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# Chronic Supraspinatus Tendonitis Pain: An Integrative Approach for Treatment with Cross-Fiber Massage, Electroacupuncture, Far-Infrared Heat, and Photobiomodulation

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## ABSTRACT

**Objective:** More than 70 million Americans suffer from chronic pain; many cases are related to sports injuries. This type of injury often involves soft tissues (muscles, tendons, and ligaments). Direct-force injury (e.g., impact trauma) and indirect-force injury (e.g., repetitive motion) are normally the cause of strained muscles, sprained ligaments, and tendonitis. The standard of acute care is RICE [rest, ice, compression, and elevation] plus anti-inflammatory medication. While this regimen often relieves acute pain, the consequence of the long-term use is chronic pain due to un-remodeled scar-tissue formation. The goal of this article is to show how a combination of integrative modalities can be used to relieve the pain caused by such injuries and their sequelae.

**Materials and Methods:** This article focuses on a combination of clinical modalities that integrate osteopathic cross-fiber massage, microcurrent electroacupuncture, far-infrared heat, and photobiomodulation to break up the scar tissue and reactivate the body's intrinsic repair mechanism. Chronic shoulder pain, associated with supraspinatus tendonitis is used here, to illustrate this integrative treatment in an acupuncture clinic setting.

**Results:** This method heals chronic pain from an injury with clinic visits, twice per week, for 3–5 weeks.

**Conclusions:** More clinical and research studies are recommended to validate this approach for this condition and other soft-tissue traumata

**Keywords:** Traditional Chinese Medicine, chronic sports injury, chronic soft-tissue injury, cross-fiber massage, microcurrent electroacupuncture, *Ashi* acupuncture, photobiomodulation (PBM) therapy

## INTRODUCTION

**A**CUPUNCTURE AND TRADITIONAL CHINESE MEDICINE (TCM) modalities, such as moxibustion, cupping, and *tu'ina* massage, often work well to relieve pain in the acute phases of soft-tissue injuries. Many acupuncturists, however, see patient later on, after all allopathic modalities have been utilized. Afterward, typical acupuncture and Chinese

medical techniques may not be effective to treat these injuries when they reach the chronic stage.

## MATERIALS AND METHODS

First, this article reviews the 3 healing phases of soft-tissue injuries, emphasizing inflammation and the critical

role of acupuncture for reintroducing acute inflammation to initiate healing. Second, an integrative treatment approach is recommended, explaining the successful treatment of chronic soft-tissue injuries in ~10 clinical treatments. This technique integrates 3 Western and Chinese medical modalities: (1) osteopathic cross-fiber massage; (2) microcurrent electroacupuncture with red and near-infrared photobiomodulation (PBM), and (3) far-infrared heat. Third, this technique is demonstrated for treatment of chronic supraspinatus tendonitis of the shoulder.

### Three Healing Phases

Western medicine identifies 3 healing phases for soft-tissue injuries: (1) inflammation; (2) proliferation; and (3) remodeling. When these 3 phases proceed naturally, healing progresses readily. When healing is disrupted—perhaps by poor blood and lymph circulation—chronic pain, its associated disability, will occur. During tissue repair, arterial blood transports nutrients and oxygen to provide products for healing, and lymph drainage removes waste products.<sup>1</sup>

*Phase 1—Inflammation.* During the initial inflammatory stage, lasting ~5 days, prostaglandins (PGs) initiate multiple tasks (i.e., stimulate the immune system, assemble platelets around the lesion, attract white blood cells that protect against infections, and remove damaged tissue). PGs protect the damaged tissue by both sending a pain message and by sensitizing the injured area to prevent further injury. Fibroblasts are activated and produce disorganized fibrous tissues in the later stage of phase 1.<sup>2</sup>

*Phase 2—Proliferation.* During this phase, lasting 3–5, weeks, new cells proliferate to form granulation tissue to replace the damaged cells, and fibrous tissues become more organized. Physical activity eliminates extraneous scar tissues that may inadvertently adhere to neighboring tissues.

*Phase 3—Remodeling.* During this phase, lasting ~3 months or more, the newly repaired tissue, that is abundantly scar-like, remodels itself. This process restores and strengthens damaged tissues. If remodeling does not occur, this results in weakened tissue that is prone to future injuries. In addition, granulated tissue develops into scar tissue. This leads to chronic pain when the remodeling is unhealed or absent, and the area of the remaining scar tissue increases with a lack of physical movements.<sup>3</sup>

### Detrimental Use of NSAIDs, Cortisone, and Icing

Conventional therapies, such as nonsteroidal anti-inflammatory drugs (NSAIDs), cortisone injections, and icing can alter and inhibit healing by blocking PG production, which, in turn, causes excessive scarring.<sup>3,4</sup> NSAIDs relieve pain most effectively the first time they are utilized but, when they are consumed daily, they lose their effec-

tiveness, and, thus, pain ensues. NSAIDs may also fail to produce more therapeutic benefits. NSAIDs stop the first phase of healing by blocking production of PGs, which compromises the subsequent stages of healing.<sup>5</sup> Rebound pain begins after 4–8 days of continual NSAIDs usage, and this rebound pain increases slowly until it becomes the major component of the chronic pain. Rebound pain may develop because NSAIDs block the tiny pain signals that cause shifting or adjustment of the posture. These adjustments are critical to stopping tissue damage from the stress and strain applied to joints, muscles, and other soft tissues when a patient is sitting or standing.

If the muscles become scarred and fibrous, tension receptors in the muscle “belly” do not readily change shape with the muscle, resulting in delayed or absent responses. As a result, the central nervous system signal for muscle contraction is increased, causing spasms and continuous tension. As pain becomes more chronic, it is often accompanied by stiffness and a reduced range of motion (ROM). Many studies have associated NSAIDs with chronic pain.

A recent study by Parisien et al. (in 2022) found transient neutrophil-driven upregulation of inflammatory responses, to be protective against the transition to chronic pain.<sup>6</sup> This study concluded that, despite analgesic efficacy at the early time of an injury, management of acute inflammation with NSAIDs may be counterproductive for long-term outcomes in low-back pain.<sup>6</sup>

Cortisone injections demineralize bone and cause soft tissue to become weak. With increased administration of cortisone, there is increased scarring of subcutaneous tissue.<sup>7</sup> Cortisone injection at the site of inflammation destroys the inflamed tissue, which stops sending pain signals and is replaced with scar tissue.<sup>8</sup> This action brings quick pain relief but, in 3 months, tiny nerve fibers enter the aging scar tissue as it shrinks and this leads to chronic pain.

Icing increases the chance of incomplete healing by decreasing blood flow to the injured tissues. This increases the possibility of reinjury or the development of chronic pain. Unintentional scarring can also result from the application of excessive icing to relieve pain.<sup>8</sup>

### Integrative Treatment Approach

There are 4 modalities used to reactivate the body’s innate healing mechanism. These modalities help the body progress quickly through the 3 phases to heal chronic soft-tissue injury. These 4 modalities include: (1) local treatment with cross-fiber massage; (2) microcurrent *Ashi* acupuncture; (3) PBM therapy; and (4) far-infrared heat therapy. Each is explained further below.

*Cross-fiber massage* is a form of deep transverse friction in orthopedic medicine. The technique is useful for mobilizing scar tissue, including in chronic tendonitis and ligament sprains.<sup>9</sup> This massage can be used to break up scars and adhesions and prepare tissue for microcurrent *Ashi*

acupuncture therapy. Although *tu'ina* is used extensively in TCM treatment of musculoskeletal disorders, it is the author's clinical experience that this method of cross-fiber massage with manual therapy is tolerated better by patients than *tu'ina*. Manual cross-fiber massage has been shown to be effective clinically.<sup>10</sup>

*Ashi* acupuncture performed with needles may restart the healing process by producing tiny "puncture wounds" when healing is incomplete or interrupted by the use of NSAIDs, cortisone injections, and/or icing. Local treatment at specific sites of sensitivity and tenderness (i.e., *Ashi* points) stimulates or restimulates healing.<sup>11</sup> Acupuncture can also relax a shortened muscle that may have chronically created tension on the tendons it serves, a tension that promoted tendonitis pain. *Ashi* acupuncture can prevent rebound pain when NSAIDs are discontinued.<sup>12</sup> A chronically shortened tendon almost always produces inflammation or tendonitis. Acupuncture can be used as a complementary method to terminate rebound pain quickly when NSAIDs are discontinued.<sup>13</sup>

*PBM* therapy is a noninvasive, pain-free, light-based therapy that uses red (630–670 nm) or near-infrared (~810–904, or 1062 nm) electromagnetic energy to target inflamed and injured tissues. Photons stimulate adenosine triphosphate (ATP) production, thereby accelerating the healing process.<sup>14</sup> When PBM is applied, patients recover from musculoskeletal injuries with less scar tissue, accelerated cell regeneration, and improved function.<sup>15</sup> PBM therapy increases the flow of oxygenated blood to the injured tissue to accelerate tissue healing. This therapy promotes collagen production by properly aligning and remodeling collagen to help reduce internal scar formation and enhance tissue elasticity. Most importantly, PBM therapy helps increase inflammatory mediators, such as macrophages, neutrophils, and lymphocytes, to accelerate and resolve the inflammatory process quickly.<sup>16</sup>

### Integrative Supraspinatus Tendonitis Treatment

Supraspinatus tendonitis is the most common tendinous lesion of the shoulder.<sup>17</sup> The clinical examination always indicates a painful resisted arm and lateral abduction in either supination or pronation. The lesion may lie at 1 of 4 sites and they are often very obvious for confirming the diagnosis. The four sites are: (1) the superior tenoperiosteal junction; (2) the inferior tenoperiosteal junction; (3) both 1 and 2 together; and (4) the musculotendinous junction. A lesion at the tenoperiosteal junction is the most-common presentation.

After confirming the diagnosis and the lesion site is determined, the treatment begins with a cross-fiber massage.<sup>18</sup> The supraspinatus tendon is situated deep to the acromion under the thick deltoid muscle. To access the tendon, the patient is placed in a seated position with the affected arm behind the back in a hammerlock position by passively

extending the arm as far as is comfortable. This position brings the supraspinatus tendon out from under the acromion, just anterior and inferior to the acromioclavicular (AC) joint. Each treatment session starts with cross-fiber massage to this area, to break up the scar tissues in the tendon, to restore the inflammatory phase of the 3 phases of healing.

The massage session lasts 10 minutes. It is performed twice weekly during office visits, for 3–5 weeks. Counter-pressure is supplied by the thumb on the area medial to the deltoid, just anterior and inferior to the AC joint. The amplitude of the massage sweep is 1", with the fingers moving horizontally across the near-vertical tendon.

Needle acupuncture can then be applied to C-4–C-6 *Huatuojiaji* points, lateral to the cervical spine; on motor points in the supraspinatus muscle; and on *Ashi* points over the supraspinatus tendon. The *Huatuojiaji* points are treated just lateral to C-4, C-5, and C-6 on the affected side, with perpendicular needle insertion 0.5"–1.5". The needles (Prime J-type, 34G×1.5") are gently twisted and thrust, until the patient feels De Qi. The motor point for the supraspinatus muscle, SI-12 (*Bingfeng*), is treated using a perpendicular needle insertion with a depth of 1"–1.5". The main *Ashi* point is over the tendon, when the patient's arm is placed behind the back, is also treated; a horizontal needle insertion is used, with a depth of 0.75"–1".

The next treatment involves  $\mu A$  electrical stimulation—pulsed at 10 Hz with 0.1 seconds between the pulses—connected between the SI-12 needle and the *Ashi*-point needles, over the supraspinatus tendon. The amplitude is increased slowly until the patient feels the electrical sensation. A 1982 study by Cheng et al., reported that the effects of direct *microcurrent* stimulation (not mA current stimulation) will increase ATP concentration.<sup>19</sup> The power of the *microcurrent* stimulation should be kept below the threshold of sensation. It has been suggested that if a patient perceives the electrical stimulation, this is actually decreasing ATP. If that patient begins to feel the electrical stimulation during the 25-minute treatment, the power should be turned down so that there is no perception of the electrical stimulation. mA Transcutaneous electrical stimulation, for example, wherein the patient feels the electrical stimulation, is not recommended. Generally, the patient senses the pulsating electrical sensation between 300 and 1000  $\mu A$ ; however, the amplitude setting for minimum sensation is recommended.

PBM therapy may be performed—using a system that has 6 red (658 nm) and 6 infrared (810 nm) low-level laser heads that can be attached to the skin—over a target area, such as an acupuncture point. Each laser head has an ~4-mm diameter aperture. For this shoulder-tendonitis treatment protocol, only a constant wavelength–modulating frequency mode is used. The red laser power output for each placement is set at 10 mW, and the near-infrared laser power output for

each placement is 50 mW. The PBM treatment time is 25 minutes. At each treatment session, the energy density dose applied for the red lasers is  $\sim 120 \text{ J/cm}^2$  per placement. For the near-infrared lasers, the energy density applied is  $\sim 600 \text{ J/cm}^2$  per placement.

The target placement locations for each laser head are as follows. Three red lasers are placed adjacent to the conventional acupuncture needle locations over the supraspinatus tendon site, in contact with the skin there. The patient is still seated in the position with the affected arm in the hammerlock position (behind the back). In this position, the affected tendon is directly below the skin above it. Thus, 3 red lasers, which have a relatively more-shallow depth penetration, are used to treat the tendon site. In addition, 4 near-infrared laser heads, which have deeper penetration, are placed adjacent to the *Huatuojiaji* points, and 2 near-infrared laser heads near the SI-12 acupoint.

Last, far-infrared heat therapy with a *Teding Diancibo Pu* lamp is applied  $\sim 2'$  above the treatment site for the entire 25-minute treatment session. This type of heat lamp, with a mineral plate, has been used in Chinese and American TCM clinics since the 1980s. It has been shown to be clinically effective for stimulating deep muscle relaxation, increasing blood circulation, and promoting faster healing.

## RESULTS

The multimodality treatment protocol should be repeated for 5–10 visits, depending on the rate of healing. Scheduling is twice per week for up to 5 weeks and the patient is then assessed for the end of the treatment. No NSAIDs or icing should be used. Because the chronic condition has been brought into the acute phase after the scar tissue has been broken up by the cross-fiber massage and *Ashi* acupuncture, there will be more pain. Thus, the inflammation will increase, which is desirable at this stage of treatment. For the pain, the patient is advised to soak the injured area in warm water with Epsom salt, take Tylenol® or a Chinese analgesic herbal formula, and apply a heating pad to manage this pain. By the sixth-to-eighth treatment, dramatic improvement in ROM along with pain reduction should occur. The healed condition will have transformed from the cell-proliferation phase to the remodeling phase. The remodeling phase may take 1–2 months to complete resolution of the last  $\sim 10\%$  of the pain so that the patient is without the pain. The patient should continue shoulder ROM exercises to ensure complete healing.

## DISCUSSION

A patient should be educated regarding the diagnosis and the source of the chronic pain, and given a treatment plan that includes instructions for home exercise. Healing takes time,

especially with this modality because it is counterintuitive that inflammation needs to be reintroduced to the injury site to ensure complete healing. More pain may be experienced during the first 2–3 weeks of the treatment and no NSAIDs and icing should be used. Only warm water with Epsom salt soaking, Tylenol (caution for excessive use to avoid hepatotoxicity) or a Chinese analgesic herbal formula, Chinese poultice patches, and heating pads are allowed to manage the pain.

## CONCLUSIONS

This integrative approach has been highly effective for healing chronic supraspinatus tendonitis. More clinical and research studies are recommended to validate this approach for this condition as well as for other soft-tissue traumata.

## AUTHOR DISCLOSURE STATEMENT

No financial conflicts of interest exist.

## FUNDING INFORMATION

No funding was received for this article.

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