-vamente falsa
a. Eu costumo adoecer mais facilmente que as outras pessoas	1	2	3	4	5
b. eu sou tão saudável quanto qualquer pessoa que eu conheço	1	2	3	4	5
c. Eu acho que a minha saúde vai piorar	1	2	3	4	5
d. Minha saúde é excelente	1	2	3	4	5

NOME:_____

DATA:_____

ASSINATURA:_____

ANEXO 3 3

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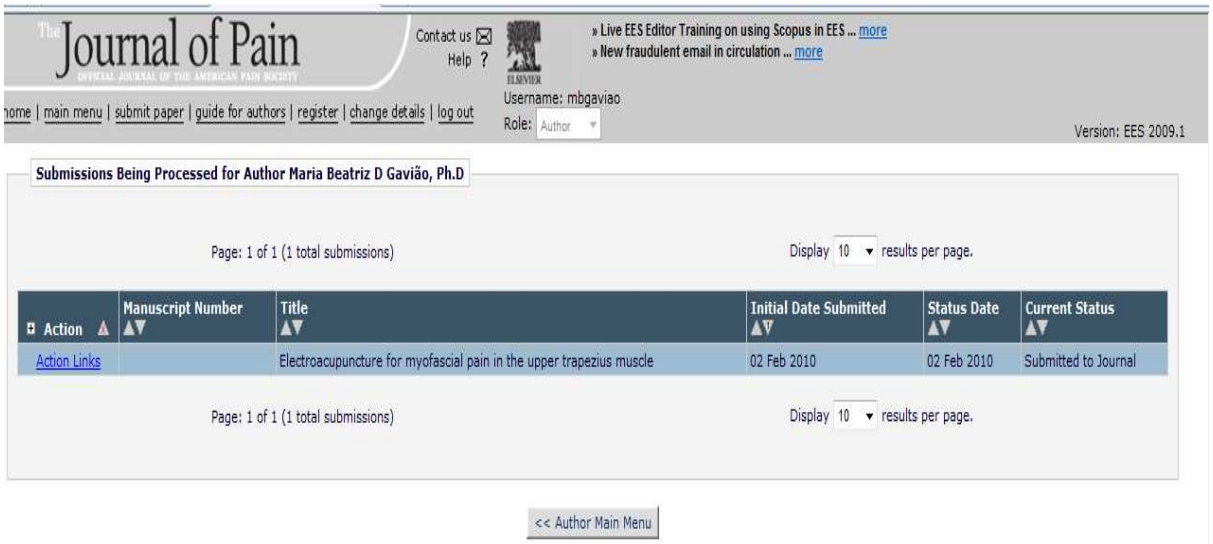
ANEXO 4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