Myofascial Pain Syndrome Treatments

Joanne Borg-Stein, MD*, Mary Alexis Iaccarino, MD

KEYWORDS

• Myofascial pain syndrome • Regional muscle pain • Treatment
• Myofascial trigger points • Pharmacotherapy

KEY POINTS

- Myofascial pain syndrome is a painful condition arising from myofascial trigger points.
- Treatment of myofascial pain syndrome consists of pharmacologic and nonpharmacologic interventions.
- Exercise and education are the mainstay treatments for all patients.
- Medications, physical modalities, dry needling, and trigger point injection are adjunct therapies that are appropriate in some patient subsets to treat myofascial pain and associated symptoms.

INTRODUCTION

Myofascial pain syndrome (MPS) is a painful condition of myofascial trigger points (MTrPs) in the skeletal muscle.[1] It can occur alone or in combination with other pain generators. MTrPs are focal areas of taut bands found in skeletal muscle that are hypersensitive to palpation. When manual pressure is applied over an MTrP, it produces a distinct local and referred pain that is consistent with the patient's presenting pain symptoms.[2] MPS is often grouped with other pain syndromes; however, it is distinct from diagnoses such as fibromyalgia in that it is focal, does not require multiple pain generators, and involves a taut band in skeletal muscle.[3]

EPIDEMIOLOGY

The prevalence of myofascial pain varies in the general population. In internal medicine and orthopedics clinics, the estimated prevalence is 21% to 30%. In a nationwide German study of more than 300 physicians experienced in treating patients with pain, 46% of patients had active MTrPs.[4] In other specialty pain clinics, estimates as high as 85% to 90% have been reported.[5] Unlike other chronic pain

Department of Physical Medicine and Rehabilitation, Harvard Medical School, 300 First Avenue, Boston, MA 02129, USA
* Corresponding author.
E-mail address: jborgstein@partners.org

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disorders, which are more prevalent in women, men and women are equally affected by MPS. However, studies in nationalized health care systems have found women to be more limited by musculoskeletal pain, with higher pain scores and more frequent absence from work.[6]

CLINICAL PRESENTATION

For a detailed review of clinical presentation, the reader is referred to the article on MPS diagnosis elsewhere in this issue by Dr Gerwin. Topics relevant to determining appropriate treatment of myofascial pain are discussed here.

MPS can be of insidious onset or occur as a result of trauma or injury. Patients complain of varying degrees of pain from mild to severe, characterized as deep and aching. Pain is focal and can have discrete referral patterns, which can help identify the muscle that contains the causative MTrP.[1] Patients may report associated autonomic dysfunction. Diaphoresis, lacrimation, flushing, dermatographia, pilomotor activity, and temperature change are common in MPS.[7] Cervical myofascial pain has been associated with vestibular symptoms, such as dizziness, blurred vision, and tinnitus.[8] Hyperesthesia, numbness, tingling, and twitching may occur if nearby nerves are irritated by the MTrPs. Decreased work tolerance, muscle fatigue, weakness, and other functional complaints may be present, and over time, mood and sleep disturbance can develop.[9–11] Eliciting associated symptoms and assessing their degree of impact on the patient is helpful in guiding treatment strategies.

Physical examination aids diagnosis and may guide treatment, particularly if local trigger point therapy is being considered. A thorough medical, neurologic, and musculoskeletal examination should be performed. Myofascial pain can be caused by postural stress, muscle imbalance, and repetitive overuse. Therefore biomechanics, joint function, and posture should be evaluated to assess their contribution.[12] Myofascial pain is associated with restricted range of motion. Muscles around the restricted area should be palpated for active MTrPs. To identify MTrPs, the examiner applies gentle pressure perpendicular to the muscle fibers. A taut band should be palpable, and direct pressure should produce significant pain, which reproduces the patient's local and referred symptoms.[12]

Laboratory studies may be useful to exclude systemic diagnoses, particularly when the clinical presentation is not definitive. In MPS, blood counts, chemistry and liver panel, erythrocyte sedimentation rate, and C-reactive protein levels are normal. A thyroid panel may be used to exclude thyroid disease as a cause of muscle pain. Radiography and advanced imaging may show concurrent osteoarthritis, diskogenic disease, neural irritation, and other mechanical changes. The relevance of these findings must be determined in individual cases based on the clinical scenario.

DIFFERENTIAL DIAGNOSIS

MPS and other muscle pain diagnoses can have overlapping and related symptoms. MTrPs occur insidiously or secondary to mechanical dysfunction and other disease states. Determining both primary and secondary causes of myofascial pain helps formulate a treatment plan. The following are questions that may aid clinicians in identifying contributing factors.

- Is there regional myofascial pain with trigger points present?
- Is myofascial pain the primary pain generator or are there other coexisting or underlying structural diagnoses?

- Is there a nutritional, metabolic, psychological, visceral, or inflammatory disorder contributing to the myofascial pain?
- Is there widespread pain that does not resemble the pattern associated with regional myofascial pain?

Table 1 provides a list of common differential diagnoses for myofascial pain. This list is not exhaustive. For a list of differential diagnoses by region of pain, please refer to the article on diagnosis of MPS elsewhere in this issue.

In difficult-to-treat cases with refractory pain symptoms, consider MPS when other diagnoses have been exhausted. In the literature, MPS has had uncommon presentations. It has been implicated in patients with chronic unilateral shoulder pain, lateral epicondylalgia, and chronic tension-type headache.[13–15] It has been found concurrently in the affected limb in patients with complex regional pain syndrome.[16] In a review of pelvic pain, symptoms of dysuria, dyspareunia, dyschezia, constipation, and

Table 1
Differential diagnosis for MPS

Joint disorders	Zygapophyseal joint disorders Osteoarthritis Loss of normal joint motion
Inflammatory disorders	Polymyositis Polymyalgia rheumatica Rheumatoid arthritis
Neurologic disorders	Radiculopathy Entrapment neuropathy Metabolic myopathy
Regional soft tissue disorders	Bursitis Epicondylitis Tendonitis Cumulative trauma
Diskogenic disorders	Degenerative disk disease Annular tears Disk protrusion or herniation
Visceral referred pain	Gastrointestinal Cardiac Pulmonary Renal
Mechanical stress	Postural dysfunction Scoliosis Leg length discrepancy
Nutritional, metabolic, and endocrine disorders	Vitamin deficiency (B_1, B_{12}, D, calcium, folic acid, iron, magnesium) Alcoholic and toxic myopathy Hypothyroidism
Psychological disorders	Depression Anxiety Disordered sleep
Infectious disease	Viral illness Chronic hepatitis Bacterial or viral myositis
Widespread chronic pain	Fibromyalgia

From Borg-Stein J. Treatment of fibromyalgia, myofascial pain, and related disorders. Phys Med Rehabil Clin N Am 2006;17(2):491–510, viii; with permission.

testicular pain can be presenting symptoms of pelvic floor myofascial pain.[17] In a study of patients with suspected carpal tunnel syndrome, approximately one-third were found to have infraspinatus trigger points and normal nerve conduction studies, suggesting that MPS may mimic or be concurrent with carpal tunnel syndrome.[18] Postoperative myofascial pain after thoracotomy and mastectomy has also been described.[19–22]

TREATMENT OF MPS

Treatment of MPS targets MTrPs and aims to correct the structural and mechanical imbalance that prompted MTrP formation. Treatment should also address sympathetic dysfunction, identify emotional stressors, and treat late complications. The following is a discussion of therapeutic interventions for MPS. Education, pharmacotherapy, local needle therapy, and exercise serve to reduce pain and associated symptoms. Most often a combination of therapies is used simultaneously or in sequence and appropriate initial therapy is patient and provider dependent.

EDUCATION

- Based on the patient's symptoms and pain characteristics, a firm diagnosis of MPS should be made.
- Build rapport with the patient by approaching them with an attitude of empathy and understanding. Validate their concerns and reassure them that their symptoms are real and not psychogenic.
- In difficult-to-treat or refractory cases of pain, the patient may have had other diagnoses. The patient should be educated on the symptoms of MPS, and explanation should be provided as to why other diagnoses are less likely.
- Unnecessary tests should be avoided.
- Probable mechanisms of pain should be discussed in simple terms, emphasizing that the muscle pain associated with MPS is not dangerous and does not cause tissue damage.
- Inquire about associated symptoms.
- Determine what is most aggravating to the patient: intolerance to pain, loss of function, lack of sleep, or fear of underlying structural or catastrophic disease. Associated symptoms vary from patient to patient but help guide individual management.
- Educate the patient on each proposed modality of treatment: pharmacotherapy, manual modalities such as osteopathy or manual release, and injection.
- Recognize and address underlying psychosocial factors, such as depression, anxiety, stress at home or work, and poor coping skills.
- Educate the patient that psychological factors exacerbate pain. A few patients may require referral to mental health providers.
- Educate patients on the importance of restful sleep, cardiovascular fitness, and body mechanics to overall lifestyle.
- Promote behavioral modification through education, including cognitive behavioral techniques.

PHARMACOLOGIC MANAGEMENT

The pathophysiology of MPS is not completely understood. However, it is believed that there are local muscle, peripheral nerve, and central nervous system components. Therefore, medications that target each of these areas may be effective in treating

MPS. For each medication, it is important to consider mechanism of action and side effect profile, which is discussed in the addendum, in the context of individual patients. The adage of starting at a low dose and slowly increasing is important to patient tolerance and compliance. The side effect profile of medications is outlined in the article on side effects of commonly prescribed analgesic medications elsewhere in this issue.

Nonsteroidal Antiinflammatory Drugs

There is a paucity of literature on the use of oral nonsteroidal antiinflammatory drugs (NSAIDs) for MPS. Several studies show effectiveness for chronic pain and fibromyalgia in combination with other medications such as diazepam, alprazolam, cyclobenzaprine, and amitriptyline, but little is known on the efficacy of oral NSAIDs in MPS.[23–26] Topical NSAIDs have been shown to be useful in MPS. In general, they have fewer systemic side effects than oral NSAIDs but are often more expensive.[27] A study of diclofenac patch use in patients with upper trapezius myofascial pain found a significant reduction in pain based on visual analog scale, neck range of motion, and cervical disability index.[28] Despite limited evidence, NSAIDs are often part of MPS treatment because they are readily available and many patients are comfortable using them without physician input. Until further evidence is offered, providers should inquire about frequency of patient use, advise on the common side effects, monitor use in patients who find it helpful, and encourage discontinued use for those who find it ineffective.

Muscle Relaxants

Muscle relaxants are a group of drugs with varying pharmacology that act on the central nervous system to disrupt nociceptive pain.[29]

Cyclobenzaprine targets muscle relaxation without affecting muscle function. Its mechanism of action is not known, but its structure is similar to that of a tricyclic antidepressant. It is often used for both pain relief and sleep, because it has a sedating effect. In 41 patients with myofascial jaw pain, cyclobenzaprine was slightly better than clonazepam or placebo in pain relief but not more effective at improving sleep.[30] A Cochrane review in 2009[31] found that because of insufficient studies, there is not enough evidence to support its use in MPS. However, cyclobenzaprine is commonly prescribed for musculoskeletal pain and is well tolerated. In MPS, prescribing this medication at night can provide analgesia and promote sleep.

Tizanidine, an α_2-adrenergic agonist, acts centrally at the level of the spinal cord to inhibit spinal polysynaptic pathways and reduce the release of substance P.[32] Studies in animal models show that, in the thalamus, it reduces the release of neurotransmitters in ascending pathways involved in central sensitization.[33,34] In a prospective study of 29 women with MPS treated with tizanidine for 5 weeks,[35] pain, sleep, and disability all significantly improved. Tizanidine has a sedating effect and can cause hypotension, therefore dosing at night may limit noticeable side effects and aid sleep. This medication is also used for spasticity, with doses titrated up to 36 mg daily. In MPS, available studies have used lower doses of tizanidine with success.[36,37]

Benzodiazepines

Clonazepam and diazepam are benzodiazepine derivatives with multiple applications as anxiolytics, anticonvulsants, and muscle relaxants and are used in the treatment of MPS.[38] Most studies of MPS treatment with benzodiazepines were performed in a subset of patients with orofacial and temporomandibular pain.[26] In 2000, an open trial of clonazepam in patients with MPS from a multidisciplinary pain facility found a

significant reduction in visual analog scale pain scores. However, of 46 participants, about 20% dropped out of the study because of intolerable side effects before reaching an effective dose.[39] The success of benzodiazepines on MPS may be targeting not only pain but also commonly associated symptoms, including muscle tension, anxiety, restless leg syndrome, and sleep disturbance. However, disadvantages to their use include a potent side effect profile, including ataxia, weakness, cognitive impairment, memory dysfunction, fatigue, depression, and adverse withdrawal symptoms.[29,40]

Serotonin and Norepinephrine Selective Reuptake Inhibitors and Tricyclic Antidepressants

There is an increasing role for antidepressants in the treatment of chronic pain, including tricyclic antidepressants, selective serotonin reuptake inhibitors (SSRIs), and serotonin norepinephrine reuptake inhibitors (SNRIs). Trials examining chronic tension headache and myofascial pain found amitriptyline to be effective for many patients.[41,42] A systematic review by Annaswamy and colleagues[43] supported the use of amitriptyline in some MPS conditions. Fewer studies have assessed the efficacy of nortriptyline.

An increasing body of evidence exists for the use of SSRIs and SNRIs in the treatment of fibromyalgia and other pain disorders.[44–46] There is little research on their use in regional muscle pain, such as MPS. However, these agents, particularly SNRIs, are used to treat regional myofascial pain. The rationale for their use stems from the fact that regional and widespread muscle pain have some overlap in signs and symptoms and approach to treatment. Thus, extrapolating from the chronic pain literature, SSRIs and SNRIs may be beneficial adjuvant pharmacotherapy. Should patients show signs and symptoms of mood disturbance in combination with MPS, antidepressant therapy may be warranted along with referral to a mental health professional.[47]

Tramadol

Tramadol is a weak opioid agonist and inhibits reuptake of serotonin and norepinephrine in the dorsal horns of the spinal cord. There are no published studies to support the use of tramadol in myofascial pain. However, several studies support its use in chronic widespread pain, chronic low back pain, and osteoarthritis, which are commonly associated with regional MPS.[48–51]

Lidocaine Patch

The lidocaine patch is a transdermal application of a local anesthetic with effective local penetration and limited systemic absorption. It has been proposed as an alternative treatment to needle injection of local anesthetics in patients with hypersensitivity associated with MPS. In a randomized control study, the lidocaine patch was effective in treatment of MPS. It did not generate as great a pain reduction score as needle infiltration, but patients were satisfied with its analgesic effect, and its use was associated with less discomfort than needle infiltration.[52]

Over-the-Counter Agents

There are a surplus of over-the-counter or nonprescription topical agents that are recommended for joint and muscle pain. Many of these products, such as Biofreeze, Salonpas, Icyhot, Tiger Balm, and others, use the active ingredient methyl salicylate or menthol to create a cool or warm sensation that dulls pain. Although published evidence for their use in myofascial pain is limited, some patients find that these medications have an analgesic effect. They can be used in combination with oral medications,

although they should not be mixed or coadministered with other topical agents. In general, they are well tolerated and have minimal side effects.

NONPHARMACOLOGIC MANAGEMENT

Exercise for Myofascial Pain

Exercise is one of the most important aspects of rehabilitation and management of musculoskeletal pain. It helps to improve flexibility, increase functional status, optimize mood, and reduce pain.

Initiating a stretching exercise program is fundamental in MPS treatment. Stretching lengthens the tight bands of skeletal muscle that have become shortened and are causing pain. Stretching improves joint range of motion, leading to decreased pain, increased mobility, and restoration of normal activity. After optimal muscle length is restored and pain is reduced, adding strengthening to the exercise program can help establish new movement patterns and increase muscle endurance.[1] This goal can be achieved with the assistance of physical therapy to strengthen weak muscle groups, correct posture, and provide feedback so as not to overuse dominant muscle groups. For example, overuse of the upper trapezius and levator scapulae for shoulder motion can be corrected by stretching of the overactive muscles, and strengthening of scapular stabilizers, such as latissimus dorsi, rhomboids, and the lower trapezius. Patients should be encouraged to maintain an active lifestyle and incorporate a cardiovascular and aerobic fitness program into their routine. Educating patients on manual techniques, exercises, and stretches that relieve pain empowers patients to self-manage symptoms and effectively move from formal physical therapy to a home exercise program.[53] As pain relief improves, patients can resume normal activity, which improves function and prevents recurrence of MTrPs.

For some patients, the pain associated with MPS may preclude an effective exercise program, and other treatments, such as trigger point injection (TPI), may be required first. However, exercise should be incorporated into the treatment plan for all patients with MPS. Clinical experience suggests that leaving a muscle in a shortened position aggravates MTrPs and prevents resolution of symptoms.[2]

Postural, Mechanical, and Ergonomic Modifications

In occupational health and ergonomics research, there is evidence that repetitive loads in undesirable positions cause muscle pain and predispose workers to injury.[54–57] Theoretically, the overused or poorly conditioned muscle develops microtrauma and myofascial shortening, placing the muscle at risk of MTrP formation. Based on this theory, it is standard clinical practice to recommend correction of postural and ergonomic abnormalities.[58] Incorporating postural training for workers[59] and patients with temporomandibular joint pain has led to improvement in pain symptoms.[60] However, there are limited long-term efficacy data to support postural change as an effective treatment of myofascial pain. Nevertheless, in occupation-related injury or a situation in which a specific repetitive or strenuous task cannot be avoided, ergonomic modifications to correct abnormal postures are encouraged.

Stress Reduction

There are many types of interventions to reduce stress in MPS, including cognitive behavioral therapy (CBT), mediation and relaxation training, and biofeedback (**Table 2**). It is theorized that autonomic innervation to muscles may provide a link between stress and muscle pain. Thus, strategies to reduce emotional and physical stress may aid in treatment of MPS. McNulty and colleagues[61] found a higher increase

Table 2 Stress reduction interventions	
CBT	A psychotherapy technique that facilitates behavior change by altering patients' beliefs or thought patterns
Meditation	Encompasses a variety of practice all with the similar goal of facilitating a sense of personal well-being or relaxation
Biofeedback	Any technique or device that increases awareness of physiologic changes in the body to improve emotions or change behavior

in needle electromyographic activity in trapezius MTrPs than in other areas of the muscle during psychological stress. A small study of patients with myofascial jaw pain found stress reduction intervention to be as effective as transcutaneous electrical nerve stimulation (TENS).[62] A randomized control trial of 3 months of CBT in chronic temporomandibular joint pain found improvements in pain, function, and activity after 1 year.[63] Stress reduction methods have also been shown to treat chronic pain, such as fibromyalgia.[64–66] Extrapolating from the fibromyalgia literature and incorporating the few studies on regional myofascial pain, stress reduction techniques and behavioral medicine may be useful adjunct therapies. However, further research would help to validate this intervention in the treatment of MPS.

Acupuncture

Acupuncture has been shown to be effective in treating myofascial pain.[67–72] In 2 Cochrane systematic reviews, acupuncture showed short-term benefit in mechanical neck pain and chronic low back pain when compared with sham acupuncture or no treatment.[67,68] Birch and Jamison[69] found that acupuncture alone over painful areas in the neck had better outcomes than NSAID treatment combined with acupuncture over nonpainful areas.

There are still several clinical questions about acupuncture that are unanswered, including number of needles used, duration of effect, and the mechanism by which it produces an antinociceptive effect. There is a close relationship between acupuncture points and trigger points, making the distinction between treatment with dry needling of MTrPs and local acupuncture more difficult to differentiate.[73] Overall, there is some evidence for the use of acupuncture as an adjunctive therapy for MPS, but further research is needed to determine treatment course and specific needling procedure.

Massage, Electrotherapy, and Ultrasonography

Massage is often sought as an alternative therapy for MPS. Anecdotal evidence and small clinic studies report it as an effective treatment; however, large vigorous trials are lacking. Two studies have found that combined with stretching, massage is helpful in reducing pain intensity and number of MTrPs.[74,75]

Several electrotherapies have been investigated for pain reduction of MTrPs, including TENS, electrical muscle stimulation (EMS), frequency-modulated neural stimulation (FREMS), and electrical twitch-obtaining intramuscular stimulation (ETOIMS). Compared with EMS or placebo, TENS has been found to be superior in pain reduction.[76–78] However, its effects seem limited to immediately after treatment, with 1 study finding no reduction in symptoms at 1 and 3 months after treatment.[78] In comparison, FREMS is shown to be as effective as TENS for myofascial pain, and its effect persisted at 3 months, whereas the TENS group did not.[79] ETOIMS, an

emerging electrotherapy technique, acts on deep motor end plates to produce a muscle twitch. It has been used in MPS, but there are few studies and limited evidence on pain reduction.[80–82]

Ultrasound applies mechanical and thermal energy to tissue, and is believed to increase circulation, improve metabolism, and increase tissue pliability. Several studies have found that ultrasound alone, or in combination with exercise, improves pain in MPS.[75,83–85] Ay and colleagues[85] conducted a blinded randomized controlled trial, in which ultrasound was found to improve pain and number of MTrPs better than sham ultrasound. This study also found ultrasound alone to be as effective as ultrasound with diclofenac. Other studies of heat and antiinflammatory use with ultrasound have reported positive effect on pain in MPS.[86,87] In conclusion, ultrasound can be an effective adjunct therapy for MPS, and some patients may benefit from the addition of heat or antiinflammatory medication with ultrasound.

NEEDLING THERAPY

The regional pain associated with MPS stems from tight bands in the muscle called MTrPs. Dry needling and TPI are treatments that directly target MTrPs. Ordinarily, stretching and exercise are the foundation for pain reduction in MPS, but in the case of persistent MTrPs, providers can offer needling therapy.[88] Dry needling or TPI are most effective when they are accompanied by manual release of MTrPs and stretching that patients can perform themselves or with physical therapy.[89]

When needle therapy is necessary, it can be performed weekly over a series of several visits. At each visit, the amount of improvement and location of trigger points should be evaluated and compared with previous visits. When needling is used in combination with other therapies, some patients may find significant relief after only a few visits, whereas others may have recalcitrant areas that require more treatment. In general, TPI is performed as a series of injections. Patients need to be educated that there may be local soreness after injection, which should resolve, and that several treatments may be needed before results are noticeable.[3]

The hallmark of needling therapy is the production of a local twitch response in the targeted muscle. It is theorized that the needle mechanically disrupts and stops the dysfunctional activity of the motor end plate of the skeletal muscle motor neuron. Hong[90] described a fast-in–fast-out needling technique, which may be beneficial in eliciting maximal number of local twitch responses. In this technique, the needle penetrates the taut muscle band, is withdrawn to the superficial tissue, and then redirected to another area without coming out of the skin. Anesthetic can be injected when a twitch response is felt.

Dry needling is a low-risk intervention that is minimally invasive and inexpensive but requires training to achieve competence.[91,92] A prospective double-blind randomized controlled trial of 39 patients with MPS in an outpatient clinic found dry needling of MTrPs significantly reduced pain compared with sham dry needling.[93] A recent meta-analysis of dry needling in MPS found 3 studies in which dry needling improved pain in the cervicothoracic region both immediately and 4 weeks after treatment.[94]

Dry needling can be performed either superficially or deep. The technique of superficial dry needling is believed to deactivate MTrPs by stimulation of cutaneous A δ fibers without producing a muscle twitch response.[95] Conversely, deep dry needling targets muscular afferents and has been shown to produce greater pain reduction.[96] In a systematic review by Annaswamy and colleagues,[43] deep dry needling was found to be more effective than superficial dry needling for relief of pain from MTrPs. However, if there is a risk for damaging deep structures such as the lung or vasculature, the

superficial method is preferred and is still efficacious. A preinjection block can be performed in the region or muscle of interest to allow more thorough and extensive needling with less patient discomfort. Preinjection blocks are also believed to block central sensitization and decrease any neurogenic component of the trigger point.[97]

TPI targets MTrPs by needle stimulation and treatment with anesthetics, steroids, or botulinum toxin. Shorter-acting and lower concentration anesthetic such as 0.25% lidocaine has shown to be less myotoxic than long-acting anesthetics like bupivacaine and less painful to inject than higher concentrations such as 1% lidocaine.[98,99] Although inflammation does play a role in MPS, the role of steroids in TPI is limited. A study of 45 patients with headache and MPS[100] found that steroid injection plus lidocaine produced a greater reduction of postinjection sensitivity than dry needling or lidocaine alone, but was no better at improving overall pain or cervical range of motion at 12 weeks.

Multiple systematic reviews, randomized controlled trials, and a Cochrane review have found no substantial evidence that injection provides more effective pain relief than dry needling alone.[85,100,101] Despite its limited evidence, anesthetic injection is still used in clinical practice. Because needling of MTrPs can cause local pain, the immediate antinociceptive effect of lidocaine and reduced latent soreness can improve the treatment experience overall. A single blinded randomized controlled trial of 29 patients with cervical MTrPs found TPI to be better than dry needling,[100] and Hong and colleagues[102] found that injection with lidocaine produced less postinjection soreness than dry needling alone. In addition, third-party payers in the United States reimburse for TPI but do not cover dry needling. Dry needling is an out-of-pocket expense for many patients, giving some preference to TPI. In the absence of significant adverse effect and recognizing the patient's cost burden, TPI may prove a useful treatment strategy. However, more research is needed to show the benefits of injection over dry needling.

Overall, there is no conclusive evidence that 1 needling technique is more effective than another. In their systemic literature review, Cummings and White concluded "because no technique is better than any other, we recommend that the method safest and most comfortable for the patient should be used."[101] Moreover, these techniques are based on the ability to accurately palpate and identify trigger points and discern them from other pain generators. In 1997, Gerwin[103] established that, with specialized training, interrater reliability in trigger point identification is good, but without training, localizing MTrPs and discerning twitch response during treatment is poor. Thus, using the technique that is most comfortable for the patient and with which the examiner is most proficient is likely to yield the best results.

Botulinum Toxin Injection

Botulinum toxin type A is a neurotoxic substance that is believed to act both centrally and peripherally to decrease pain. At the neuromuscular junction, it blocks the release of acetylcholine to prevent muscle hyperactivity and spasm. Its action at the neuromuscular junction allows it to target MTrPs, reducing local ischemia within muscles, and freeing entrapped nerve endings.[104] It has antinociceptive properties, preventing release of pain neurotransmitters at primary sensory neurons.[105] It also may act centrally, at the spinal and supraspinal levels,[106] and in the somatic and autonomic nervous system.[104] Botulinum toxin has an off-label use in myofascial pain and chronic musculoskeletal pain. Its multiple sites of action may prove beneficial not only to release tight MTrPs but also to disrupt nociceptive pain and treat associated autonomic symptoms.

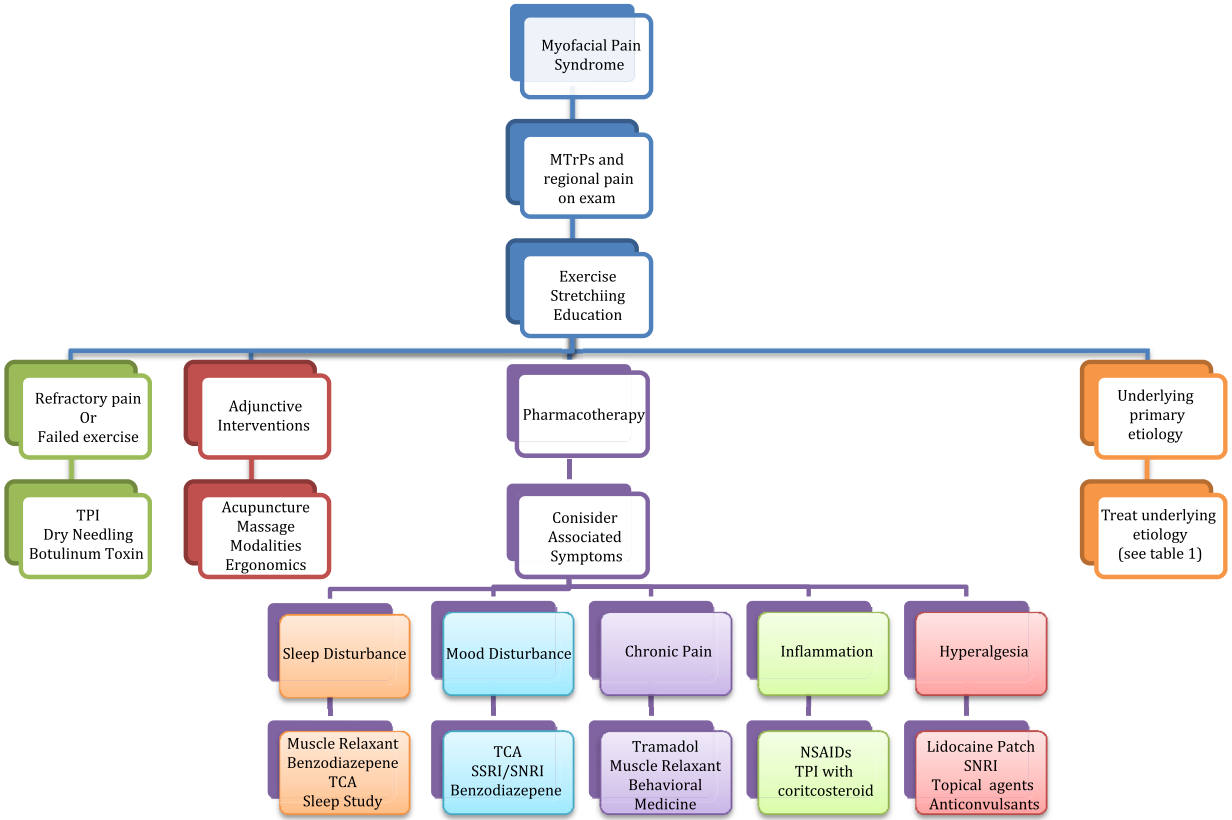

Fig. 1. MPS treatment summary. NSAIDs, nonsteroidal antiinflammatory drugs; SNRI, serotonin norepinephrine reuptake inhibitor; SSRI, selective serotonin reuptake inhibitor; TCA, tricyclic antidepressant; TPI, trigger point injection.

Studies on the efficacy of botulinum toxin in MPS are mixed. A 2012 Cochrane review[107] of botulinum toxin in MPS of the body (excluding the head and neck), evaluated 4 studies, including 233 patients, and found insufficient evidence for its use. Similarly, Ferrante and colleagues[108] conducted a randomized controlled trial of botulinum toxin for neck and shoulder pain and found it no better than placebo. Wheeler and colleagues[109] had similar results in the treatment of refractory cervicothoracic myofascial pain. However, other studies of MPS have found botulinum toxin to be beneficial.[110–114] In a multicenter randomized placebo-controlled trial of 145 patients with back and shoulder myofascial pain, Gobel and colleagues[115] found significant improvement in pain with botulinum toxin injection. Still other literature endorses that botulinum toxin may be best used in refractory cases of pain, taking advantage of its antinociceptive and muscular effects.[116]

Variations in study outcomes make the use of botulinum toxin difficult to endorse over other conservative, proven interventions. In a recent review by Gerwin,[117] the potential pitfalls of botulinum toxin studies were explored and an explanation offered for results variability. These pitfalls include a robust response to placebo, confounding variable in the control groups, incomplete treatments, and inappropriate periods between treatment and reassessment. More studies are required to better understand the role of botulinum toxin treatment in MPS.

SUMMARY

MPS is common in musculoskeletal practice, either as a primary or secondary pain disorder. As well as causing local muscle pain and limiting function, it can be associated with sympathetic dysfunction, emotional stressors, postural malalignment, and sleep disturbance. It is critically important to take a multifaceted approach to treatment (**Fig. 1**). Patient education and engagement in active training and exercise are necessary for functional restoration. Pharmacotherapy and needling therapy can be added to address primary complaints and comorbid symptoms. With a variety of tools available for treatment, MPS continues to be one of the most challenging yet rewarding musculoskeletal pain conditions to treat.

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