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To evaluate the immediate effects of acupuncture therapy in myofascial pain syndrome (MPS), 13 subjects (11 females and 2 males), aged from 34 to 59 years old were recruited and all had suffered MPS anywhere from 1 to 180 months. The oblique insertion of an acupuncture needle was performed at an Ah's point (trigger point, TrP) and through the associated taut band without any twirling. The needle was removed anywhere from several seconds to 2 to 3 minutes after insertion whenever the needle sensation disappeared. Clinical evaluations included measurements of a range of motions (ROM) of the neck by an electrogoniometer; and of subjective pain by a visual analog scale (VAS). The thickness of the upper trapezius muscle was measured at the TrP area, by a 9 MHz real-time sonographic machine, the scanning probe of which was exerted with a constant load of 1.5kg. All measurements were recorded and compared before and immediately after acupuncture therapy. After acupuncture therapy, the ROM of the neck was significantly increased in all of the motion planes measured, and pain was significantly relieved in terms of the VAS. The upper trapezius muscle thickness significantly increased in the transverse view after acupuncture. This finding may indicate that acupuncture therapy at an Ah's point brings significant pain relief and muscle relaxation immediately in MPS. (J Rehab Med Assoc ROC 2003; 31(1): 13 - 20)

Key words: acupuncture, myofascial pain syndrome, sonography

INTRODUCTION

Myofascial pain syndrome (MPS) is characterized by the existence of palpable taut bands with trigger points, which may induce referred phenomena due to a dysfunction of the skeletal muscle fibers. It includes referred pain, tenderness, muscle spasms, and autonomic dysfunction in the zone of reference, as well as local twitch responses to noxious stimuli on trigger points. [1-7] It is a very common source of ubiquitous muscle pain with a restricted motion range and/or some degree of weakness but without

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atrophy. Simons hypothesized that the palpable taut band is due to an energy-consuming contraction of sarcomeres, which produces tissue ischemia and a metabolic deficiency (energy crisis).[5] This combination could induce a vicious cycle of contraction and ischemia. The taut band can be released with subsequent pain relief after specific and effective treatments, including (1) full muscle elongation by either intermittent cold spraying and stretching, or deep pressure massaging (acupressure-like), and (2) mechanical and/or chemical TrP inactivation by either dry needle irritation or injection. Successive dry needle insertions in the TrP area often elicits local twitch responses (LTR), immediately inactivating that area and releasing the very taut band. Once the LTR has disappeared and the taut band is released, pain is relieved. [8-18]

Acupuncture is an ancient Chinese therapy proven and developed through human experience. [19-21] Acupuncture therapy is also applied in MPS. [22] Ah's points were described by an ancient Chinese physician, S.M. Sun (AD581-682) as another kind of acupoint only found in muscles with pathological conditions, and it disappeared as muscle conditions improved. The points are not included in the classical meridians of acupuncture. Patients experience strong withdrawal responses when such a hyperirritable point is palpated. The Ah's point seems to share the same characteristics and locations as the TrP in MPS. [23]

The oblique insertion of an acupuncture needle into a TrP and through the very taut band without any twirling is one of the most effective acupuncture techniques. The taut band is released within seconds to minutes after needle insertion, and the needle is removed immediately after relief of pain is achieved. Clinical scales of subjective descriptions and functional assessments may provide indirect evidence of treatment effectiveness. Real-time ultrasonography using a high frequency linear array transducer has been advocated recently in evaluating muscle pathology and conditions. [24-26] Gerwin and Duranleau also reported a case in which muscles with MPS containing taut bands with tender TrPs were monitored by ultrasonography while they were stimulated and inactivated by dry needling. [27]

The purpose of this study was to evaluate the immediate effects of acupuncture therapy at Ah's points in MPS, by comparing the measured ultrasonographic changes of the muscles involved, in addition to clinical measurement, before and after acupuncture therapy.

METHODS

Subjects

Thirteen subjects (11 females and 2 males) aged from 24 to 59 years old, with an average age of 44.8, were recruited from the outpatient clinics of the Department of Physical Medicine & Rehabilitation, Chang Gung Memorial Hospital, Taipei, Taiwan. All subjects were suffering from myofascial pain for an average duration of 28.2 months but ranging in duration from 1 to 180 months. Symptoms of neck stiffness, limited range of motion in neck turning and nodding, and TrP at the upper trapezius muscles were found among all subjects.

Acupuncture Therapy

Acupuncture with a technique of oblique needle insertion was performed. The diameter of the needles used was that of No. 23 gauge and they were 10 cm long. Each subject sat comfortably with back and forearm support to easily stabilize his or her shoulder girdle. The needles were inserted obliquely at an Ah's point (trigger point, TrP) and through the associated taut band without any twirling and they were removed within seconds to several minutes after wards whenever the needle sensation disappeared.

Patient Evaluation

The immediate effects of oblique acupuncture therapy on MPS of the upper trapezius muscles were evaluated clinically and morphologically. Clinical measurement results a pain scale, or/and ranges of neck motions were recorded before and after acupuncture. Conversely, changes of muscle thickness were measured ultrasonographically and also before and after treatment.

Pain was subjectively measured with a visual analog scale (VAS, ranging from 0 of painlessness to 10 of extreme pain). The range of neck motions, including three motion planes (flexion/extension, lateral bending, and rotation), were determined with an electrogoniometer (XM 110, Biometrics Ltd, UK).

Conversely, a 9 MHz real-time sonographic machine

(Aloka SSD2000, Tokyo, Japan) was used to image the muscle we measured. To avoid pressure effects on muscle ultrasonographs, the linear array transducer was implemented with a loading device. Being centered at an Ah's point with skin marks, the upper trapezius muscle was examined by ultrasonography in both longitudinal (long axis of muscle) and transverse (right angle to the long axis of muscle) views in symptomatic site (Figure 1). Its thickness was determined with a contact scanning area of 6 cm2 and a constant load of 1.5 kg across measures by incorporating the ultrasound transducer into a push-pull scale.

Data Analysis

Data were collected and analyzed on an IBM PC-compatible computer with a SPSS 8.0 software package (standard version, SPSS Inc.). Averages of VAS measurements-taken before and after acupuncture were compared by the Wilcoxon signed ranks test. Conversely averages of neck ROMs in three motion planes and averages of muscle thickness in two views were compared before and after acupuncture by the paired *t* test. Statistical significance was proposed as a *p* value of less than 0.05.

RESULTS

Thirteen subjects with MPS of the upper trapezius muscle were selected. The VAS (ranging from 0 of painlessness to 10 of extreme pain), neck ROM, and upper trapezius muscle thickness was measured before and after acupuncture in this study.

ROM and VAS

The range of neck motions was measured in three different planes: flexion/extension in a sagittal plane, lateral bending in a coronal plane, and rotation in a transverse plane. Full ROMs, before and after acupuncture, were compared in these three motion planes, respectively. Significant improvements of ROM of neck were found in all results (Table 1). Pain was also significantly relieved, as indicated in the changes of VAS before and after acupuncture (Table 1).

Muscle Thickness

The thickness of the upper trapezius muscle with

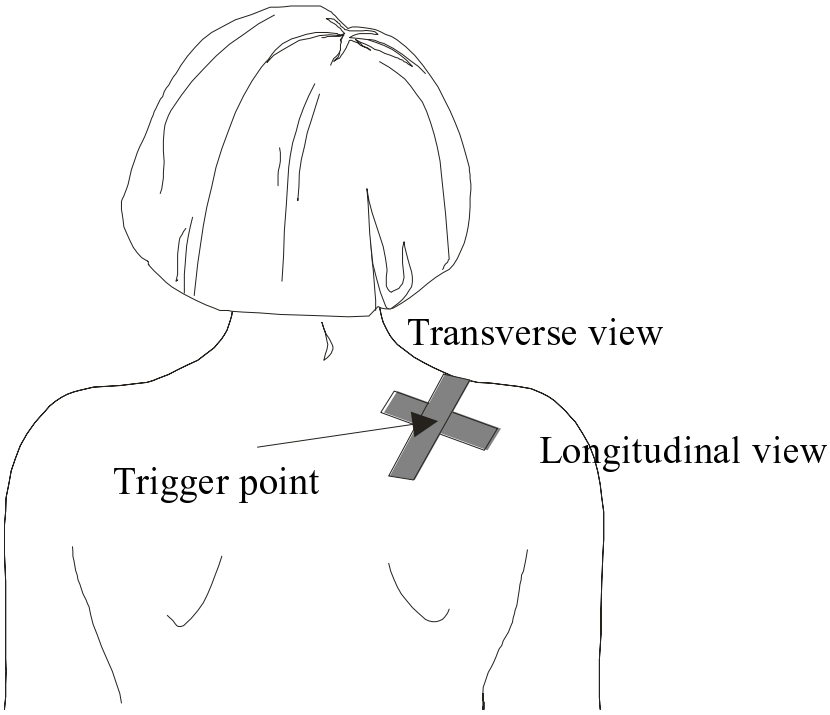

Figure 1. Measurement of upper trapezius muscle thickness in both transverse and longitudinal views, centered at a trigger point.

Table 1. Difference in neck range of motion (ROM) and scores of the visual analog scale (VAS) before and after acupuncture

Physical Parameters	Number of Subjects	Acupuncture		Mean±SD	*P* value
		Before	After	Difference	
ROM					
Flexion/ Extension	13	91.77 ± 25.8	109.23 ± 24.2	17.46 ± 11.8	0.009*
Lateral bending	13	61.54 ± 17.4	68.46 ± 17.7	6.92 ± 7.9	0.008*
Rotation	13	96.54 ± 23.9	109.69 ± 25.0	13.15 ± 14.7	0.007*
VAS	13	5.38 ± 1.12	3.08 ± 1.55	2.31 ± 1.55	0.003*

*p <0.05

SD denotes standard deviation.

ROMs before and after acupuncture are compared by the paired t test, and scores of the VAS are compared by the Wilcoxon signed ranks test.

Table 2. Thickness differences in the upper trapezius muscle of transverse and longitudinal views before and after acupuncture

Muscle	View	Number of Subjects	Acupuncture(cm)		Mean±SD	*P* value
			Before	After	Difference	
Upper trapezius	Transverse	13	0.66 ± 0.21	0.72 ± 0.18	0.06 ± 0.0877	0.033*
	Longitudinal	13	0.57 ± 0.16	0.60 ± 0.17	0.04 ± 0.0924	0.170

*p <0.05

SD denotes standard deviation.

trigger points, where an acupuncture needle was inserted along the long axis of this muscle, was measured ultrasonographically. This muscle thickness was significantly increased after acupuncture in the transverse view, but not in the longitudinal view (Table 2). Nevertheless, thickness changes may be either increased or decreased after acupuncture, and twelve such cases in the transverse view showed an increase and one a decrease, and nine cases in the longitudinal view showed an increase and four a decrease (Figure 2).

DISCUSSION

Many treatment alternatives may be effectively applied in the management of myofascial pain syndrome. All of these focus on inactivating the TrP and/or releasing the taut band. Manual therapy of stretching and cold spray as well as deep pressure massage, thermotherapy, electrotherapy, and even self-stretching techniques are frequently used in therapeutic programs for MPS. However, trigger point injections may be the most reliable and effective technique for immediate and complete pain relief. [8] Lidocaine solution (0.5%) is recommended for injection, but dry needling is also effective to inactivate the TrP if a local twitch response (LTR) is elicited.[13-14]

The effects of acupuncture in MPS vary from study to study. Acupuncture is very important in managing a great variety of diseases and symptoms in Chinese. It has been used and practiced for more than 2500 years. [19-20] Acupuncture points can be easily determined by anatomical “landmarks” as well as by the “own body scale”, which is based on the hand or finger dimensions of the subjects treated.

Through experience, 361 acupuncture points had been discovered and gradually organized as a network of 14 channels (called meridians).[20]

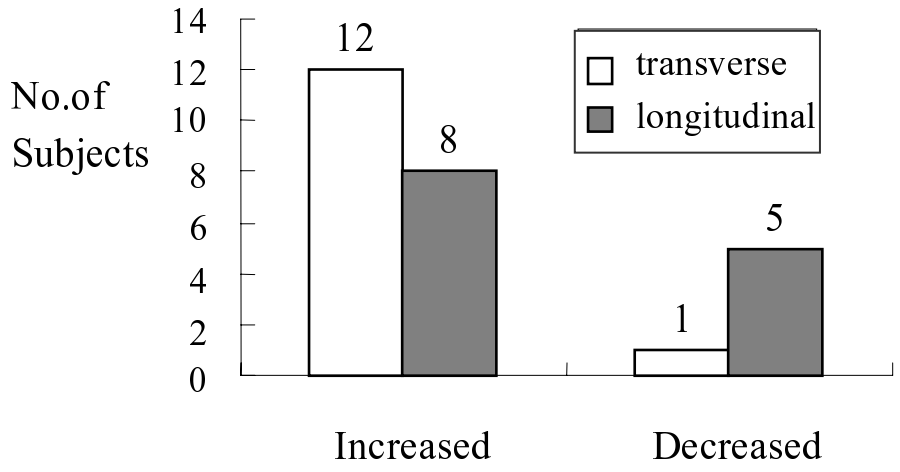

Figure 2. Frequency of muscle thickness changes, either increased or decreased, in the upper trapezius muscle after acupuncture.

The acupuncture points for muscle pain relief may be classified into three groups. The points of the first two groups belong to classic meridians.[29] The points of the third group are called Ah's points. Ah's points were first mentioned in the most famous ancient book of acupuncture, Lingshu, (The Yellow Emperor's Classic of Internal Medicine, the People's Health Publishing House, Beijing, 1979) and first published in Chinese in 100 BC. A famous ancient physician S.M. Sun (AD 581-682) detailed the points as extraordinary acupuncture points, not belonging to the classic meridians and found only in pathological conditions.[30] Remarkable signs of physical withdrawal and verbal groans, such as 'Ah....', were triggered when the point inside the muscle was palpated and manipulated.

Acupuncture therapy for MPS with the needle insertions at Ah's points was reported to be more effective than when done at classical points. [28] Patients may jump up and yell "Ah! Yes, this is the point!" when a hyperirritable Ah's point is palpated. Some studies have shown that direct mechanical stimulation to TrP could result in symptomatic relief equivalent to that of injected medications. Karel Lewit reported 86.8% (241/312) in immediate effects in/on pain relief and 29.5% (92/312) of permanent effects on myofascial pain relief by TrP dry needling. [23]

The structure of an acupuncture needle is different from that of an ordinary injection needle in its fine and blunt tip, such as gauge No. 23 which is usually used for tissue separation rather than for cutting. The effects of oblique acupuncture on muscle strain were proven by an experimental study. [30] In that study, the subjects were asked to perform a series of oblique squatting exercises to exhaustion. One leg of each subject was randomly selected for acupuncture and the other was left alone for control study. Acupuncture was applied at TrP of the vastus lateralis muscle immediately after exercise termination and a muscle biopsy was done 48 hours later. The myofibril structures altered to various extents under electronic microscopy, including a distortion or disappearance of the Z and/or M lines and disorientation of the myofibrils. After acupuncture therapy, the Z line width alteration was reduced from 68.15% to 31.25% ($p<0.01$) and to 9.37% ($p<0.01$). The volume density of myofibril, which had been reduced after exhausting exercise, was normalized from -9.44% (density reduction) to 0% ($p<0.01$). These results suggested that oblique acupuncture could promote a recovery process for the structural alternation of skeletal muscles after strenuous exercise.

In the present study, the "before and after" design was employed to evaluate the acupuncture effects. The results showed a significant reduction of pain in terms of VAS and significant increases of neck motion ability in terms of flexion/extension, lateral bending, and rotation.

In regard to ultrasonographic all-measured muscle

thickness, significant incremental improvements were found in the transverse view, but not in the longitudinal view. The correct evaluation of soft tissue ultrasonography necessitates a strict perpendicular approach to show a clear image of anisotrophy of muscle fasciae. Technically, perpendicular positioning of the scanning probe in a transverse approach seems to be easier, compared to that of a longitudinal approach in measuring the thickness of muscles determined by fasciae. To be closely observed, muscle thickness at the trigger areas could be increased or decreased after acupuncture. Ultrasonographic pictures were centered at a restricted area of the TrP, where muscle thickness was determined. Based on the model proposed by Simons, [31] an improvement of MPS may be attributed to relaxation of the taut bands and their associated trigger points. Depending on the relative prevalence of taut bands and trigger points in the measured area, "relaxation" may either increase or decrease muscle thickness of the very area studied/treated. The decrease of muscle thickness may be due to the total effect of relaxation of contracted trigger points with strained muscle fibers after acupuncture. Likely, the increase of muscle thickness may be due to the total effect of relaxation of taut bands within the muscles.

From this study, the immediate effects of oblique acupuncture therapy at Ah's points for MPS were proven by significant changes in subjective VAS measurement results, objective neck ROM, as well as the ultrasonographic muscle thickness of the affected site. Relations between Ah's points and TrPs, and the long-term effects of acupuncture on MPS requires further study. The ultrasonographic transducer used in this study was only 9MHz, which may not be high enough in resolution to identify the individual taut bands and TrP in this study.

CONCLUSION

The ultrasonogrpahic transducer used in this study was only 9MHz, which may not high enough in resolution to identify the individual taut bands and TrP in this study. Acupuncture therapy by oblique needle insertions had significantly relieved pain and increased neck motion in MPS, though it may either increase or decrease muscle thickness due to the relative prevalence of taut bands and TrP at the site of ultrasonographic examination.

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斜刺針法在治療肌筋膜疼痛症候群之即時療效：以超音波檢查研究斜方肌之物理性質和尺寸改變之證據

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筋膜疼痛症候群（myofascial pain syndrome, MPS），臨床症狀以局部肌肉疼痛，可摸到緊束帶（taut band）及壓痛點（trigger point, TrP）等，而轉位痛(referral pain)、局部的痙攣及交感神經功能失調也同時可見。而 MPS 的有效治療方法包括有物理治療（如間歇性使用冷噴霧及伸展肌肉運動）或使用藥物注射或用空針刺激在局部壓痛點，而在針刺治療方面，除了以針垂直刺入壓痛點外，經由緊束帶來針刺壓痛點也是緩解筋膜疼痛症候群的方法之一，即所謂"斜刺"針法。

本次實驗的目的即爲使用"斜刺阿是穴"的方式，以穿過緊束帶，用針刺激筋膜疼痛症候群的壓痛點，並評估此種治療方法是否有效。在評估療效方面，我們用頸部轉動的角度、軟組織超音波影像診斷，以及疼痛指數（visual analog scale, VAS）來評估療效。本研究包括 13 位病患（女性 11 位，男性 2 位），主要是在肩部斜方肌的緊束帶及壓痛點的 MPS 患者，分別施以"斜刺阿是穴"的手法穿過緊束帶來刺激壓痛點以治療 MPS。方法爲在病人有背靠及前臂有支持情況下施以針刺治療，斜刺後不運針且在病人感到針後酸痛消失後起針（數秒至數分鐘）。在針刺前後即時用下列方式評估：1)記錄 VAS 分數；2）頸部三個軸（前後、左右、側彎）的角度（以電子角度儀測量）；3)軟組織超音波影像：使用 9Hz 探頭的軟組織超音波儀來測量針刺處斜方肌垂直及縱切面的厚度（探頭均施以 1.5kg 重量, 用垂直的壓力，且確定表面肌電圖儀訊號已穩定。

結果分析在針刺治療前後的 VAS 分數和頸部三個軸向轉動的角度，均有明顯的進步，且具有統計學上差異（$p < 0.05$），而在超音波檢查的厚度方面，在橫切面有 12 例增加，有 1 例減少厚度，在縱切面有 9 例增加，4 例減少。

根據 D.G Simons 研究，在 MPS 之切片型態學上研究，在緊束帶上，壓痛點本身是比正常肌纖維更粗，而其收縮之肌纖維是比正常肌纖維更窄。故緊束帶會使肌肉塊變粗或變細是要看壓痛點數目及位置而定。治療後原來在緊束帶上的壓痛點處因放鬆而使得肌肉塊變平變薄，而原來在緊束帶上收縮之肌纖維，治療後則因不再持續收縮而使肌肉塊反而變厚。故在本研究中在軟組織超音波影像厚度增加者可能主要是肌纖維放鬆結果，而厚度減少者則爲掃瞄在中央壓痛點（central TrP）所在處，故掃瞄雖有不同結果，在臨床症狀即時緩解卻同樣有效。

由本研究顯示針斜刺阿是穴在 MPS 的即時症狀緩解在所有病患均有明顯效果。Karel Lewit 曾報告空針刺 TrP 對 MPA 的即時效果爲 86.8%，將來仍需進一步研究其長期療效。（中華復健醫誌 2003; 31(1): 13 - 20 ）

關鍵詞：針刺(acupuncture)，筋膜疼痛症候群(myofascial pain syndrome)，超音波影像(sonography)

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