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# Far-infrared ray patches relieve pain and improve skin sensitivity in myofascial pain syndrome: A double-blind randomized controlled study

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ABSTRACT

*Objective:* Myofascial pain syndrome (MPS) is a common disorder characterized by muscle pain if myofascial trigger points (MTrP) are stimulated. This study evaluated the effectiveness of far-infrared ray (FIR) patches in reducing the severity of pain in patients with MPS.

*Methods:* A double-blind, randomized controlled study involving 125 patients with MPS and 201 MTrPs located in the trapezius muscle. A FIR patch was applied to 98 MTrPs for 24 h in the intervention group (61 patients) and a placebo patch was applied to 91 MTrPs in the control group (57 patients) at the end. Pain intensity was measured using the visual analogue scale (V) while pressure pain threshold (P) and maximal pain tolerance (T) were measured using an algometer before and after treatment.

*Results:* The mean age of the patients was 37.16 years old and 67% were female. There was a positive correlation between P and T ($p < 0.001$). Older Age was associated with higher P and T due to poor skin sensitivity ($p < 0.001$). V improved significantly in both groups to a similar extent, but only in the intervention group, P and T decreased significantly (which implied better skin sensitivity) ($p < 0.05$). P and T decreased the most in the female group aged over 35, probably due to thinner skin in this subgroup.

*Conclusions:* FIR and placebo patches were equally effective at relieving pain (with decreased V), but P and T dropped only in the intervention group with FIR patches. This probably resulted from FIR penetrated only to the skin layer and improved skin sensitivity with more blood circulation, but the muscle remained unaffected. Further studies should investigate the effect of longer exposure or higher energy applications.

## 1. Introduction

Myofascial pain syndrome (MPS) is a common pain disorder responsible for many pain clinic visits. It is one of the most common causes of musculoskeletal pain, with an estimated prevalence of 12% in the general population.[1]

The characteristic physical finding of MPS is the presence of a myofascial trigger point (MTrP) on the taut band of skeletal muscle. Referred pain can be triggered and a local twitch response can be evoked if the MTrP is mechanically stimulated.[2] An MTrP is defined as being active if spontaneous pain occurs or as being latent if the pain occurs only when it is stimulated. Sensitive loci are sensitized nociceptors located in MTrP.[3] These points release more acetylcholine during relaxation, which causes the contraction of muscle fibers and the formation of a taut band. MTrPs also result in a reduction in pain threshold.

The diagnostic criteria for MTrP enabled the clinicians to make a more objective diagnosis of MPS,[4] including: (1) an hyperirritable tender spot, (2) recognition of pain on this spot, (3) taut band contained on this spot, and (4) referred pain and local twitch response when this

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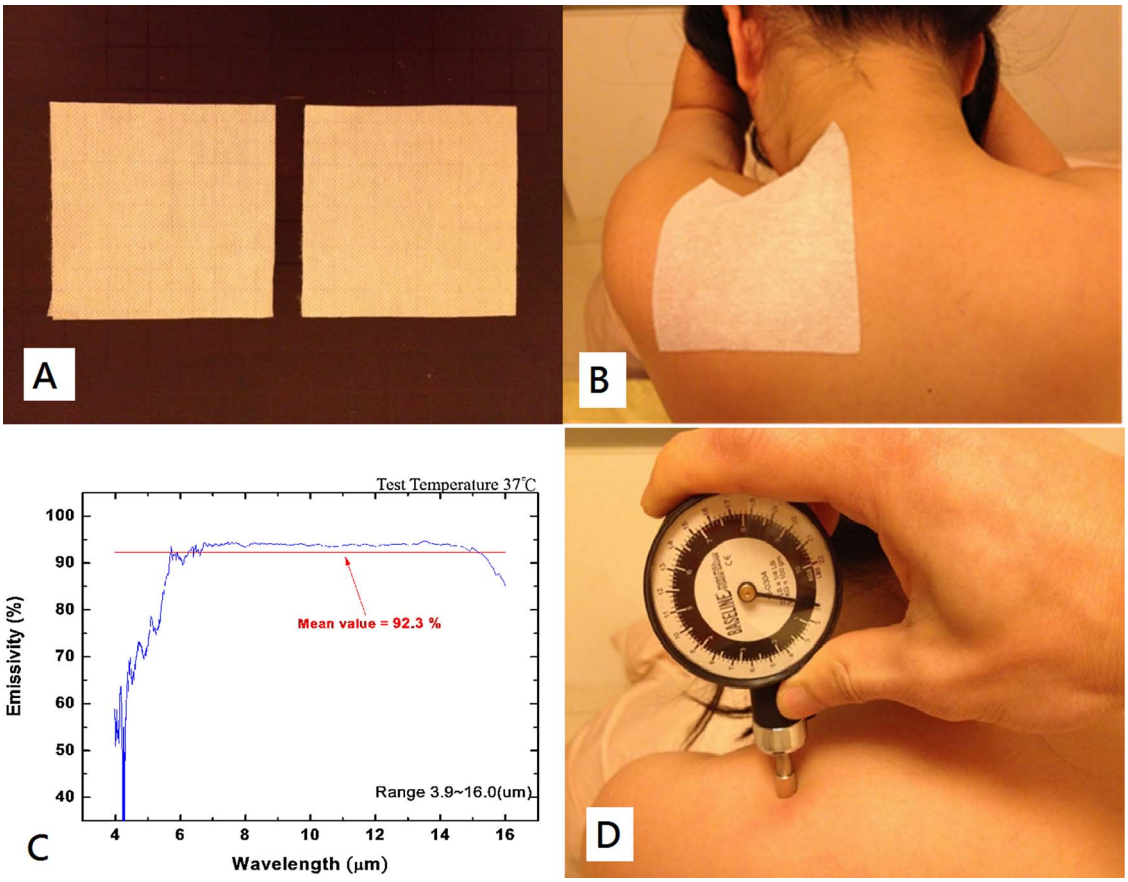


**Fig. 1.** A. The far infrared patch (left) and placebo patch (right) are identical in appearance. B. Patches are applied to the upper trapezius region of patients with myofascial pain syndrome (MPS). C. The energy analysis of the far infrared patch by Fourier Transform Infrared Spectroscopy. D. The algometer for measuring pressure pain threshold (P) and maximal pain tolerance (T) (Pain Diagnostics and Thermography Corporation, Model PTHAF2).

spot is stimulated. However, it is difficult to measure the sensitivity of MTrPs by imaging studies or blood flow tests.[5]

Previous study reported that abnormal endplate potential on the active loci is related to the excess acetylcholine released from neuromuscular junctions near MTrP.[6] Simons et al. proposed a theory of energy crisis to explain the etiology of MPS, in which the muscle tends to contract when overused or injured, thus impairing blood flow and energy storage which preventing entry of calcium into muscle cells.[4] The influx of calcium makes the muscle contract longer and induces more injury, which forms a vicious cycle.[7]

The primary goal of treatment for MPS is trigger point relaxation and pain relief. A number of noninvasive and invasive techniques are currently used to treat patients with the syndrome.

Thermotherapy, for example, is a noninvasive technique that has been shown to improve local blood circulation, relax the muscle and lower the muscle tension at MTrPs. The modality, however, puts patients at risk for burn injury and needs to be used with caution.[8] Transcutaneous electrical nerve stimulation (TENS) is another commonly used noninvasive treatment for MPS. The modality has been shown to increase the release of endorphins into the microcirculation and to modulate the autonomic nervous system. However, it provides only short-term pain relief and is not effective in all patients.[9]

Acupuncture and local injection of anesthetics at the MTrP are commonly used invasive techniques for treatment MPS.[8] Acupuncture mainly relieves pain and relaxes muscle by inducing a local twitch response through repeated puncturing at the MTrP locus. This technique, however, induces pain and increases the risk of complications such as infection, bleeding or pneumothorax.[10]

On the other hand, FIR therapy has been shown to be effective at improving blood circulation, while poor blood circulation may be the cause of energy crisis and muscle pain in MPS.[11,12] The infrared radiation can be divided into three categories by wave length: near-infrared radiation (0.8–1.5 μm), middle-infrared radiation (1.5–5.6 μm) and far-infrared (FIR) radiation (5.6–1000 μm).[12] FIR therapy can improve blood flow in skin and promotion wound healing with evidence in animal study and human clinical trial.[13,14] The Far-infrared patch (FIR) is on the market now and can be a safe and convenient solution to the above-mentioned disadvantages, such as safety concern or discomfort.[15] Patients can apply the patch by themselves without discomfort or danger. Patients can go to work with patch on them without being noticed. If FIR patch can treat MPS successfully, many patients including those who are physical disabled can also benefit from it. However, few studies have investigated the effectiveness of FIR at relieving pain in patients with MPS.[16] Lai et al. reported that although the FIR resulted in significant improvement in pain scores in patients with MPS, there was no significant difference in pain scores between the intervention and control groups. They also reported that only patches containing far-infrared emitting ceramic powder (cFIR) resulted in a significant decrease in degree of trapezius muscle stiffness in the intervention group.

The present study aims to evaluate whether application of the FIR patch at trigger points in the trapezius muscle is effective at reducing pain and increasing the pressure threshold and pain tolerance in patients with MPS.

## 2. Methods

### 2.1. Study population

All patients in this study were recruited from a large teaching