ORIGINAL ARTICLE

Remote Influences of Acupuncture on the Pain Intensity and the Amplitude Changes of Endplate Noise in the Myofascial Trigger Point of the Upper Trapezius Muscle

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ABSTRACT. Chou L-W, Hsieh Y-L, Kao M-J, Hong C-Z. Remote influences of acupuncture on the pain intensity and the amplitude changes of endplate noise in the myofascial trigger point of the upper trapezius muscle. Arch Phys Med Rehabil 2009;90: 905-12.

Objective: To investigate the remote effect of acupuncture on the pain intensity and the endplate noise (EPN) recorded from a myofascial trigger point (MTrP) of the upper trapezius muscle.

Design: Randomized controlled trial.

Setting: University hospital.

Participants: Patients (N=20) with active MTrPs in upper trapezius muscles and no experience in acupuncture therapy.

Interventions: Patients were divided into 2 groups. Those in the control group received sham acupuncture, and those in the acupuncture group received modified acupuncture therapy with needle insertion into multiple loci to elicit local twitch responses. The acupuncture points of Wai-guan and Qu-chi were treated.

Main Outcome Measures: Subjective pain intensity (numerical pain rating scale) and mean EPN amplitude in the MTrP of the upper trapezius muscle.

Results: The pain intensity in the MTrP was significantly reduced after remote acupuncture (from 7.4±0.8 to 3.3±1.1; $P<.001$), but not after sham acupuncture (from 7.4±0.8 to 7.1±0.9; $P>.05$). The mean EPN amplitude was significantly lower than the pretreatment level after acupuncture treatment (from 21.3±9.5μV to 9.5±3.5μV; $P<.01$), but not after sham acupuncture treatment (from 19.6±7.6μV to 19.3±7.8μV; $P>.05$). The change in the pain intensity was significantly correlated with the change of EPN amplitude ($r = 0.685$).

Conclusions: Both subjective changes in the pain intensity and objective changes of the EPN amplitude in the MTrP region of the upper trapezius muscle were found during and after acupuncture treatment at the remote ipsilateral acupuncture points. This study may further clarify the physiological basis of the remote effectiveness of acupuncture therapy for pain control.

Key Words: Acupuncture; Electromyography; Trigger points, myofascial; Pain; Rehabilitation.

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ACUPUNCTURE THERAPY HAS been widely used for treating patients with musculoskeletal pain.[1-5] In many cases, the sites of acupuncture needling are selected in regions remote to the painful site.[6-9] The physiological basis for this remote effect is still uncertain. It has been found that the distribution of acupuncture points of the same meridian is similar to the pattern of referred pain from certain MTrPs.[10] For example, the connection of the large intestine meridian is located within the territory of the referred pain elicited by stimulation of the MTrP in the middle scalene. Both are distributed in the anterior and lateral aspects of the upper limb. The similarity between the acupuncture and needling of an MTrP has also been well documented.[10-12] It has been hypothesized that the connections of MTrP circuits in the spinal cord is the basic mechanism of the referred pain pattern.[13,14]

Clinically, an MTrP is a most tender (hyperirritable) spot in a taut band of skeletal muscle fibers characterized with a specific pattern of referred pain and an LTR.[15,16] An LTR is a rapid contraction of muscle fibers in the taut band in response to high-pressure mechanical stimulation. Based on the studies of both human subjects and animals, it has been demonstrated that there are multiple sensitive loci in an MTrP region.[17,18] These sensitive loci are probably nociceptors located in the endplate zone.[19] The prevalence of EPN recorded by EMG equipment is significantly higher in an MTrP region than a non-MTrP region,[20,21] and is highly correlated with the irritability (sensitivity) of an MTrP.[22]

In this study, we investigated the changes in pain intensity and EPN prevalence in the MTrP region of the upper trapezius muscle in patients with chronic pain in the shoulder region during and after acupuncture treatment on the ipsilateral remote acupuncture points in order to confirm the remote effect of acupuncture.

METHODS

General Design

The patients were treated with either acupuncture or sham acupuncture therapy on 2 acupuncture points. For every subject, the subjective pain intensity and the objective changes of EPN in the MTrP region of the upper trapezius muscle were assessed before, during, and after the whole course of treatment.

Patients

Patients for this study were selected from a pain control clinic by a physiatrist who was not involved in the outcome

List of Abbreviations

EMG	electromyography
EPN	endplate noise
LTR	local twitch response
MTrP	myofascial trigger point

measures. The inclusion criteria included (1) having intolerable chronic pain in 1 side of the shoulder with active MTrPs in the ipsilateral upper trapezius muscle, (2) having no treatment with acupuncture previously, and (3) having poor response to previous conservative and noninvasive treatment, such as oral medicine or physical therapy.

The exclusion criteria for the selection of patients included (1) having conditions with contraindication for needling, such as local infection, malignancy, serious medical problems, taking anticoagulant medicine, pregnancy with threatened abortion, and so forth; (2) taking medicine that might change the pain intensity or pain threshold, such as analgesics, sedatives, substance abuse (including alcohol, narcotics), and so forth; (3) having previous surgery or trauma to the neck, upper back, or upper limb; (4) having history of significant neurologic deficit involving neck or upper limb, either central or peripheral origin; and (5) having evidence of cognitive deficit.

Either the inclusion or the exclusion criteria were assessed by the same physiatrist based on detailed medical history and careful physical examination. The selected patients were randomly divided into acupuncture and sham-acupuncture groups using a computerized randomization program. Every subject signed the consent form, which was approved by our university's institutional review board.

Identification of Myofascial Trigger Points

The identification of an active MTrP in the upper trapezius muscle was performed with palpation examination. Diagnosis of an MTrP was based on (1) a most sensitive (tender) spot in a palpable taut band and (2) recognized pain (as patient's usual clinical complaints) when this sensitive spot was compressed.[15,16,23] Other supportive criteria for diagnosis included (1) a typical referred pain pattern as described by Travell and Simons,[15] and (2) a local twitch response elicited by snapping palpation of the MTrP.[23] The identified active MTrP of the upper trapezius muscle was marked (on the skin with an area approximately 1 cm in diameter) for EPN study.

Identification of Acupuncture Points

A well trained licensed acupuncture instructor performed all the acupuncture procedures, including identification and needling of acupuncture points. Before treatment, 2 acupuncture points, Wai-guan (triple energizer [TE]-5) in the extensor indicis muscle, on the dorsal forearm, between the radius and ulna, 3 cm superior to the dorsal transverse wrist crease, and Qu-chi (large intestine [LI]-11) in the extensor carpi radialis longus muscle, on the lateral side of the cubital crease with elbow in full flexion, were determined and marked. This acupuncturist was not involved in the outcome assessments. These 2 acupuncture points were also MTrPs (Ah-Shi points) as confirmed by palpation examination. In our study, these 2 acupuncture points were selected based on an extensive review of acupuncture literature and the clinical experience in acupuncture therapy by experienced acupuncturists who had practiced in acupuncture for more than 15 years. Both acupuncture points have been frequently selected for the treatment of neck and shoulder pain.[7-9] There was evidence of good results by needling these 2 acupuncture points in our previous experience.[24]

Treatment Procedures

The patient was in a comfortable prone position with the head turned to the contralateral side and the ipsilateral upper limb placed near the side of the examination table. This position could allow the simultaneous acupuncture needling to the forearm muscle and recording of EPN from the MTrP of the upper trapezius muscle. In this position, the patient was unable to observe either the procedure of treatment on the forearm or the EMG recording of EPN in the MTrP of the upper trapezius muscle. The skin over the marked acupuncture point was cleaned with alcohol before needle insertion. The disposable acupuncture needle with a size of #30 and a length of 25 cm (1 in) or 37 cm (1.5 in) was used for every patient. In the sham-acupuncture group, the acupuncture needle was inserted into a rubber connector, which was firmly taped on the marked point for acupuncture (fig 1).[25] The needle contacted the skin and the patient could feel the sharp needle tip, but the needle did not penetrate into the skin. Then the needle stayed there (without moving the needle) through the whole course of treatment. In the acupuncture group, a newly modified technique was used for acupuncture therapy. The acupuncture needle was inserted into the regular depth in the subcutaneous layer. Similar to the technique of MTrP injection,[16,17,26] the needle was moved in and out in different directions at a speed of about 2cm/s. This in-and-out manipulation was performed with simultaneous rotation of the needle to facilitate the in-and-out movement (screwing in-and-out technique). With this rapid (high-pressure) needle movement, it was much easier to induce the De Qi effect (soreness or pain and/or local twitch responses). When an LTR was elicited, the muscle twitching could cause needling moving or needle grabbing and could always be perceived by the one who was doing needling. To elicit LTRs during needling is essential for complete and immediate pain relief after needling.[25] This in-and-out movement continued for 15 seconds, and then the needle was stationary for at least 3 minutes.

The sequence of treatment is expressed in figure 2. For each subject, the Wai-guan point was treated first. About 5 minutes after completing needle manipulation (screwing in-and-out) at Wai-guan, the Qu-chi point was treated with the same procedure, but the acupuncture needle stayed in Wai-guan continuously without any needle movement. Five minutes after completion of needle manipulation at Qu-chi, both needles in these 2 points were manipulated (screwed in and out) simultaneously for 15 seconds, and then stayed quietly for another 3 minutes. The acupuncturist used 2 hands simultaneously to manipulate the needles.

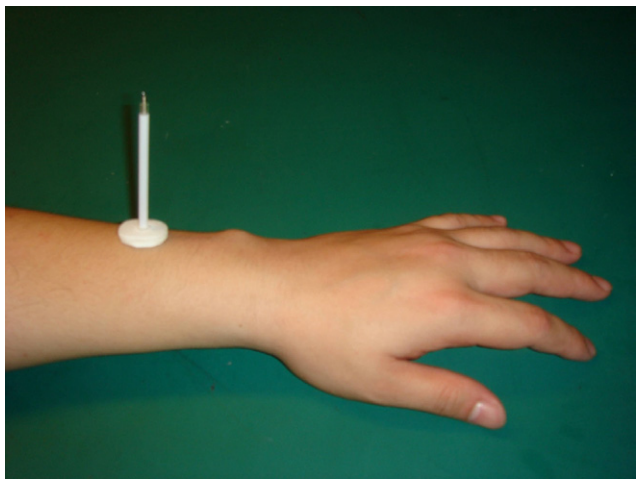

Fig 1. Sham acupuncture performed in this study with an insertion of acupuncture needle into a rubber connector that was firmly taped on the skin.