Review Article

Myofascial Pain – An Overview

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Abstract

Skeletal muscle is the largest organ in the human body. Any of these muscles may develop pain and dysfunction. In modern society, myofascial pain is a major cause of morbidity. It may present as regional musculoskeletal pain, as neck or back pain mimicking radiculopathy. It may also present as shoulder pain with concomitant capsulitis, and hip or knee pain with concomitant osteoarthritis. The condition is treatable. However, it is often under-diagnosed and hence under-treated. Traditional medical training and management of musculoskeletal pain have focused much attention on bones, joints and nerves. This review will focus on muscles, myofascial pain and dysfunction. During history taking and physical examination, precipitating and perpetuating factors, taut bands, trigger points, tender spots and sensitised spinal segments have to be accurately located and correctly identified for effective needling treatment. There is also a high recurrence rate unless appropriate exercises are prescribed, with active participation from the patient, to restore flexibility and balance to the muscles. With rehabilitation, many patients do not have to continue to suffer unnecessary pain that affects their daily activities and quality of life. Early diagnosis and management may also help reduce psychosocial complications and financial burden of chronic pain syndrome.

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Introduction

The skeletal muscle is the single largest organ in our human body. It accounts for nearly 50% of our body weight. Any of these muscles may develop pain and dysfunction.

Musculoskeletal pain is a major cause of morbidity.[1] Its prevalence increases with age. A growing number of individuals in our ageing population have musculoskeletal pain that affects their daily activities and function. It has a significant impact on their quality of life. This is creating a growing financial burden on our healthcare system.

In traditional medical training, management of musculoskeletal pain has focused much attention on the bones, joints and nerves.[2] Muscles in general, and myofascial pain in particular, have received less attention as a major source of pain and dysfunction. Myofascial pain, which is treatable, is often under-diagnosed and under-treated. A large number of patients can be left suffering in pain for years.

This review will focus on myofascial pain which is a major cause of musculoskeletal pain in modern society, and its management.

What is Myofascial Pain (MFP)?

The traditional and narrow definition of myofascial pain is that it is pain that arises from trigger points (TRPs) in a muscle.[3] TRPs are small and sensitive areas in a muscle that spontaneously or upon compression cause pain to a distant region, known as the referred pain zone. Tender spots (TSs), in contrast to TRPs, only cause pain locally. Taut bands (TBs) are groups of muscle fibres that are hard and painful on palpation. TB is an objective and consistent palpatory finding in muscles with myofascial pain. Within TB, the most painful and sensitive areas are the TRP and TS. Nowadays, in broader terms, myofascial pain includes muscle pain from TB with TRP and/or TS. The muscles are in spasm, with increased tension and decreased flexibility. It usually presents with regional muscle pain distributed in 1 or 2 quadrants of the body.

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Fibromyalgia, on the other hand, is a separate category of a muscle pain condition.[4] The muscle pain is diffuse, with tender points as defined by the American College of Rheumatology. The muscle pain is widespread, distributed symmetrically above and below the waist. However, there is no TB in the muscles.

Although MFP and fibromyalgia are separate entities, these 2 conditions may occur concomitantly. MFP may develop in fibromyalgia patients. TB with TRP/TS may develop in the muscles with diffuse pain. The common denominator of both conditions is negative laboratory findings and no systemic inflammation.

Epidemiology

MFP is a major cause of musculoskeletal pain. There is a high prevalence of MFP in patients with regional musculoskeletal pain. It is one of the most frequent causes of back pain and neck pain.[5] In a study of 164 patients referred to a pain clinic with chronic head and neck pain of at least 6 months duration, 55% were found to have a primary diagnosis of MFP.[6]

In a general medical clinic study, the primary complaint of 30% of patients was due to MFP.[7] The prevalence of MFP pain in pain management centres is higher. In a comprehensive pain centre study on 283 consecutive patients, 2 physicians independently reported MFP as the primary diagnosis in 85% of cases.[8] One physician who examined 96 patients in another pain centre study found MFP to be the primary cause of pain in 74% of cases, and 93% of cases had at least part of their complaint caused by MFP.[9]

Precipitating and Perpetuating Factors

Trauma

Macrotrauma – Contusions, sprains and strains may give rise to MFP acutely.

Microtrauma – The onset is more subtle. Chronic repetitive overloading or overuse of muscles may lead to fatigue and gradual onset of MFP.[10,11]

Mechanical

Internal factors – Poor posture, scoliosis

External factors – Poor ergonomics, when the working environment of an individual is poorly molded to his or her physique.[12,13]

Degeneration

Ageing, structural degeneration of bones and joints, with gradual loss of myofascial flexibility, may lead to MFP

Nerve Root Compression

Irritation of the nerve root may lead to sensitisation of the spinal segment and MFP in the innervated muscles.[14-16]

Emotional Psychological Stress

Anxiety, increased sympathetic output and sleep deprivation may lead to increased muscle tension, fatigue and decreased MFP threshold.[17]

Endocrine and Metabolic Deficiencies

Thyroid and oestrogen insufficiencies are known to cause MFP.

Nutritional Deficiencies

Vitamins and minerals insufficiencies may perpetuate MFP.

Chronic Infection

Chronic virus or parasite infections may perpetuate MFP.

Chronic Muscle Imbalance

Chronic muscle imbalance is prevalent in our modern society. In the human body, skeletal muscles can be broadly divided into 2 groups:[18]

- Dynamic muscles, such as rhomboids and gluteus medius, are muscles that are activated when one is in dynamic motion. These muscles are relatively inhibited when one is in a static posture.
- Postural muscles, such as scalenes and quadratus lumborum, are muscles that are activated when one is in a static posture. These muscles are relatively inhibited when one is in dynamic motion.

With a sedentary lifestyle, as one spends more time in static postures than in motion, dynamic muscles will become progressively inhibited and lax while postural muscles will become progressively tight and inflexible. An imbalance between the dynamic and postural muscles will gradually develop. The muscle imbalance may lead to MFP.

Pathophysiology

Precipitating factors of MFP may cause the facilitated release of acetylcholine at motor end plates, sustained muscle fibre contractions and local ischaemia with release of vascular and neuroactive substances, and muscle pain. More acetylcholine may then be released, thus perpetuating the muscle pain and spasm. Electrodiagnostic studies have shown increased electromyographic activities at TRPs and TSs.[19] Local muscle fibrosis may occur after a prolonged period of time.[20]

Spinal Segmental Sensitisation (SSS)

If MFP is left untreated, it may become an irritative focus and send persistent pain impulses via a sensory neuron into the spinal cord. The spinal loop that is constantly bombarded with noxious stimuli and irritated may develop the facilitated release of nociceptive neurotransmitters with lowered

threshold for synaptic activation, amplification and perpetuation of pain – a state called spinal segmental sensitisation.[21-23] This condition may affect sensory, motor and sclerotomal components of the hyperactive and hyperexcitable spinal segment with the following physical manifestations:

Dermatomal sensitisation: Due to increased sympathetic output, the skin and subcutaneous tissues become indurated with trophoedema. The skinfold thickness is increased and the affected area is exquisitely tender.

Myotomal sensitisation: Muscles innervated by the spinal segment that is sensitised develop hypertonicity and spasms with TRP/TS.

Sclerotomal sensitisation: Bursitis, enthesitis, epicondylitis and tendonitis may occur in the affected distribution innervated by the spinal segment that is upregulated.

Cycle of Degeneration

Muscles and joints in the human body are closely interlinked. Motion at one joint is related to motions at adjacent joints, from distally to proximally, from the lower limbs and lower trunk to the upper limbs and upper trunk. When MFP persists for some time without treatment, adjacent structures may also evolve their own TRP/TS, called satellite TRP/TS. MFP may impede normal joint motion, cause joint dysfunction and lead to joint degeneration. The pathology may spread through a ripple effect from one motion segment to adjacent motion segments and then to other parts of the musculoskeletal system (Fig. 1).

Clinical Presentations

MFP is a great imitator.[24,25] It frequently presents as regional musculoskeletal pain. In the upper limb, it may present as shoulder pain in patients with impingement or capsulitis. In the lower limb, it may present as hip or knee pain in patients with osteoarthritis. Neck or back pain of myofascial origin may mimic radiculopathy with pain radiating down upper or lower limb. The pain may be referred from TRP/TS over the dermatome of a sensitised spinal segment innervating the TB. It may also result from neurological entrapment. The brachial plexus may be compressed as it passes through tight scalenus muscles in the upper trunk. The sciatic nerve may be compressed as it passes through tight piriformis muscle in the lower trunk.

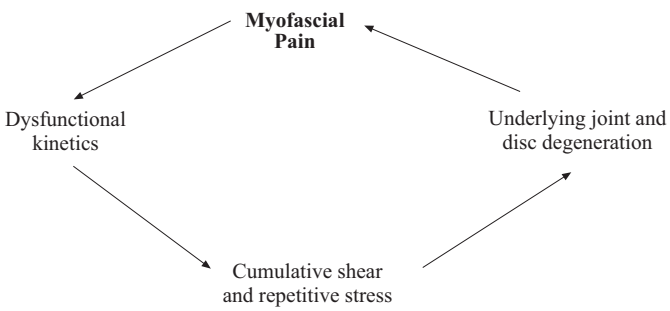

Fig. 1. Cycle of degeneration.

History and Examination

During history taking and physical examination, one should look for precipitating and perpetuating factors of the MFP. One should also look for yellow flags or indicators of psychosocial factors associated with chronic pain syndrome. Red flags or indicators of serious concomitant musculoskeletal pathologies, such as fractures, neurological deficits, malignancy and infection, should be excluded.

During inspection, asymmetry of posture and restriction of active and passive range of motions should be noted. Abnormal movement pattern as a result of myofascial pain and tightness should also be noted.

Palpation is the basic method of diagnosis. In order to feel and locate the TB accurately, it is important to adequately relax muscles that are in pain and spasm. This is essential for subsequent needling treatment to be effective. Relaxation can be achieved mechanically by passively approximating the origin of a muscle to its insertion. Relaxation can also be achieved by neuromuscular techniques, as elaborated in the exercise section below. Optimal muscle relaxation should be attained before effective palpation using the following methods:

i. *Flat palpation*: With finger bellies for an initial survey of muscle tone for any spasm or superficial tenderness.
ii. *Finger tip palpation*: Across muscle fibres for the TB and TRP/TS in small superficial muscles.
iii. *Pincer palpation*: Between the thumb and fingers for accessible muscles, such as sternocleidomastoid, upper trapezius, pectoralis major, latissimus dorsi and hip adductors.
iv. *Overlying hand palpation*: One hand applies pressure while the underlying hand palpates for the deep muscles, such as glutei muscles and piriformis.

After TRPs/TSs in the TBs are located, an algometer (force gauge meter) can be applied manually over it to measure the minimum pressure that induces pain.[23] Associated dermatomal sensitisation and trophoedema can be detected clinically by pinching and rolling the skin between thumb and finger, either along the trunk longitudinally or across the limb circumferentially. The skin innervated by the sensitised spinal segment will be thickened and tender. Due to increased sympathetic activity and induration, skin electric resistance over the sensitised

spinal segment is decreased. The increased skin electric conductance can be objectively measured with an electric conductance meter by electrical current passed between a reference electrode held in one hand and an explorative electrode moved across the examined dermatome.[23]

Imaging Studies

Imaging studies may provide useful anatomical information. However, MFP, TB, TRP and TS usually do not show up in these investigations. Abnormal imaging findings, degenerative changes, prolapsed discs and rotator cuff tears are also frequently found among asymptomatic individuals and not necessarily the cause of pain.[26-29] Therefore, it is important for the clinician who is treating the patient to correlate the medical history and physical examination with imaging results to determine the musculoskeletal pain generator.

Treatment

Treatment of MFP requires a multifaceted approach. In the short term, the aim is to abolish the TB, TRP and TS for pain relief. In the long term, flexibility has to be restored to the muscle, and any associated precipitating or perpetuating factors have to be removed, so as to reduce the recurrence rate.

Physical Modalities

Physical modalities are useful supplementary treatments for MFP.[30,31] They may help to control muscle pain and spasm. However, they should not be used in isolation. Otherwise, they may provide only temporary relief with limited benefits.

Heat therapy is one of the most commonly used physical modalities. It increases blood flow and tissue distensibility and decreases muscle spasm and pain. Hot pads provide superficial heat with limited subcutaneous penetration. Ultrasounds, on the other hand, provide deep heat with higher subcutaneous penetration. Contraindications of heat therapy include circulatory insufficiency, sensory or cognitive impairment, malignancy and inflammation.

Electrical therapy is another commonly used physical modality. It improves vascular circulation to eliminate inflammatory byproducts from the painful site. It also helps to relieve muscle spasm and oedema. However, it should not be used over carotid sinus or pregnant uterus and in patients with a cardiac pacemaker or defibrillator, malignancy or infection.

Medication

Medication is another useful supplementary treatment for MFP. Paracetamol or muscle relaxants may be prescribed for mild MFP. If these are ineffective, non-steroidal anti-inflammatory drugs (NSAID) or cyclo-oxygenase-2 (COX-2) selective inhibitors may be used, particularly if there is a local inflammatory component to the MFP. Narcotic analgesics may sometimes be necessary for severe MFP. Adjuvant analgesics, such as antidepressants or anticonvulsants, may be added if there is a neuropathic component to the MFP. Somnolence, an attending effect of muscle relaxants, narcotic analgesics, antidepressants and anticonvulsants, may be useful at night for patients with emotional stress and sleep deprivation.

Needling and Infiltration

Two types of needles are commonly used: hypodermic and acupuncture needles. Hypodermic needles allow needling with infiltration of local anaesthetic during the procedure. The local anaesthetic helps to relieve post-needling soreness. Gauge 25 and 27 hypodermic needles are usually used. Acupuncture needles are stainless steel filiform needles with a diameter range of 0.25 to 0.35 mm. They are finer and less traumatic. However, they do not allow for the infiltration of local anaesthetic during the procedure.

One of the aims of needling is to mechanically break up the TRP/TS and any associated fibrotic core. The needle is targeted at the point of maximum tenderness within the TB. When the needle penetrates the TRP/TS, the TB is disrupted. The muscle may manifest a local twitch response, and the TB with TRP/TS disappear.[3]

The management of SSS requires careful examination of objective signs of dermatomal, myotomal and sclerotomal sensitisation, and determination of the spinal segment sensitised. Treatment is then targeted at the spinal segment, with careful choice of needling locations and targets, in order to alleviate the hyperactivity. Paraspinous block, described by Fischer,[23,32] involves infiltration of local anaesthetic along the paraspinous space adjacent to spinous process of the vertebra, followed by needling of the interspinous ligament that is sensitised. Together with needling and disruption of TRP/TS in other sensitised muscles, the hypercontractile elements are disrupted and hyper-irritability in the spinal segment is desensitised neuro-mechanically. Biomechanical tension at adjacent structures is also relieved and the recurrence of MFP is reduced after treatment.

Needling also inhibits nociception and provides pain relief by spinal cord pathway modulation, generalised neurohumoral stimulation and release of endorphin. Various other needling methods have been described. Baldry[33] describes the superficial dry needling technique where dry needles are inserted into superficial tissues overlying TRP/TS and left in situ for 30 seconds to 3 minutes. Chu and Schwartz[34] described the electrical twitch obtaining intramuscular stimulation, a needling technique with

electrical stimulation.

Acupuncture is based on traditional Chinese medicine diagnoses of organ dysfunction and system imbalance. Needling at acupoints located along meridians and extra-meridians treats blood stagnation and relieves pain. It helps to restore blood circulation and equilibrium in the human body.

Contraindications to needling include bleeding diatheses, anticoagulation, local or systemic infection and inability to rest the treated region after the procedure.

Exercise

After needling the TRP/TS, it is essential to correct the muscle imbalance to achieve a good therapeutic result. It is important to try to restore normal length and flexibility to the muscles. However, one should be careful of achieving this by direct stretching exercises when a muscle is still in pain and spasm. Direct stretching may cause more pain and more spasm in the painful muscle. Instead, flexibility may be restored to the painful muscle through limbering exercises.[35-37] The following neuromuscular relaxation techniques may be applied:

i. Muscle relaxation by exhalation.
ii. Muscle relaxation by eye movement, inferiorly and in the direction in which relaxation is desired.
iii. Muscle relaxation following isometric contraction, by autogenic inhibition.
iv. Muscle relaxation following minimal activation of the antagonist muscle, by reciprocal inhibition.

It is also important that strengthening exercises should not be started too early. Before pain has fully subsided, the muscles are still tight and in spasm. Strengthening exercises, if started too early, may cause more pain, spasm and tightness. Strengthening exercises should only commence after the pain has been fully treated and resolved. It should then begin gradually with isometric exercises and progress to repetitive low resistance exercises to develop endurance, before high resistance exercises to develop strength, as well as stabilisation exercises.

Conclusion

MFP is a common and treatable cause of morbidity. If left undiagnosed and untreated, it may develop into chronic pain with overlying psychosocial and functional problems. This may lead to further distress, anxiety and even depression. The vicious cycle may give rise to further somatic preoccupation.

This major source of musculoskeletal dysfunction requires more focused attention. Its early diagnosis and treatment may help to reduce overlying psychosocial complications and the attending financial burden of chronic pain syndrome.

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