Review Article

DOI: 10.7860/JCDR/2021/50242.15551

Physiotherapy Section

Recent Advances in Diagnosis and Management of Myofascial Pain Syndrome: A Narrative Review

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ABSTRACT

Myofascial Pain Syndrome (MFPS) is a disorder common among patients who experience musculoskeletal pain. The condition originates from the muscles and the fascia which surrounds it. Initially, this condition used to be prevalent among people in their 40s and 50s. But presently, even young adults are affected. In this review, several databases have been consulted in the course of reviewing MFPS related studies. Aspects reviewed include its aetiopathophysiology, diagnostic criteria and management of MFPS. It is important to note that an increasing number of people among the ageing population suffer from musculoskeletal discomfort that interferes with their everyday activities and functions. It has a huge influence on their overall well being. This is creating a growing financial burden on the healthcare system. There is a lack of consensus regarding proper diagnostic criteria or tool, and treatment of MFPS. This review aimed to summarise recent advances in the diagnosis and intervention.

Keywords: Dry needling, Manual therapy, Skeletal muscle disorder, Trigger points

INTRODUCTION

The Myofascial Pain Syndrome (MFPS), acute or chronic, is described as a painful regional syndrome characterised by the presence of an active Trigger Point (TrP) in a skeletal muscle. Patients may complaint of localised pain or referred pain from different sites [1]. Experts have identified that at least 10% of people who have back pain have some underlying neurological problem. Of these, over 5% have specific identifiable causes, while the remaining 5% do not have any specific recognisable aetiology [2].

The MFPS is one of the issues affecting the musculoskeletal system. Characteristics of this condition include the presence of active TrPs, pain and spasm. Chronic MFPS results in continual muscle spasms. These muscle spasms are often associated with injury or they may develop over time due to chronic stress, as well as unhealthy changes in the body system [3]. Frequent release of neurotransmitters affects formation of the taut band inflict a palpable nodule within the muscle, while also causing a local constraining of the muscle which ultimately triggers energy crisis within the muscle. Also, energy release causes intense localised muscular contraction which results in tissue ischemia. Contractures of this nature result in repeated spasms which can be a reason behind localised fiber destruction [4].

Myofascial pain-induced spasms could occur due to muscle overuse, tiredness, previous injury, straining of the muscle, or static positioning of the muscle for a prolonged duration. Consequently, the muscle becomes deprived of fluid and energy, resulting in hyperexcitability and consequently a forceful contraction. This spasm may involve a part of a muscle, the whole muscle, or in some cases, adjacent muscles [5-7]. There are specific tender areas in muscle TrPs. These areas are involved in the MFPS with characteristics such as stiffness of the muscle, tenderness and pain that radiates to different areas. The radiating pain is known as referred pain [8].

The Myofascial TrPs (MTrPs) are units which are believed to be hyperirritable spots in taut bands of skeletal muscles- a unit area comprising various “contraction knots” in muscle fibers. The presence of active MTrPs plays a role in the onset of several clinical pain-related conditions due to the shortening of the muscle fiber and excessive pressure on veins or nerves close to these contraction knots. As such, the inactivation or elimination of MTrPs by numerous interventions might relieve chronic myofascial pain [9]. This review aims to summarise the recent advancements in the diagnosis and treatment of MFPS.

LITERATURE SEARCH

Different databases like Google Scholar, PubMed and Scopus were explored while writing this review; using the keywords ‘dry needling’, ‘manual therapy’, ‘MFPS’, ‘skeletal muscle disorder’, ‘TrPs’, and ‘muscle spasm’ in combination and/orindividually. The studies included RCTs and Quasi experimental designs focusing on diagnosis and management of MFPS. Relevant articles that focused on aetiology, pathophysiology, clinical findings, diagnostic criteria and management of MFPS were selected and reviewed.

AETIOPATHOPHYSIOLOGY OF MFPS

Currently, clinicians and medical practitioners believe that MFPS is characterised by the expression of regionally distributed muscular pain related to the manifestation of palpable regions of hypersensitivity called a MTrP. In line with the integrated hypothesis, MTrPs are found at intervals of the motor end plate region of the muscle [10-12]. This condition is believed to be initiated by local injury from gross or repetitive microtrauma. Hyperirritable knots formed in the muscle due to release of neurotransmitter at motor end plate [13-16]. Persistent contraction ends up in a cascade of chemical responses together with the discharge of vasoactive elements and inflammatory factors like bradykinin that contribute to the expression of localised muscle pain [15,17]. At the same time, persistent peripheral sensitive input releases substance P into the dorsal horn, resulting in neuroplastic changes (increased excitability) at intervals in the central nervous system, called central sensitisation [18]. Previous literature found that animal tissue mechanisms play a great role in mediating pathophysiology of MFPS and MTrP by involving the sensitised spinal and motor neuron circuit mechanism that is called central sensitisation [12,18]. The endplate dysfunction characteristic of MTrPs involves both the nerve terminal and the post junctional muscle fiber, thus, it is known as “neuromuscular disease”. MFPS is initiated by localised injury with repetitive micro trauma, whereas Fibromyalgia (FM) has no aetiology [13,14]. The MTrPs are located at the motor endplates [17]. The pain increases due to frequent release of acetylcholine, leading to repetitive vaso-activation and inflammation and further leading to pain which may persist for more than three months [14,19-21].

Clinical Findings of MFPS

The MFPS primarily has a specific anatomic and clinical distribution [Table/Fig-1] [8,9]. It usually manifests as regional muscle pain related to abnormalities in each motor and sensory perform [22]. Clinically, there is a presence of a palpable taut band of muscle. These muscles contain localised, hyperirritable nodules known as MTrP, and the muscles show some form of weakness while there is no compromise in the Range Of Motion (ROM). Latent Twitch Response (LTR) is additionally usually ascertained in association with MTrPs, known as a fast and transient twitch of the taut band. FM may be a syndrome characterised by chronic widespread contractor pain and therefore the presence of palpable TrP [23]. Though some consider the LTR a collateral diagnostic sign of a MTrP others suggest it to be less reliable, adding to the seeming confusion during diagnosis as compared [24-26]. These TrPs are outlined as separate areas of tissue that are painful to but four metric weight units of examination pressure but, TrPs are indistinguishable from the conventional surrounding tissue. So, a crucial clinical distinction between MFPS and FM is that during physical examination of the affected muscles, MFPS presents with localised TPs. Another necessary clinical distinction between FM and MFPS is the presence of distinctive and secondary findings associated within the clinical manifestation of FM together with sleep disorders, irritable internal organ syndrome, nervous bladder, fatigue, psychological feature pathology, anxiety, depression, headaches, articulation temporomandibularis disorders, numbness, tingling, and Raynaud's development [23].

Features	Myofascial Pain Syndrome (MFPS)
Distribution	Regional muscle pain [21]
Palpatory findings	Myofascial Trigger Points (Trp) [24]
	Palpable taut band of muscle containing hyperirritable nodules [17,25]
Associated observations	Palpable taut band of muscle containing hyperirritable nodules [17,25]
	Weakness without atrophy [25]
	Reduced Range of Motion (ROM) [25]
	Local twitch response [25]
Secondary symptoms	Diaphoresis [13]
	Lacrimation [13]
	Flushing [7]
	Pilomotor activity [9]
	Temperature changes [8]

[Table/Fig-1]: Clinical findings of MFPS [7-9,13,21,24,25].

DIAGNOSTIC CRITERIA

The original set of diagnostic criteria for MFPS includes tenderness, LTR, hurting, weakness without atrophy of muscle, involuntary symptoms and decreased ROM [Table/Fig-2]. The diagnosis is confirmed by the presence of an MTrP, a palpable, hyperirritable nodule inside the target muscle. Despite these clearly outlined signs and symptoms, there is still no uniformly accepted diagnostic protocol for MFPS, and therefore the reliability of the present planned diagnostic criteria for MFPS is important for clinical judgment for medical practitioners. Three recent findings were identified for diagnosis of MTrPs [27]:

a) The electromyographic recording and ultrasound imaging of local twitch responses;

b) The spontaneous electrical activity of multiple active loci in the MTrP;

c) And biopsies of MTrPs that show contraction knots and giant round muscle fibers.

A systematic review of nine studies was conducted by Lucas N et al., which showed that none of study satisfied the presence of MTrP [28]. Only one study reported inter-rater agreement on the presence of an MTrP [20]. Of those studies, none had reported the interrater responsibility of characteristic the situation of an MTrP in symptomatic muscle; but, smart responsibility estimates were noted for individual diagnostic signs as well as native tenderness and pain recognition. In distinction, lower responsibility estimates were ascertained for hurting, taut band, jump sign and LTR. These collective results recommend that the responsibility was bigger for the subjective signs of tenderness, and pain recognition; counter-intuitively, responsibility estimates for objective signs of a taut band and twitch response were lower.

Criteria	Definition
Chief criteria	Regional pain complaint
	Pain pattern follows a known distribution of muscular referred pain
	Palpable taut band
	Focal tenderness at one point or nodule within taut band
	Restricted ROM or slight muscle weakness
Small criteria	Manual pressure on MTrP nodule reproduces chief pain complaint
	Snapping palpation of the taut band at the MTrP elicits a local twitch response
	Pain is diminished or eliminated by muscular treatment

[Table/Fig-2]: Diagnostic criteria of MFPS [29].
Trp: Myofascial trigger points; ROM: Range of motion

In 2015, Rivers WE et al., conducted a global study of 214 pain specialists to explore the accord on the clinical options and presentation of MFPS. The bulk of practitioners agreed that MFPS is distinct from different conditions of chronic system pain, with Associate in Nursing calculable prevalence of 31 [21]. The accord amongst these clinicians was that a new spot, with or without referred pain, and pain recognition area unitis an essential diagnostic criterion for the identification of MTrP in MFPS. However, usually adopted criteria as well as palpable taut band, palpable nodule, and/or hurting weren't considered essential for the designation of MFPS. Confirmation of the designation ought to embody a mix of any three of the subsequent signs: muscle stiffness/spasm, restricted ROM, symptoms that area unit aggravated with stress, and/or a palpable taut band/nodule.

Additionally, they emphasised that the designation of MFPS ought to be contingent upon the presence of pain for longer than three months, which each native and broader regional pain expression is also considered [21]. Two counsel criteria embody native tenderness and pain copy, whereas in distinction, taut band and LTR responses show poor clinical responsibility. For this reason, the proof supporting the designation and treatment of MTrPs is insufficient, and thus, physical examination alone shouldn't be employed in the diagnostic workup of the chronic system pain in patient [17,25]. A promising tool has been found to be valid and reliable that has been found to be of benefit when used in acute cases of MFPS, scoring in the tool ranging from 0-14, 15-39 and 40-50 which may evaluated the spasm as to be mild, moderate and severe respectively [29].

New Diagnostic Criteria for MFPS

Analysis emerging from current studies shows a number of objective diagnostic tools with the potential to enhance the identification of MFPS [Table/Fig-3] [14,19,31,36]. For example, biomarkers can be used as objective indicators of traditional and/or pathologic biological processes. These inflammatory biomarkers might play a vital role within the objective differential assessment of the chronic contractor pain patient [14]. Ultrasound imaging is another tool with potential to be used within the objective assessment of a chronic pain patient. Sikdsar et al., showed that elliptically formed, hypoechoic regions inside the muscle corresponded to focal areas

of reduced vibration amplitudes [30,31]. Similarly, another tool to assess MTrP is Magnetic Resonance Elastography (MRE) imaging. It assesses the mechanical properties of tissues and detect taut bands [32]. Electromyography (EMG) that consists of electrodes inserted subcutaneously to record action potentials directly from the muscle fibers has been found to determine abnormal neuron activity related to changes in muscle tissue. Couppé C et al. argued that MTrP regions exhibit increased spontaneous electrical activity at the motor end-plate region within the absence of voluntary muscle contraction, suggesting that this might be a valuable objective live of focal regions of hyperirritability inside the muscle [33]. Despite the potential of those tools within the diagnostic workup of the chronic contractor patient, the clinical utility of those modalities to assess MTrPs is proscribed.

New diagnostic criteria	Myofascial Pain Syndrome (MFPS)
Ultrasound imaging	Elliptically shaped, hypoechoic regions within the muscle corresponded to focal areas of reduced vibration amplitudes [31]
Biomarkers	Altered biochemical environment of inflammatory factors at active MTrP sites [14]
	Increased proton concentrations (lower pH), substance P, bradykinin, serotonin, calcitonin gene- related peptide, and Interleukin1β [36]
Magnetic resonance elastography	Taut bands in muscle uniquely present as a chevron pattern at higher wave velocities within the central band [19]
Electromyography	MTrP regions exhibit enhanced spontaneous electrical activity at the motor endplate region in the absence of voluntary muscular contraction [33]

[Table/Fig-3]: New diagnostic criteria [14,19,31,33,36].

Biomarkers usually need off-site analysis whereas MRE, EMG, and ultrasound need costly, therefore, limiting their practicability in clinical application. Infrared thermography was found suitable for skin mapping for the temperature at the location of the TrP and also for assessing the effect of therapies for the purpose. No qualitative differences were suggested in biopsies of MTrPs of trapezius and gluteus medius in comparison to biopsies of vastus lateralis muscle which was taken as control in a pilot study which was for analysis of mitochondrial function in identified MTrPs by high resolution respirometry [34]. Intracortical disinhibition may be seemed as marker for the MFPS, even a parameter for efficacy of treatment [37]. A taut band and tender nodule as confirmatory signs may bring doubt in the diagnosis of MFPS in the pathophysiology of the MFPS. This is a foundational gap in our understanding of the pathophysiology of MFPS; future research must focus on elucidating the underlying mechanisms of MTrP formation, and its relevance in the pathophysiology and clinical manifestation of MFPS [23].

MANAGEMENT OF MFPS

By searching previous literature, various treatment methods are present to manage MFPS which can be discussed into two headings: non pharmacologic and pharmacologic treatment as shown in [Table/Fig-4].

Non Pharmacologic treatment	Pharmacologic treatment
Dry needling [39]	Lidocaine and non-lidocaine based dry needling [37,38]
Manual therapy [41]	COX-2 selective inhibitors [56,57] and NSAIDs [53]
Active and passive stretching [44]	Tramadol [56]
Ultrasound therapy and Hydrocortisone Phonophoresis [47,48]	Tropisetron [58,59]
Deep pressure massage [42,43]	Succinylcholine [60]
Foam roller or roller massage [44,45]	MTrP injections [13,39]

[Table/Fig-4]: Recent advances in treatment of MFPS.

A) Non Pharmacological Treatment

Injections on MTrPs are effective. This is attributed to the disruptive effect of the needle as well as ending of the dysfunctional activity of motor endplates. Dry needling is employed by MTrP injections as it is a fast and effective way of inactivating MTrPs and relieves pain [13]. In a particular study, patients received lidocaine based and non lidocaine based dry needling. Results showed that both reduced MFPS during the procedure [13]. In another study, the patients were billed to undergo a surgery of the knee. However, they eventually underwent dry needling while under general anesthesia with postoperative evaluation. Dry needling superiority was observed as compared to placebo (p-value=0.02) [38]. It has proven that dry needling is as effective as TrP injections, and thus it qualifies as a first line acute treatment [39]. A systematic review of needling therapies for MTrPs found that the substance injected does not influence the outcome, and dry needling is not necessarily inferior to wet needling [40]. Manual therapy plays an important role in MFPS treatment and is recognised as a very effective technique in MTrPs inactivation [41]. Previous literature discussed the effect of various modalities, such as spray based stretch therapy and deep pressure massage [42,43]. Foam rollers and rolling massage have been found to be effective in recovering and reducing Delayed Onsent Muscle Soreness (DOMS) and exercise induced muscle damage [15,44,45]. Active and passive stretching both have significant effects in relaxing the muscle and lengthening the sarcomere but when followed at least three weeks with three sets of minimum 30 seconds up to 60 seconds for three times in single set [46]. Recent randomised controlled trials have shown that ultrasound has the potential to decrease the basal level of electrical activity while also minimizing TrP sensitivity [35]. A 2012 study investigated the application of hydrocortisone phonophoresis, pressure release, ultrasound therapy, and placebo in upper trapezius MTrPs treatment. All groups treated experienced a significant reduction in pain, while ROM improved [47]. The therapeutic effects of phonophoresis and pressure release were superior compared to ultrasound [48]. Another non pharmacologic treatment employed is the Transcutaneous Electric Nerve Stimulation (TENS). This therapy stimulates nerve fibers with electrical current leading to pain relief [49] but there is little to no evidence supporting its use over medication or TrP injections. It should therefore be employed as an adjuvant therapy. While electrical muscle stimulation (EMS) when combined with passive stretching has been more effective in lengthening of the muscle, result seen biceps [50]. Moreover, microcurrent and trans cranial direct current stimulation have also proven to be as fast healers as they mimic the body's own developed current, faster healing by repairing the collagen and substituting it with true collagen unlike other healing mechanisms [51,52].

B) Pharmacologic Treatment

Non steroidal Anti-Inflammatory Drugs (NSAIDs) are widely used in MFPS treatment due to their availability and relatively mild side-effects. However, in spite of their wide usage, there is very little evidence for the role of an anti-inflammatory medication in MFPS [53]. Several studies are strongly in support of NSAIDs for the treatment of musculoskeletal disorders, especially low-back pain and acute musculoskeletal disorders [50,54,55], But prolonged usage should be approached cautiously due to side effects that may affect the gastrointestinal system, the renal system, or the blood clotting [55]. The effect exhibited by Cyclooxygenase-2 (COX-2) inhibitors is analogous to conventional NSAIDs and just like NSAIDs there are several randomised controlled trials and proof for their effectiveness in MFPS.

Results from studies shows that COX-2 selective inhibitors are well-tolerated in acute low back pain [54,56,57]. Tramadol is a well-known mu-receptor agonist which inhibits reuptake of dorsal horn presynaptic norepinephrine and serotonin, while also stimulating central release of serotonin. Several studies have shown evidence that tramadol is very effective in low back pain, osteoarthritis, and a

few chronic pain syndromes [56,58]. As per its use in the treatment of myofascial pain, no studies have investigated the effectiveness of this agent; but then, its low-abuse potential and multimodal analgesic effects makes it appealing [13,57,58]. Tropisetron is a 5-HT3 receptor antagonist as well as an agonist of the alpha-7-nicotinic receptor. It serves as an analgesic for myofascial pain and FM. It is however important to note that in several randomised controlled trials, tropisetron injections at TrPs have shown a significant pain improvement [58,59]. Succinylcholine, a depolarising muscle relaxant when applied on the TrPs on the upper trapezius with phonophoresis technique transdermallyin with dose of 25 mg gel significantly relieves the pain and MTrP [60].

CONCLUSION(S)

The present review highlighted the recent advancements in pathophysiology, diagnostic criteria and treatment of MFPS. An emerging treatment of Phonophoresis with Succinylcholine, tropisteron injections or MTrP injections with or without dry needling and foam roller had shown promising results in treating the patients with MFPS. Further, this review focused on non invasive treatment technique which may be cost effective also but can be intervened by only those who keep a sound knowledge of locating TrPs like physiotherapists.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: May 08, 2021
- Manual Googling: Sep 02, 2021
- iThenticate Software: Sep 16, 2021 (27%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? No
- Was informed consent obtained from the subjects involved in the study? No
- For any images presented appropriate consent has been obtained from the subjects. No

Date of Submission: **May 08, 2021**
Date of Peer Review: **Jun 14, 2021**
Date of Acceptance: **Sep 03, 2021**
Date of Publishing: **Oct 01, 2021**