

Psychological stress treated by acupuncture and evaluated by trapezius muscle electromyography*

Tratamento do estresse psicológico pela acupuntura, avaliado pela eletromiografia do músculo trapézio

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SUMMARY

BACKGROUND AND OBJECTIVES: Stress is a modern life phenomenon and may be present in the lives of anyone, regardless of age, gender, social class or profession. This research aimed at proposing an alternative treatment for stress with acupuncture, evaluating by electromyography right and left trapezius muscles of patients under psychological stress one week before evaluations and after acupuncture.

METHOD: Participated in this study 20 volunteers submitted to a questionnaire to evaluate signs of psychological stress. The trapezius muscle was selected for best reflecting stress signs. The study was bilateral and muscle action was captured at rest and during isometric activities with raising and lowering movements. The following points were needled during each one of the 10 acupuncture sessions: C7 point, points obtained as from a pentagram and confluence points of the distinct meridian affected on the pentagram.

RESULTS: RMS values, compared before and after

acupuncture treatment, at rest and with elevation of the scapula were statistically significant ($p < 0.01$).

CONCLUSION: Muscles have shown less electromyographic activity after treatment, thus showing the efficacy of acupuncture for patients under psychological stress.

Keywords: Acupuncture, Electromyography, Psychological stress, Trapezius muscle.

RESUMO

JUSTIFICATIVA E OBJETIVOS: O estresse é considerado um fenômeno da vida moderna, que pode estar presente na vida de todas as pessoas, independente de idade, sexo, classe social ou profissão. Esta pesquisa foi realizada visando propor um tratamento alternativo para o estresse, pelo tratamento com acupuntura, avaliando eletromiograficamente o músculo trapézio, direito e esquerdo, de indivíduos portadores de estresse psicológicos, uma semana antes das avaliações e após a acupuntura.

MÉTODO: Para a realização deste estudo foram selecionados 20 voluntários, submetidos a um questionário que avaliou os sinais de estresse psicológico. O músculo estudado foi o trapézio por refletir melhor os sinais de estresse. Este foi estudado bilateralmente e a ação muscular foi captada no repouso e durante atividade isométrica, realizando-se movimentos de elevação e abaixamento. Em cada uma das 10 sessões de acupuntura foi realizado o agulhamento do ponto C7; pontos obtidos a partir de um pentagrama e ponturar pontos de confluência do meridiano distinto afetado no pentagrama.

RESULTADOS: Os valores de RMS, quando comparados antes e após o tratamento com acupuntura, no repouso e em elevação da escápula foram estatisticamente significativos ($p < 0,01$).

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CONCLUSÃO: Os músculos apresentaram menor atividade eletromiográfica após o tratamento, mostrando assim a eficácia da acupuntura em indivíduos portadores de estresse psicológico.

Descritores: Acupuntura, Eletromiografia, Estresse psicológico, Músculo trapézio.

INTRODUCTION

Acupuncture aims at reestablishing the balance between contradictory function states and homeostasis, alternating states of energy and with this maintaining the ideal organization of the organ and the organism to be treated. The theoretical-philosophical basis of acupuncture is the energetic rebalance of meridians, which are channels sending vital energy (Qi) throughout the body.

Electromyography is a technique to monitor electrical activity of excitable membranes, representing the measure of sarcolemma's action potential as a voltage effect as a function of time. The electromyographic signal (EMG) is the algebraic sum of all detected signals in a certain area and may be affected by muscular, anatomic and physiologic properties, as well as by peripheral nervous system control and by the tools used for signal acquisition¹.

Stress is a psychophysiological body change, noticeable through physical and psychological symptoms to react to a situation of stress and oppression. Stress is a process rather than a single reaction, because when a person is submitted to a stress source, a long biochemical process is installed and its onset is manifested in a very similar manner by symptoms such as tachycardia, excessive sweating, muscle tension, dry mouth and sensation of alertness. Stress is considered a modern life phenomenon and may be present in the lives of anyone, regardless of age, gender, social class or profession.

Electromyography (EMG) has been widely used to study muscle system functions and dysfunctions during movement, and has allowed studies in different areas of interest for physical therapists and other professionals dedicated to movement.

EMG captures the myoelectric signal resulting from muscle fibers action potentials, which occur before their contraction, so it is not a measure of muscle strength. The electromyographic signal is originated by the action potential, which is fired by each motor unit during muscle contraction, and the sum of all motor units activities is the electromyographic signal which may be captured by superficial skin electrodes. This is a safe, sensitive and non-invasive technique² which aims at evaluating muscle activity during a certain movement, synchronization of activated muscles, muscle

contraction intensity and duration and the activity of synergists and/or antagonists². After being collected, the signal has to be processed to be interpreted.

This study aimed at proposing an alternative treatment for psychological stress using acupuncture.

METHOD

Participated in this study 10 control group individuals (CG) and 10 stressed group individuals (SG) of both genders, aged between 18 and 25 years, who have signed the Free and Informed Consent Term containing all research procedures, according to resolution 196/96 CNS.

Volunteers were selected via a questionnaire to identify stress signs, made up of patient's identification and presence of subjective signs and symptoms of stress, such as memory problems, self-report of bruxism during sleep and/or alertness, stiff muscles, insomnia, boredom, tachycardia, emotional hypersensitivity, among others. The trapezius muscle was bilaterally evaluated and muscle action was captured at rest and during isometric activity with raising and lowering movements.

Two surface active differential electrodes were used to capture electrical signals, with signal detection surface made up of two parallel silver bars with amplitude range of 20 to 500 Hz, roll-off of at least 12dB/octave, common mode rejection index > 80 dB, noise < 2 RMS μ V (20-40 Hz), input impedance > 100 mega ohms and 20 times gain.

After collection, the electromyographic signal has gone through a LYNX signal conditioning module model MCS 1000-V2, with 16 input channels, which were configured to receive load cell signals, with on/off switch, electrogoniometer and electromyographic signals. For electromyographic record, channels were gauged by a Butterworth-type two-pole analog filter to allow a final gain of 2000, with cutoff frequency of 20 Hz in the high pass filter and of 500 Hz in the low pass filter. Analog signals were amplified and prepared to be converted into digital signals by a LYNX analog/digital conversion plate (A/D) model CAD 12/36, with 12 bytes of resolution, 16 analog inputs and DMA support (direct memory access), allowing maximum signal collection speed independent from the microcomputer central processing unit.

Signal acquisition system was checked by Aqdados Software and always according to the following sequence: a) channels configuration enabling 4 channels for electromyographic signals (channels 1 to 4), with amplitude of up to 2000 μ V; b) signals sampling frequency adjustment established for 1000 samples per second

in all channels used; c) suitability of essay parameters with duration time of 5; d) data treatment screen configuration established for simultaneous visualization of 4 channels, being all configured for electromyographic signals; e – essay to test enabled channels.

Initially, the volunteer was informed about the experiment. Patient was placed on a chair with Frankfurt plane parallel to ground. Activities to be executed during the experiment were practiced before each essay, followed by the placement of electrodes to capture electric activity of muscles to be evaluated, preceded by skin cleaning with cotton soaked in alcohol and hair removal.

Electrodes were fixed to the skin with double-face adhesive collar and/or adhesive tape. Electrodes were placed on the intermediate region between the innervation zone center, which is the motor point, and the muscle tendon, longitudinally aligned and parallel to muscle fibers direction, always with a distance of 1.5 cm between each pair as from the center of the electrodes. Since the electrode fixation site on the trapezius muscle is easily identified by palpation, volunteer was asked to perform maximum forced elevation. Electrode was fixed at the point of highest volume.

After fixing the electrodes an essay was carried out with the volunteer to observe the presence of possible interferences and whether the electrodes were adequately capturing muscle electrical activity. It is important to stress that a ground reference electrode was always used to decrease interferences even further.

Initially the signal was collected with the volunteer at rest, sitting with Frankfurt plane parallel to the ground, without performing any movement. Data at forced elevation were collected 2 seconds after the beginning of the activity maintained for 5 seconds and being performed in 5 stages. Captured signals were analyzed by the data treatment screen to assure the quality of acquired data.

The following points were needled during all acupuncture sessions: strong heart point C7; points obtained as from a pentagram aiming at evaluating general patient's condition to reach energetic balance, which may vary according to the acupuncture session because they depend exclusively on individual's general status at that moment and confluence points of the distinct meridian affected on the pentagram.

Volunteers were submitted to 10 acupuncture sessions. The first session was carried out in the same week when the first electromyographic signals were collected. Then, patients were submitted to weekly sessions until completing 10 sessions.

With the volunteer comfortably laid on a stretch, balance points were established and needles were inserted into

specific points where they remained for 30 minutes. Before insertion, points were cleaned with 70° alcohol.

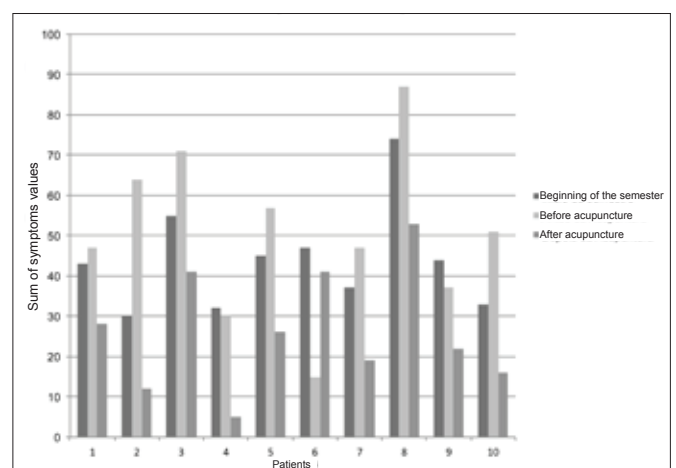
This study was approved by the Research Ethics Committee, Federal University of Alfenas (UNIFAL-MG), protocol 048/2010.

RESULTS

A basic questionnaire was used to select volunteers to exclude individuals not matching the objectives of the research. This questionnaire was developed by research participants so that volunteers would match the objective. We selected 10 individuals for the control group (CG) and 10 for the stressed group (SG). SG answered the questionnaire in the beginning of the research, before the tests period and after acupuncture. This questionnaire has shown the level of stress quantified as from the sum of presented symptoms values on each studied period. We have observed a positive change before and after acupuncture in the level of stress of patients during the analyzed period (Graph 1).

Electromyography has measured muscle activity of volunteers at rest and when raising the trapezius muscle before and after acupuncture. Muscle activity was converted into RMS values by the electromyograph and has shown that the trapezius muscle has higher activity when the individual is under psychological stress.

Statistical analysis has shown significant differences between SG and CG after acupuncture both at rest and at scapula raising movement; mean RMS value for SG at rest was 6.92 and after treatment the value was 6.92 (Table 1). SG values at scapula raising movement was 195.45; after treatment the value was 87.14 ($p < 0.01$) (Table 2).



Graph 1 – Sum of values of symptoms presented by each stressed volunteer in the analyzed periods.

Table 1 – Mean square root values of the trapezius muscle at rest before and after acupuncture, evaluated by electromyography.

Variation Sources	Pre-Treatment	Post-Treatment
Patients	10	10
Mean	20.9590	6.9200
Standard error	0.6422	0.7873
Standard deviation	2.0307	2.4897
p-value =		< 0.0001**

**= p < 0.01(significant at 1% probability).

Table 2 - Mean square root values of raised trapezius muscle signals before and after acupuncture, evaluated by electromyography.

Variations Sources	Pre-Treatment	Post-Treatment
Patients	10	10
Mean	195.4580	87.1340
Standard error	5,9014	10.6585
Standard deviation	18.6619	33.7052
p-value =		< 0.0001**

**= p < 0.01(significant at 1% probability).

DISCUSSION

According to some authors³ who have clinically evaluated masticatory muscles activity during normal chewing – a study on electromyographic data normalization – it was possible to suggest that absolute data may confirm clinical findings observed from the qualitative analysis of electromyographic signals. So, data normalization was waived in this study.

Little is said about acupuncture to treat psychological stress, but acupuncture effects on muscle activity have been shown by electromyography and its results to treat pain have also been evidenced, especially for pain

syndrome, where the concept of sensitive or painful points has a close relationship with the concept of acupuncture points⁴, what made possible to infer that virtually all volunteers had lower levels of psychological stress after acupuncture.

Our study has shown that RMS values were lower after acupuncture indicating decreased muscle activity and stress, as observed by other studies⁵⁻⁷. Stress-induced psychological and physical symptoms were also decreased^{8,9}.

CONCLUSION

Muscles had less electromyographic activity after treatment, which evidences the efficacy of acupuncture for individuals under psychological stress.

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