Myofascial Trigger Point Pain Syndromes

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Abstract

Myofascial pain syndromes caused by trigger points (TrPs) in muscle are a common cause of local and generalized pain. Trigger points are hyperirritable zones in contracted bands of muscle, thought to be caused by muscle overload or stress. Stress TrPs have characteristic electromyographic features, and can be visualized with ultrasound and magnetic resonance elastography. Trigger point needling or injection can be effective in inactivating TrP, but correcting triggers is also critical.

Keywords

- myofascial pain
- trigger points
- referred pain
- low back pain
- trigger point needling

Chronic widespread pain affects an estimated 10 to 15% of the population worldwide.[1] Myofascial pain, a type of musculoskeletal pain, is a very common type of both acute and chronic pain, and is surprisingly often overlooked. Myofascial pain was found in up to 85% of patients in a U.S. pain clinic.[2] The lifetime prevalence of myofascial pain is estimated at 85%.[3] Myofascial pain may be unrecognized because the presenting symptoms are often headache, neck and shoulder pain, pelvic pain, limb pain, or neural pain syndromes, although each specific pain syndrome may have a significant myofascial trigger point comorbidity.

Myofascial Pain

The term *myofascial pain*, denoting pain coming from myofascial (muscle) TrPs, was popularized by Travell and Simons.[4] They emphasized the concept of pain arising from specific small, hardened, tender regions in muscle identifiable by palpation. They called these hardened and tender spots *trigger points*. Their revolutionary concept was that pain caused by TrPs could be manifest at a distance from the TrP, which is termed *referred pain*, the principal mechanism by which myofascial TrP pain is manifest clinically. There is still controversy as to the relevance of TrPs.[5]

Trigger Characteristics

The TrP, the focal pain generator in muscle, is a contracted band of muscle that is exquisitely tender to palpation. The TrP is a peripheral nociceptor, capable of inducing peripheral and central sensitization and referred pain.[6] It is identifiable by palpation (see the Diagnosis section), but the contracted taut band can be visualized as a hypoechoic region by ultrasound (US)[7,8] and is a zone of relative ischemia. Pathological descriptions of a TrP are lacking. Trigger points have an electromyographic signature termed *SEA* (spontaneous electrical activity) or endplate noise, which is persistent, fast, low-amplitude (950 UV or less) activity with less frequent, high-amplitude discharges of approximately 600 UV.[9] The extracellular fluid at the TrP site is acidic with a pH of 4 to 5, and contains an accumulation of neurotransmitters and cytokines.[10] Thus, the TrP is an anomaly in skeletal muscle with characteristic imaging, electrophysiologic, vascular, and biochemical features. Trigger points are also modulated by the sympathetic nervous system (SNS),[11] making TrPs clinically susceptible to states in which the SNS is activated, such as anxiety and stress. Two good resources for pressure points can be found in the *Pressure Pointer Manual* (http://www.pressurepointer.com/PressurePointerManual.pdf.) and in a YouTube video available at https://www.youtube.com/watch?v=sltGyJvbvWw.

Referred Pain

Trigger points that are clinically relevant causes of pain are spontaneously painful and tender to palpation. Spontaneously painful TrPs are termed *active*, whereas TrPs that are tender only when palpated, but are not a cause of spontaneous pain, are termed *latent.* Nonpainful, latent, TrPs are not truly inactive, however. They have a host of abnormal effects, including disordered pattern of muscle recruitment,[12] facilitation of referred effects such as muscle cramps,[13] and altering electrical

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activity of distant muscles.[14] Treatment of latent TrPs can be clinically beneficial.[15] However, all TrPs, both active and latent, have remote effects. The most evident indication of this is the presence of pain at a distance from the TrP. Thus, TrP in the infraspinatus muscle can cause pain in the anterior shoulder and down the arm, simulating a cervical radiculopathy. A TrP in the sternocleidomastoid muscle can cause headache pain. A rectus abdominis muscle TrP can cause back pain. This referred pain is mediated through sensitized peripheral and central nervous system (CNS) mechanisms.[16,17]

Referred pain from TrPs is a critical concept because many of the pain syndromes present as referred pain syndromes, requiring an awareness of TrP referred pain patterns and careful examination of muscles for TrPs to identify the origin of a particular pain complaint, like hip pain, knee pain, or frozen shoulder pain. For example, TrPs in many of the shoulder girdle muscles refer pain into the neck, shoulder, and down the arm, simulating radicular pain syndromes.

Nerve entrapment is another mechanism of TrP-related pain. A familiar example of this is piriformis muscle syndrome, in which the sciatic nerve, usually the peroneal nerve fibers, are entrapped. Other examples of nerve entrapment by a TrP are the pronator teres syndrome of median nerve entrapment, and the radial tunnel syndrome that entraps the posterior interosseus nerve by a supinator muscle TrP.

Diagnosis

The easiest and most efficient way to diagnose myofascial pain syndrome caused by a TrP is by manual palpation of the muscle. The muscle is placed in a neutral or intermediate position, neither shortened nor elongated. The index and long finger pads (see ►**Fig. 1**) are used to palpate, perhaps against underlying bony surfaces, like the scapula in the case of the infraspinatus muscle or against the innominate bone in the case of the gluteus medius and minimus muscles (flat palpation). Muscles that do not overlie bone are palpated by rolling the muscle between the thumb and the fingers, as in the case of the sternocleidomastoid muscle (pincer palpation). In both flat and pincer palpation, the object is to identify contracted (i.e., hardened) bands within the muscle. Muscle must be palpated perpendicular to the direction of muscle fibers. Therefore, it is important to know the fiber direction of the muscles to be treated. The examiner moves his or her fingers along the hardened, taut band to locate the area of greatest firmness. This is usually the area of greatest tenderness. Up to this point, the finding is objective: The examiner can identify the abnormal band in muscle without the patient's input. The patient is asked to report pain associated with palpation. Active and latent TrPs will both be painful to palpation, but an active TrP will produce pain that is familiar to the patient. Attempts have been made to objectify the diagnosis, but they have largely been relegated to the research realm. These include electromyography and diagnostic ultrasound, although the latter is beginning to be used clinically to identify TrPs and to guide treatment.[18] Magnetic resonance elastography also defines myofascial contracted, taut bands,[19] but is not of practical clinical use.

Predisposing Factors

Myofascial TrPs are considered to be the result of muscle overuse such as acute or chronic mechanical stress and metabolic stress, although the evidence is circumstantial.[20] Factors thought to be associated with TrP formation are listed in ►**Table 1**.

Treatment

The treatment of myofascial TrP pain syndromes involves inactivating the TrPs and addressing the predisposing factors to prevent recurrence.

Trigger Point Inactivation

Both the manual inactivation and the invasive inactivation of TrP are effective treatments. Most studies have been done of TrP injections with local anesthetic or with TrP inactivation by needling without injection, so-called deep dry needling. Recent studies have demonstrated the effectiveness of each needling technique, both injection and deep dry needling. Earlier reviews of invasive treatments concluded that the evidence was inadequate to make a recommendation,[21] but recent reviews have

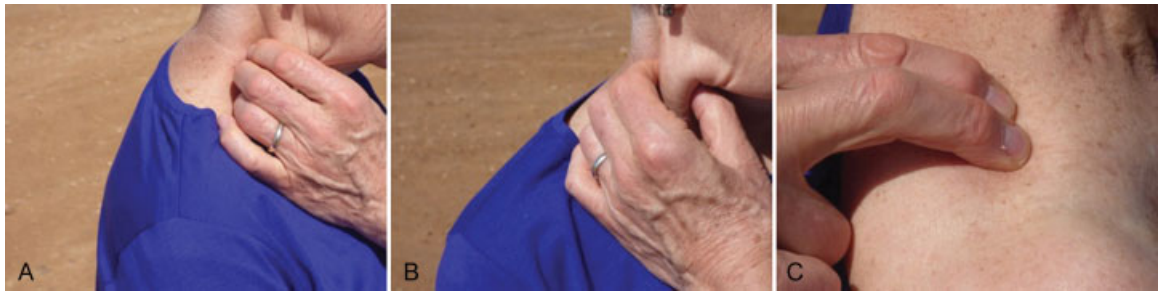

Fig. 1 (**A, B**) Pincer palpation: Pincer palpation allows the muscle to be rolled between the thumb and the index and long fingers (and sometimes the ring finger) for muscles that can be grasped between the fingers, as the sternocleidomastoid muscle (shown). Flat palpation (**C**) is used for muscles that cannot be grasped between the fingers, but that can be palpated against a relatively firm surface, like the trapezius muscle (shown). In both cases, pincer palpation and flat palpation, the fingers move across the muscle perpendicular to the fiber direction, to detect a taut or hard band of muscle, to identify a zone of tenderness in the taut band, and by applying gentle to moderate pressure for 5 to 10 seconds, elicit referred pain if present. The patient is asked during the examination if there is pain produced by palpation, and if it is recognized as a pain that the patient has spontaneously experienced.

Table 1 Etiologic factors associated with trigger point syndromes

Mechanical provocative factors
Scoliosis
Leg-length inequality
Spondylosis
Joint osteoarthritis
Postsurgical joint replacement
Work-related mechanical stress
Repetitive strain injury (e.g., keyboard work)
Postural work-related mechanical stress
Hypermobility syndromes (Ehlers-Danlos syndrome)
Metabolic provocative factors
Hypometabolic states (e.g., hypothyroidism)
Iron deficiency
Vitamin deficiency
Vitamin D
Vitamin B12
Infectious diseases
Lyme disease
Candida vaginal yeast infection
Nerve compression (e.g., radiculopathy, entrapment)

concluded that TrP injection and deep dry needling are effective therapies.[22,23] Trigger points tend to re-form after treatment; however, repeated treatment is effective, as neuroplastic changes reverse and central sensitization subsides, resulting in less frequent and less intense pain.

The factors that predispose to TrP formation must be addressed to prevent recurrence. Thus, careful medical, work, and dietary histories must be taken to identify factors such as those listed in ►**Table 1**. Workplace mechanics must be evaluated and improved to make the workplace ergonomically suitable. Psychological stresses that drive trigger point formation must also be assessed and addressed. When prevention is added to the treatment program, long-term resolution of myofascial TrP pain is possible.

Specific Myofascial Pain Syndromes

Myofascial pain generally presents as specific pain syndromes, but can present as generalized pain or fibromyalgia.[24]

Nerve Entrapment

Nerve entrapment can result from compression of the peripheral nerve by contracted bands of muscle, as in piriformis syndrome,[25] or as a consequence of shortened, contracted muscle bands, as in myogenic thoracic outlet syndrome. In myogenic thoracic outlet syndrome, shortening of the scalene muscles by a TrP elevates the mobile first rib, compressing the neurovascular bundle between the first rib and the clavicle. Direct compression of nerve roots in the interscalene compartment by the scalene muscles is facilitated in part by the increase in the cross-sectional diameter of the shortened scalene muscles. Similarly, the shortened, but widened piriformis muscle compresses the sciatic nerve against the sciatic notch. Other entrapment syndromes caused by TrPs are occipital neuralgia and meralgia paresthetica. Treatment of the TrP can alleviate the nerve entrapment.

Fibromyalgia

Chronic widespread pain associated with sleep disturbance and with multiple comorbidities such as temporomandibular joint dysfunction, migraine headache, or irritable bladder/irritable bowel syndrome, is commonly termed *fibromyalgia*. It has been attributed to a CNS disorder of the descending nociceptive inhibitory system, although increased activity of central facilitatory pathways may also play a part.[26] However, in recent years, widespread referred pain from TrPs has been identified as an important component of fibromyalgia pain,[27,28] emphasizing the role of peripheral nociceptors input in fibromyalgia and providing another potential therapeutic approach to the management of this condition.

Headache

The contribution of myofascial TrP pain has been well studied in both migraine and chronic tension-type headache. The mechanism that is operative in both types of headaches is CNS sensitization and referred pain. In a migraine headache, a TrP acts as one type of trigger that activates the trigeminovascular cascade implicated in migraine genesis, and also causes pain directly by the mechanism of referred pain. The treatment of muscle triggers in the neck and shoulder muscles has been shown to reduce headache acutely[29] and to reduce headache frequency and intensity over several months,[30] in addition to reducing hypersensitivity and allodynia at both the local pain region in the neck or shoulder and at the site of referred pain in the head. Trigger point activation in the neck and shoulders can reproduce headache, and treatment of the TrPs can alleviate headache. The muscles most commonly involved are the sternocleidomastoid, the upper trapezius in the shoulder, the oblique capitis inferior, and the splenii (capitis and cervicis) muscles in the neck.

Frozen Shoulder

This complicates a rotator cuff tear, brachial plexopathies, osteoarthritis, and very importantly, stroke rehabilitation. The diagnosis of adhesive capsulitis is often made when the real problem is muscular. Trigger points in the shoulder region muscle restrict movement of the shoulder and create pain on movement and at rest. The key muscle that must be examined is the subscapularis muscle. Release of this muscle alone can do much to restore painless range of motion to the shoulder. Additional muscles that harbor TrPs compromising shoulder function include the infraspinatus, supraspinatus, levator scapulae, latissimus dorsi, teres major, and the trapezius muscles. Dry needling of the shoulder muscles has been shown to relieve pain and improve function.[31,32]

Low Back Pain

Low back pain is arguably the most common cause of disability. Muscle tissue can be the primary source of low back pain or a comorbid cause of pain, accompanying spondylosis, spondylolisthesis, radiculopathy, and degenerative disk disease. Myofascial TrPs develop in these conditions possibly as the result of muscular stress occasioned by the underlying condition. In nonspecific low back pain as well as in the specific conditions mentioned above, a TrP can be a significant cause of low back pain.[33] The key to understanding low back pain caused by a TrP is knowing that TrP pain can be referred from distant sites. Trigger points in the superficial erector spinae longissimus thoracis and iliocostalis muscles, as well as those in the deep lumbar multifidi muscles, produce both local pain and pain that is referred distally, usually caudally. Pain can be referred from dorsal paraspinal TrPs to the ventral abdomen, especially in the region of the rectus abdominis muscle. Deep psoas muscle TrPs refer pain to the low back and often to the ipsilateral groin and thigh. Ventral TrP in the abdominal muscles can also refer pain to the low back. These sources of pain must be considered when pain seems to be enigmatic, and when appropriate therapy of other conditions that cause low back pain have failed to provide relief. Myofascial TrPs can also accompany psychological stresses that result in low back pain as well as neck pain. Trigger points in the muscles that cause low back pain can be treated manually or by needling with or without injection. There are no adequate studies of TrP needling or injection of nonspecific low back pain, and the most recent review was inconclusive.[34] Radicular pain may also present as TrP pain before nerve impairment such as paresthesias, dysesthesias, or weakness is seen. Inactivation of the TrPs can relieve pain in patients with radicular pain sydromes,[35] but will not improve the root compression.

Knee Pain

Knee pain is a common problem, comorbid with osteoarthritis and with degenerative and traumatic tears of cartilage in the knee. Trigger points in the vastus medialis head of the quadriceps refer pain to the medial aspect of the knee, whereas those in the vastus lateralis refer pain to the lateral aspect of the knee; TrPs in the rectus femoris refer pain to the knee in general. Post-total knee-replacement-restricted range of motion can be improved rapidly by inactivating TrPs in the quadriceps muscle. An elegant randomized, placebo-controlled trial clearly established that treatment of TrPs immediately before total knee replacement significantly shortened the time to achieving pain relief after surgery.[36]

Conclusion

Myofascial TrPs are a cause of local and referred pain. They can cause local or generalized pain that is acute or chronic. Referred pain from a TrP can mimic other pain syndromes and often makes diagnosis difficult. The treatment of myofascial pain syndromes requires both the inactivation of the TrP and the correction of underlying precipitating causes. Trigger points needling, both a TrP injection and deep dry needling, is effective in inactivating a TrP.

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