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Sequential Myofascial Trigger Point Injection to Treat a Patient with Myofascial Pain Syndrome Associated with Reflex Sympathetic Dystrophy: A Case Report

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A patient with traumatic rotator cuff tear of right shoulder developed severe myofascial pain syndrome with reflex sympathetic dystrophy (RSD) involving the right upper extremity. She was unable to take any type of manual therapy or needle treatment due to severe allodynia in the whole right upper limb. She visited our pain clinic about 2 months after the onset of trauma. She received myofascial trigger point (MTrP) injection beginning with injection into the MTrP of the right first dorsal interosseous muscle, followed by injecting MTrPs of the right wrist-finger extensors and right anterior deltoid muscles. The allodynia was remarkably reduced. Then she received intra-articular steroid injection into her right shoulder joint and subacromial bursa. Two weeks later, she was able to use her right hand for light activity. She received further injection of MTrPs in the right shoulder girdle muscles including deltoid, supraspinatus, infraspinatus and teres minor muscles. She had almost pain free with nearly full range of motion in her right shoulder by 3 months after injection. The mechanism of MTrPs and their association with RSD were discussed. (J Rehab Med Assoc ROC 2003; 31(3): 155 - 163 )

Key words: muscle pain, myofascial trigger point, reflex sympathetic dystrophy, trigger point injection

INTRODUCTION

A myofascial trigger point (MTrP) is defined as a highly localized painful or sensitive spot in a palpable taut band of skeletal muscle fibers; it is characteristic of myofascial pain syndrome (MPS).12-25 An active MTrP is one with spontaneous pain or pain in response to movement, while a latent MTrP is a sensitive spot with pain or discomfort in response to compression only.19,20,26 MPS is usually caused by or associated with acute injury or chronic repetitive trauma to soft tissues, lesions involving various structures, or emotional stress. Many medical conditions (perpetuating factors), including mechanical stress, metabolic or endocrine inadequacies, chronic infections, or psychological factors, may perpetuate MPS or may aggravate its severity.14,14,17

The characteristics of an MTrP include: 1). discriminated tender spot (MTrP) in a palpable taut band (also referred to as “nodule”); 2). consistent and charac-
teristic referred pain pattern upon compression of an MTrP; 3) local twitch response (LTR) elicited by snapping palpation on MTrPs in some muscles, or by needling of MTrPs in almost all cases; 4) restricted range of stretch due to shortening of muscle fibers in a taut band; 5) muscle weakness with no remarkable atrophy due to waxing and waning phenomena of MTrPs; 6) spread of pain to other parts of body in severe cases of myofascial pain syndrome; 7) associated referred autonomic phenomena including vasomotor and pilomotor responses, and hypersecretion. [4,6,8-10,13-16]

A recent study by Gerwin et al has suggested that “spot tenderness”, “pain recognition”, and “taut band” are the most reliable signs and the minimal criteria needed to identify an MTrP, while “referred pain” and “LTR” are most useful as confirmatory signs of the MTrP. [18,19] It has been concluded that it is essential to have hands-on training in order to achieve a reliable examination of MTrP. [18,19] Recently identified objective confirmatory findings of MTrPs include the electromyographic (EMG) recording and ultrasound imaging of LTRs, the spontaneous electrical activity of multiple active loci, and histological findings of contraction knots in the MTrP site. [20]

Treatment of MTrP [4,6,8-10,12-15,17,21-24] include one or more of the following items: 1. Manual therapy such as intermittent cold (with Fluori-methane or Ethyl Chloride spray, or ice massage) and stretch (may be combined with other techniques such as post-isometric relaxation), [25,26] deep pressure soft tissue massage (by manual compression on an MTrP, combined with gentle stretch of muscle fibers in an MTrP region by moving the finger following the direction of muscle fibers), mobilization, or manipulation. 2. Thermotherapy (usually combined with other therapy). 3. Electrotherapy by stimulation of muscle fibers around an MTrP may facilitate relaxation of a taut band and may improve local circulation. 4. Trigger point injections with Lidocaine or Normocaine solution or dry needling into an MTrP. [27,28] In addition to the above items, the following three issues are essential for long-term inactivation of the MTrP: 1. Treatment of underlying causes. 2. Elimination of perpetuating factors. 3. Instruction in and consistent performance of a home program including self-stretching techniques, maintaining proper postures and therapeutic exercises, and other physical medicine modalities.

The clinical observation of autonomic phenomena associated with active MTrP has been well documented. [122] MTrPs have been found to be a complication (or a manifestation) of reflex sympathetic dystrophy (RSD). [124] Trigger point injection could be an effective way to treat muscle pain in some RSD patients. [125] In this case report, a patient with severe MTrPs and RSD was successfully treated with MTrP injection for pain control.

CASE REPORT

History:

A 35-year-old lady was involved in an automobile accident and developed pain and swelling in the right shoulder. She was unable to move her right shoulder due to severe shoulder pain (especially at the anterior shoulder). Initial X-ray examination of the right shoulder revealed evidence of rotator cuff tear at the supraspinatus tendon portion. No surgical intervention was recommended at that time. She continued to receive physical therapy. However, the pain in the right shoulder was getting worse gradually, especially during mobilization therapy. About 3 weeks after the re-injury, the pain spread to the right arm, forearm, wrist, and hand, progressively from the proximal to the distal portions. Swelling in the right hand was remarkable. Gradually, she also experienced episodic cold sensation with skin discoloration (pale or cyanosis) in her right hand. She became hypersensitive to touch in the whole right shoulder and arm and was unable to move her right shoulder and elbow due to severe pain. She was given oral steroid with little help. She was unable to take any local injection therapy to the right shoulder due to severe pain and allodynia. She had tried acupuncture therapy but she was unable to tolerate the needle insertion. Under the impression of reflex sympathetic dystrophy, the
The primary physician referred this patient to our pain clinic for further management.

**Initial physical examination at pain clinic:**

She was examined at our pain clinic about two months after the initial injury. At that time, she reported pain intensity of 10/10 based on the numerical pain scale (0 = no pain; 10 = worst pain ever experienced). On examination, this poor lady fixed her right upper limb in a position tightly closed to her body with half flexion of her elbow and wrist. Mild swelling and trophic change in the hand were noticed. She was unable to move the whole right upper extremity in all joints but only flexion in the thumb and fingers. Allodynia was remarkable in the right shoulder-scalpular area, the arm and the forearm. The skin in the right hand was very cold. The diagnosis was regional myofascial pain syndrome with reflex sympathetic dystrophy involving the right upper extremity due to right rotator cuff tear.

**Myofascial trigger point injection:**

Since she was unable to take any physical therapy modality on her right shoulder and refused to have any needle intervention (including MTrP injection) into the shoulder, she was treated with myofascial trigger point injection into the right first dorsal intersosseous muscle. The procedure of MTrP injection was the same as the protocol recommended by Hong. The needle penetrated through the skin into the subcutaneous tissue adjacent to the palpated MTrP region. Then the needle was further moved into the muscle fibers in the MTrP region in a straight track with multiple thrusts rapidly ("fast in" technique) to elicit LTR. A drop of 1% lidocaine (approximately 0.05 - 0.1 ml) was injected each time if an LTR is elicited. The needle was then withdrawn to the subcutaneous tissue layer but not out of the skin, and then was moved into another site in a different direction to elicit another LTR for another injection. Similar procedures were repeated at different angles (directions) in the same MTrP region to elicit more LTRs. Approximately 10-15 insertions were searched for LTR loci (sensitive loci) in one MTrP region.

As shown in Table 1, immediately after the first injection on the first dorsal intersosseous muscles, the pain intensity was reduced to 2/10 in the right hand, and 7/10 in the right elbow. The mobility and strength of right wrist and hand were also increased. She was able to tolerate touch (with reduced allodynia) on the right forearm and elbow. MTrP injection was then performed on the MTrPs of the extensor carpi radialis muscle and the extensor digitorum communis muscle. Within 30 seconds after the injection, she reported that the pain intensity in her right shoulder was reduced to 8/10, and further reduced pain in the right elbow, forearm, wrist and hand. She was able to move her elbow, wrist and fingers in full range. The allodynia in the right shoulder and arm were also reduced, so that she was able to tolerate touch on her right shoulder. MTrP injection was then performed over the MTrPs of the right anterior deltoid muscle.

Shortly after this treatment, she reported the pain intensity in her right shoulder was 5/10. She was able to move her right shoulder for 30-40% of normal range. The muscle strength was also increased. The swelling of the hand was completely subsided and the hand was also getting warmer than before. Then she received a local injection with Triamcinolone Acetonide 40 mg (Kenacort-A 1 ml) plus 1% xylocaine 5 cc into the right shoulder joint and the subacromial bursa. Daily physical therapy program including short-wave diathermy and interferential current electrotherapy to the right shoulder, and mobilization of the right shoulder were prescribed.

**Physical examination and further treatment two weeks after initial MTrP injection:**

After one complete session of physical therapy, this patient was further examined two weeks later. She had reduced pain and increased mobility, but still had diffuse active MTrPs in the right shoulder girdle muscles. She was able to use her right hand for light activity. The range of motion of the right shoulder was still restricted in all directions (50-70% of normal range). The pain intensity of the right shoulder at rest was only 3/10. However, the pain increased to 7-8/10 during resistive contraction of the shoulder abductors. The muscle strength was reduced (3/5) in these two muscle groups due to shoulder pain. The sensory function was normal. Deep tendon reflexes were within normal limits.

She received further injection of MTrPs in the right shoulder girdle muscles including deltoid, supraspinatus, infraspinatus and teres minor muscles. Immediately after
Table 1. Changes in pain characters in the right upper extremity after the initial course of myofascial trigger point (MTrP) injection therapy on a patient with traumatic reflex sympathetic dystrophy

<table>
<thead>
<tr>
<th></th>
<th>Initial Examination</th>
<th>After initial MTrP injections</th>
<th>2 weeks after initial treatment</th>
<th>3 months after initial treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain Intensity (0-10/10)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shoulder/Arm</td>
<td>10/10</td>
<td>10/10</td>
<td>8/10</td>
<td>5/10</td>
</tr>
<tr>
<td>Elbow/Forearm</td>
<td>10/10</td>
<td>7/10</td>
<td>3/10</td>
<td>0/10</td>
</tr>
<tr>
<td>Wrist/Hand</td>
<td>10/10</td>
<td>2/10</td>
<td>0/10</td>
<td>0/10</td>
</tr>
<tr>
<td>Allodynia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shoulder/Arm</td>
<td>severe</td>
<td>severe</td>
<td>moderate</td>
<td>mild</td>
</tr>
<tr>
<td>Elbow/Forearm</td>
<td>severe</td>
<td>moderate</td>
<td>mild</td>
<td>none</td>
</tr>
<tr>
<td>Wrist/Hand</td>
<td>severe</td>
<td>mild</td>
<td>none</td>
<td>none</td>
</tr>
<tr>
<td>Passive Range of Motion (% of normal)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shoulder</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>30-40%</td>
</tr>
<tr>
<td>Elbow</td>
<td>0%</td>
<td>50%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Wrist</td>
<td>0%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Thumb/Fingers</td>
<td>0%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Strength (0-5/5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shoulder</td>
<td>0/5</td>
<td>-</td>
<td>2-3/5</td>
<td>3/5(*4/5)</td>
</tr>
<tr>
<td>Elbow</td>
<td>0/5</td>
<td>-</td>
<td>4-5/5</td>
<td>5/5</td>
</tr>
<tr>
<td>Wrist</td>
<td>0/5</td>
<td>-</td>
<td>5/5</td>
<td>5/5</td>
</tr>
<tr>
<td>Hand</td>
<td>0-2/5</td>
<td>-</td>
<td>5/5</td>
<td>5/5</td>
</tr>
</tbody>
</table>

* Pain intensity was reduced from 2/10 to 0/10, and muscle strength increased from 3/5 to 4/5 immediately after the second course of MTrP injection.

injection, the pain in the right shoulder was subsided completely. The muscle strength was also increased to 4/5.

**Outcome:**

She continued to receive the physical therapy program for 10 more weeks, and returned to our pain clinic 3 months after the initial treatment for follow-up evaluation. At that time, she remained pain free with full range of motion in the right shoulder. The muscle strength was 4/5 in the shoulder abductors (with mild pain during resistive contraction) and 5/5 in others. A follow-up phone call was performed about one year after the initial visit, and she reported no problems.

**DISCUSSION**

The appropriate treatment of traumatic tendon-ligament injury includes physical therapy and anti-inflammatory medicine (either systemic or local). However, this patient did not respond to the systemic anti-inflammatory therapy and local physical therapy, and was not able to tolerate local injection. This case report have demonstrated that MTrP injection on certain selected satellite MTrPs could help for pain control on the origin (key) MTrPs near the site of injury, so that the patient was able to receive local steroid injection to the site of injury.

MTrP phenomena are the common results and primary pain problems of many different soft tissue lesions. RSD could be a manifestation of severe MTrP problem.[37] The pathogenesis of MTrPs is probably related to integrative mechanisms in the spinal cord in response to sensitized nerve fibers associated with abnormal endplates.[36,37] The evidences of spinal cord mechanism in the pathogenesis of referred pain[38-42] and
local twitch response[43-45] have been well documented.

When an MTrP is very active (or very severe), satellite MTrPs may develop following the distribution of the referred pain via spinal cord mechanisms.[37,46-48] Travell and Simons have illustrated the referred pain pattern for each individual muscle in the Trigger Point Manual.[12,14,15] Referred pain has been well recognized clinically, and its neurological mechanism has been documented.[38,41,48] There are silent (ineffective) synaptic connections in the dorsal horn.[39-41,48] A sensitized or hyperirritable receptive field of a sensory neuron may cause increased sensitivity and enlargement of preexisting but "sleeping" nociceptive receptive fields in other sites of the muscle or even in other muscles corresponding to other sensory neurons by "unmasking" the silent synaptic connections.[38,41] The afferent pain fibers from muscle nociceptors in the original receptive field have silent synaptic connections in the spinal cord to the sensory neurons of other receptive fields. When the original receptive field is sensitized, substance P and calcitonin gene-related peptide may be released in the site of dorsal horn neurons of the original receptive field and may diffuse into the neurons of the other receptive fields to activate the ineffective synaptic connection to become an effective connection.[41] This would explain the referred pain developed in the other receptive fields when the original receptive field is stimulated. For a severe active MTrP, the irritation in its receptive field is very strong and the threshold of other spinal neurons corresponding to other receptive fields may be reduced remarkably. Finally, spontaneous pain may occur in the sites of receptive fields of other sensory neurons. The expansion of receptive fields is caused by this "central sensitization" mechanism.[52] Through this mechanism, new MTrPs, or "satellite MTrPs", may develop in the referred zone of the original MTrP. The concept of key trigger point[29,30,46,51] or primary trigger point[14,15] has been described in the literature. The key MTrP is the original MTrP produced in response to an injury. However, if the original pathological lesion is not appropriately treated, MTrPs may spread out to the other sites of the body. It is also likely that these connections among the dorsal neurons may also influence the autonomic systems in the spinal cord so that RSD may develop in a severe case of MTrPs.

Treatment of a key MTrP may suppress satellite MTrPs.[29,30] When the threshold of sensory neurons is increased by treatment to the original MTrP, the threshold of other sensory neurons corresponding to the satellite MTrPs can also be increased. Similarly, effective treatment of a satellite MTrP in the referred zone of the key MTrP may also increase the pain threshold of other satellite MTrPs, or even the key MTrP, through the same spinal cord mechanism, since all these satellite MTrPs have certain connections with the key MTrP. It has been suggested that the distribution of the referred pain pattern is similar to the acupuncture meridians.[54,55]

The mechanism of MTrP injection is still uncertain. It has been demonstrated that there are multiple loci in an MTrP region.[29,30,46,51] When an MTrP locus is stimulated with sharp needle tip, pain, referred pain, or LTR can be elicited. The effectiveness of MTrP injection depends on the mechanical stimulation to these MTrP loci, but not the injected solution or medicine.[27,28,31] The occurrence of a LTR during MTrP injection indicates that an MTrP locus is encountered by the needle. It is possible that the formation of an MTrP locus is due to the formation of an MTrP circuit in the spinal cord.[44,55] The MTrP circuit can be temporarily inactivated when an LTR is elicited.[55]

The pathogenesis and the therapeutic responses of severe MTrPs in our patient can be well explained with the above mechanism. An original trauma to the right rotator cuff in this patient might activate latent MTrPs to become active MTrPs[37,46] in the shoulder girdle muscles to cause the initial shoulder pain. When the original traumatic lesion was re-injured before it was completely healed, or a new rotator cuff lesion developed from a re-injury, MTrPs in the shoulder might be exacerbated, and might spread out gradually. Inappropriate or excessive stretching during mobilization therapy might also cause persistent (unhealed) lesion in the rotator cuff. Gradually, shoulder MTrPs (key MTrPs) might spread out to the whole limb. The referred zone of the key MTrP of anterior deltoid muscle covers the areas of biceps and triceps muscles. According to this specific referred pain patterns, the satellite MTrPs induced by the original anterior deltoid MTrP might developed in the biceps or triceps muscles. Subsequently, MTrPs in the triceps might cause satellite MTrPs in the extensor carpi radialis muscles or other wrist-finger extensors (under the referred
zone of triceps MTrPs). Eventually, satellite MTrPs in the first dorsal interosseous might develop since this muscle was under the referred zone of MTrPs of extensor indicis. It was not unlikely that MTrPs in the whole upper limb might develop following the same mechanism. Finally, it might affect the autonomic system to develop RSD.

The MTrPs of the most distal muscle were usually the last ones to develop if the original key MTrPs were in the proximal portion of the limb, and thus might be the least sensitive (or least irritable) ones. This was the reason why the MTrP of the first dorsal interosseous muscle was selected for initial MTrP injection. Inactivation of the distal satellite MTrPs might reduce the activity of other satellite MTrPs. Similarly, the proximal MTrPs would be inactivated gradually following subsequent MTrP injection on other relatively more distal MTrPs.

Before the original etiological lesion (traumatic rotator cuff inflammation) was completely eliminated, the therapeutic effects of MTrP injection might be only temporarily. After local steroid injection to the right shoulder, the inflammation of the injured rotator cuff might be healing gradually, and thus all MTrPs became less and less active, and finally subsided completely.

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111-20.


以接續性肌筋膜激痛點注射來治療合併有反射性交感神經失調症之肌筋膜疼痛症候群的病患：病例報告

官大紳 洪章仁

國立成功大學醫學院復健學科 弘光技術學院物理治療學系

一位右肩遭受創傷性旋轉環帶撕裂傷的患者，在其右側上肢發展出嚴重的肌筋膜疼痛症候群、合併有反射性交感神經失調症。由於整個右上肢有嚴重的觸感痛，這位患者無法接受任何型式的徒手治療與針刺療法。她大約在受傷 2 個月之後，來到我們的疼痛門診。她接受了肌筋膜激痛點的注射療法，從右手中指背側骨間肌的激痛點注射開始，接著再注射右側手背與手指伸肌群、以及右側前三角肌的激痛點。此時觸感痛有顯著地降低，因此她接受了右側肩部關節與尖峰下滑囊的關節內藥物的注射。兩個禮拜之後，她已經可以使用她的右手來從事輕度的工作。隨後她又接受了右側肩胛部肌肉群的肌筋膜激痛點的注射，包括有三角肌、銅上肌、銅下肌和小圓肌的注射。在注射過後約 3 個月，她幾乎不再有疼痛的現象，並且右側肩部幾乎有完全的活動範圍。本文將討論肌筋膜激痛點的機轉，以及它與反射性交感神經失調症的相關性。（中華復健醫誌 2003; 31(3): 155-163）

關鍵詞：肌肉疼痛(muscle pain)，肌筋膜激痛點(myofascial trigger point)，反射性交感神經失調症(reflex sympathetic dystrophy)，激痛點注射(trigger point injection)