A new insight into the management of myofascial pain syndrome

Miyofasial ağrı sendromu tedavisinde yeni ufuklar

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Abstract
Myofascial pain syndrome (MPS) is a musculoskeletal disorder which is characterized by pain, muscle spasms, and muscle tenderness, as well as a limited range of motion, weakness, and rarely, autonomous dysfunction. Management includes exercise programs in particular, and many other invasive and non-invasive therapies, depending on the clinical status of the patient. The main options include medical therapies with analgesics, myorelaxants and antidepressants, hot pack therapy, exercise, stretch and spray therapy, ischemic compression, therapeutic massage, biofeedback, transcutaneous electrical nerve stimulation (TENS), ultrasound (US), interferential (IFA) current, low-energy light amplification by stimulated emission of radiation (LASER), extracorporeal shock wave therapy (ESWT), trigger point injections, dry needling, and acupuncture. There is growing evidence that trigger point injections and dry needling, as well as stretching exercises, are effective alternatives in the management of MPS. Management success is primarily based on the cooperation of the patient and the treating physician and the elimination of predisposing factors.
Keywords: Myofascial pain syndrome; physical therapy; trigger point; trigger point injection

Özet
Miyofasiyal Ağrı Sendromu (MAS), ağrı, kas spazmı, duyarlılık, hareket kısıtlılığı, güçsüzlük ve nadiren otonom disfonksiyon gibi semptom ve bulgularla seyreden bir kas iskelet sistemi hastalığıdır. MAS tedavi sürecinde, hastanın klinik durumuna göre başta egzersiz tedavileri olmak üzere, birçok farklı noninvaziv ve invazif tedavi yöntemi uygulanabilmektedir. Analjezik, miyorelaksan ve antidepresan gibi medikal tedaviler, hotpack, egzersiz, germe ve sprey, iskemik kompresyon, terapötik masaj, biofeedback, transkütanöz elektriksel sinir stimulasyon, ultrason, interfaransiyal akım, düşük enerjili LASER, ekstrakorporeal şok dalga tedavisi (ESWT), tetik noktalara enjeksiyonları, kuru iğneleme ve akupunktur başıca tedavi seçenekleridir. MAS tedavisinde tetik nokta enjeksiyonu/kuru iğneleme ve germe egzersizlerinin etkinliği ile ilgili daha güçlü kanıtlar olmakla birlikte tedavi sürecinde hekim ve hastanın işbirliği ve olası predispozan faktörlerin kontrolü tedavinin başarısında rol oynayan diğer faktörlerdir.
Anahtar kelimeler: Miyofasiyal ağrı sendromu; fizik tedavi; tetik nokta; tetik nokta enjeksiyonu

Introduction

Myofascial pain syndrome (MPS) is a musculoskeletal disorder which is characterized by pain, muscle spasms and muscle tenderness, as well as a limited range of motion, weakness, and rarely, autonomous dysfunction (1,2). It is the most common cause of musculoskeletal pain. The incidence of the disease is reported to be 12% in population. A total of 31% of the patients admitted with pain are diagnosed with MPS (3). Myofascial pain syndrome is characterized by referred pain arising from hypertensive trigger points advancing through the muscle. Trigger points are defined as local ischemic areas in muscles and myofascial tissues. Local ischemia is considered to induce local muscle spasms after a certain period due to recurrent microtrauma injuries, poor posture, and excessive use of muscles (2,3).

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The primary goals of the management are relieving pain, improving range of motion (ROM) of the joints, and removing predisposing factors for trigger points. In this respect, the main management options include patient education, management of predisposing factors, medical therapies with analgesics, myorelaxants, antidepressants, hot pack therapy, stretch and spray therapy, ischemic compression, therapeutic massage, biofeedback, transcutaneous electrical nerve stimulation (TENS), ultrasound (US), interferential (IFA) current, low-energy light amplification by stimulated emission of radiation (LASER), extracorporeal shock wave therapy (ESWT), trigger point injections, dry needling, and acupuncture (4).

This review focuses on the management approaches of MPS along with efficacy assessments in light of up-to-date randomized controlled studies, in particular, in the literature.

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Methods
An extensive literature search was performed to create a comprehensive narrative in the treatments for myofascial pain. This was done by searching PubMed, Ovid, and Google Scholar for the key terms that "myofascial pain syndrome, physical therapy, trigger point and trigger point injection". Controlled studies were given first priority, followed by observational studies. Systematic reviews and Cochrane reviews were included, and non-English sources were omitted.

Preventive Treatments of Myofascial Pain
Patient Education
Initially, the patient with MPS is informed about the muscular nature of the disease. The patient can be instructed by loading pressure on trigger points, which increases pain severity. Therefore, the patient is informed about his/her disease and feels more secure. The patient is also informed regarding predisposing factors including poor posture, excessive use of muscles, psychological stress, and preventive approaches against the risk factors to achieve a high rate of management success and prevent recurrences. In addition, the patient is instructed about the methods to handle pain. Therefore, the management of MPS requires a multidisciplinary team of specialists including clinical psychologists, physiotherapists, psychiatrists, and social advisors (4,5).

Management of predisposing factors
The following predisposing factors should be considered in the management of MPS (1,3):
Anatomical factors: anatomical asymmetry, leg-length inequality, pelvic asymmetry, scoliosis, and shoulder impingement syndrome.
Medical factors: Iron, vitamins B, C, and D, folic acid, Ca^{2+}, K^{+}, and Mg^{2+} deficiencies; hypothyroidism, testosterone or estrogen deficiencies; entrapment neuropathies; thoracic outlet syndrome; radiculopathy and multiple sclerosis; central sensitivity syndromes; multiple chemical sensitivity; irritable bowel syndrome; endometriosis; chronic infection foci; and statin use.
Ergonomic factors: poor posture with an excessive load on muscles, activity-induced mechanical stress, and recurrent activities.
Psychosocial factors: depression, psychosomatic diseases, and secondary gain.
Sleep disorders: depression, anxiety, chronic pain, medications, caffeine, and shift work.
Parafunctional problems: nocturnal bruxism, teeth grinding, nail biting.
Management of these predisposing factors or elimination of their effects is a critical step in the management schedule of MPS (1,3).

Pharmacologic Treatment of Myofascial Pain
The most recommended medical therapies include analgesics, non-steroidal anti-inflammatory drugs, myorelaxants and tricyclic antidepressants, anxiolytics and anticonvulsants (6,7).

Tramadol, a weak opioid agonist, was reported to be effective in relieving generalized pain associated with myofascial pain. Initially, short-term codeine was also used to achieve temporary relief (8). In addition, diclofenac patches on the trigger points in the trapezius muscle were associated with improved clinical scores (9). Furthermore, short-term muscle relaxants may be used in patients with typical manifestations of MPS along with generalized muscle spasms (7). In a study investigating the efficacy of thiocolchicoside ointment or thiocolchicoside injections, the authors reported that both management modalities were effective alternatives in the management of MPS (10). Furthermore, there is another study reporting that tizanidine, an alpha-adrenergic agonist, may reduce pain in patients with MPS (11).

Sleep disorders are common in patients with MPS. Low-dose tricyclic antidepressants such as amitriptyline or doxepin hydrochloride can be used to improve sleep quality and reduce pain severity, as well as to treat symptoms of depression, along with chronic pain in patients with MPS. Additionally, antihistamines including dimenhydrinate and diphenhydramine hydrochloride can be administered to patients with MPS suffering from sleep disorders. Diazepam is also recommended for the relaxation of reflex spasms and the management of anxiety in MPS patients (3,4).

Non-pharmacologic Treatments of Myofascial Pain
Superficial heating
The most common superficial heat applications used for MPS and other musculoskeletal disorders are hot pack therapy and infrared heating. These modalities are utilized to relieve painful muscle spasms, reduce pain, and increase ROM of the joints, as well as for sedation in patients with MPS. However, superficial heating is contraindicated in patients with sensorial impairment, poor skin circulation, malignant tumors, or acute inflammation (7).

Exercise
Stretching and relaxation exercises as well as posture strengthening exercises are the most frequently recommended therapies for MPS patients. Passive stretching is considered to be the only tolerable exercise on hypersensitive trigger points and to have a crucial role in the management of MPS, as it provides long-term relaxation. Muscle stretching techniques are effective when the sarcomere length through the involved muscle is equal. As a result, the vicious cycle can be terminated and ROM of the joints can be improved. In addition, posture exercises are useful in minimizing mechanical stresses on muscles (12). Furthermore, the primary goal of post-isometric relaxation (PIR) is to relax muscles, relieve pain, and enable a healthy synergism in agonist

muscles and a reciprocal link in antagonist muscles. This method has been also reported to be effective in the management of MPS (13).

Stretch and spray

Stretch and spray therapy inactivates trigger points and involved muscles. The involved muscle is stretched and sprayed quickly parallel to the muscle fibers at a distance of about 18 inches from the skin with a 30° angle, usually with fluoromethane. It is considered that sudden reductions in the skin temperature block pain sensation of the spinal stretch reflex and other points above. Reduced pain sensation allows muscles to reach to the full normal length to inactivate trigger points and relieve muscle spasms and referred pain (14). In one study, stretch and spray therapy was reported to be more effective in the management of chronic MPS, while stretching exercises along with superficial heating were more potent in the management of acute MPS (3). It was also observed that a higher number of children responded to stretch and spray therapy which was applied to trigger points (15).

Ischemic compression

Ischemic compression technique is based on the principle of thumb pressure applied to trigger points for a period of time. As the pressure is gradually increased, pain severity is reported to be reduced and ROM of the muscle is improved within 15 seconds to one minute (16). Simons et al. (2) recommended ischemic compression following hot pack therapy and active ROM. Ischemic compression followed by stretching exercises was reported to improve trigger point sensitivity and reduce pain severity (17,18). In addition, ischemic compression in combination with hot pack therapy and active ROM provided a dramatic improvement in MPS symptoms (14).

Massage

Massage, which has a wide range of use for relieving musculoskeletal pain, has a significant sedative, myorelaxant, and analgesic effect through improved local blood and lymphatic circulation (19). Massage is more effective than hot pack therapy alone in the management of MPS. However, massage techniques such as friction and petrissage may cause increased pain when applied to hypersensitive trigger points directly and intensively (20). In a study combining massage and exercise for the management of MPS, a significant improvement in clinical scores was observed (21).

Biofeedback

The main goal of biofeedback is to teach the patient how to control excessive muscle tensions. Although it is not used as monotherapy in the management of MPS, many patients benefit from biofeedback by gaining an insight how to handle muscle tension and anxiety (22). In a study using EMB biofeedback, a more significant reduction was obtained in pain severity and duration compared to the control group (23).

TENS

It has been suggested that TENS is effective in the management of musculoskeletal disorders, stimulation of gate-control mechanisms and sensory nerves, the release of β-endorphins and enkephalins, and pain relief through local vasodilation and stimulation of acupuncture points. A study investigating the efficacy of TENS on myofascial pain and trigger point sensitivity demonstrated that intensive TENS improved pain scores of all modules in the short-term; however, no difference in the local sensitivity of the trigger points was observed (24). In another study comparing TENS with placebo TENS on latent trigger points, TENS was found to be superior in reducing pain scores only (25).

US

Ultrasound can be applied as a part of physical therapy, thanks to its vasodilatory effect due to deep heating as well as by accelerating the metabolism, enhancing viscoelasticity, and decreasing pain and muscle spasm (4,5). Several studies showed that moderate-dose US (0.8-1.5 W/cm^2) was effective in the management of MPS (26,27). Additionally, an increase in the pressure pain threshold after several minutes of application was observed with low-dose US (520 W/cm^2) on trigger points in MPS patients (26). There are also several studies indicating the efficacy of high-power pain threshold (HPPT) US (1.5-3 W/cm^2) in the management of MPS (28,29). Similarly, Koca et al. (30) assessed the efficacy of low-, moderate-, and high-dose US in patients with MPS. The authors reported that HPPT US was more effective than low- and moderate-dose US.

IFA

Interferential therapy (IFA) is considered to be effective in the management of musculoskeletal disorders through several mechanisms including gate-control, endogenous opiate release, local pump effect, increased local circulation via autonomous nerves, and the elimination of chemicals that stimulate pain receptors (31,32). A study involving cervical MPS patients revealed that IFA that was applied to the upper trapezius muscle at 4000 Hz frequency for 20 minutes in combination with myofascial stretching exercises significantly improved early clinical scores (14).

LASER

It is considered that low-energy laser has analgesic, microcirculative, curative, and anti-inflammatory effects (33-35). There are a number of studies evaluating the efficacy of laser in the management of MPS in the literature. Simunovic (34) reported that low-energy laser significantly improved pain and functional scores. Hakguder et al. (35) observed that low-energy laser on trigger points plus stretching exercises were more effective than stretching

exercises only. However, Dundar et al. (36) found that laser therapy was not superior to placebo in patients with MPS.

ESWT

Extracorporeal shock wave therapy (ESWT) activates neovascularization by interfering with microcirculation around the tendons and secretes local growth factors in patients with tendinopathies. Many studies investigating the use of ESWT in musculoskeletal disorders are available in the literature (37). However, there are a limited number of studies regarding the use of ESWT in MPS. Müller and Licht (38) reported that low-dose ESWT (0.04-0.26 mJ/mm^2) for a mean session time of 7.3 provided a statistically significant improvement in pain scores in MPS patients. In another study, the authors reported that three sessions every three days with low-dose ESWT were more effective compared to conventional US therapy (39).

Trigger point injections

An intramuscular technique is one of the most effective methods to desensitize painful points. Trigger point injections provide rapid pain relief in patients with MPS (3,4). The most frequently used medications include local anesthetics, physiological saline, corticosteroids, botulinum toxin and tropisetron (4,5). Trigger point injections are mainly used to break the vicious cycle of ischemia-pain-muscle spasm, reduce hypersensitivity, dilute nerve-sensitizing substances, release intracellular potassium, which may depolarize and thereby disrupt nerve conduction, increase circulation at the trigger point due to the local vasodilation effect, activate the endogenous opioid system, and block the intra-dorsal horn passage of noxious (3,4).

Gül and Onal (40) reported that local anesthetics with lidocaine injections produced a higher improvement in the clinical scores in MPS patients, compared to TENS or laser therapy. Another study demonstrated that local anesthetic injections on trigger points relieved pain and improved limited cervical ROM; however, the symptoms recurred within 10 minutes following the naloxone infusion (an endogenous opioid antagonist) (41). Güzel et al. (42) compared local anesthetic injections with dry needling in MPS patients. The authors reported that local anesthetic injections and dry needling on trigger points had similar efficacy. However, they concluded that clinical efficacy was initiated earlier with local anesthetic injections, offering a positive psychological impact for the patients. Another study suggested that diclofenac injections at myofascial trigger points reduced the pain score more than lidocaine injections (43). Although steroid injections at trigger points are still controversial, triamcinolone plus lidocaine were found to cause a relatively higher rate of pain relief, compared to lidocaine monotherapy (44). In a comparison study between saline and mepivacaine injections on myofascial trigger points, Frost et al. (45) reported that the saline injection was more effective. In recent years, botulinum toxin injection has become promising in the management of chronic MPS. However, it is relatively costly. Chesire et al. (46) reported that botulinum toxin type A improved pain scores more than a placebo. On the other hand, Wheeler et al. (47) did not observe any significant difference in the healing process between the botulinum toxin and the placebo in patients with refractory unilateral cervicothoracic myofascial pain. On the contrary, Porta (48) compared botulinum toxin type A and steroid injections and reported that the botulinum toxin was more effective during the first and second visits, in particular, and at one and two months, respectively. Overall, botulinum toxin injection is considered to have a longer effect with a lower rate of injection requirements compared to local anesthetics or steroid injections (46,48). Furthermore, tropisetron at trigger points produced rapid and long-term improvements in pain scores in MPS patients (49,50). Saline or local anesthetic injections with or without steroids were reported to have several side effects including worsened healing, tissue weakness, local atrophy of the adipose tissue, skin depigmentation, crystal deposit-induced inflammation, hypothalamo-pituitary axis suppression, local bleeding, pneumothorax, and joint damage presenting with avascular necrosis (44-48).

Dry needling

Dry needling exerts its therapeutic effect by mechanically disrupting sensory or motor components of the nerve endings, which contribute to the trigger point activity, having an impact on local endorphin release and gate-control mechanism (51). Although no drug-related adverse event is expected with dry needling, injection should be administered to the exact trigger points. A number of studies on dry needling are available in the literature and it is mostly considered an effective therapy (51). Hong and Hsueh (52) investigated the efficacy of lidocaine injection and dry needling and reported that none of the therapeutic methods was superior to another. However, they highlighted that the patients who underwent dry needling had a relatively higher post-injection sensitivity. In another study using dry needling, lidocaine monotherapy, lidocaine plus steroid injection, and acupressure plus vapocoolant in patients with back pain, Garvey et al. (53) observed that all techniques significantly improved pain scores, indicating no difference among the groups. Dry needling has only a few iatrogenic side effects such as minor local bleeding and pneumothorax. Dry needling and injections are contraindicated in pregnancy, bleeding diathesis, concomitant use of anticoagulants, and local or systemic infection (44,51).

Acupuncture

There is a high degree of correspondence of 71% between the locations of trigger points and

acupuncture points. According to the 1997 National Institutes of Health (NIH) consensus statement on acupuncture, acupuncture is an adjuvant therapy and can be regarded as an alternative in the management of myofascial pain, fibromyalgia, back pain, osteoarthritis, and lateral epicondylitis (54).

Conclusion

In conclusion, several factors may play a role in the etiology of MPS. Management includes exercise programs in particular and invasive and non-invasive therapies, depending on the clinical status of the patient. Monotherapy may be insufficient to achieve complete recovery in MPS patients. There is growing evidence that trigger point injections and dry needling, as well as stretching exercises are effective alternatives in the management of MPS. Nevertheless, it should be kept in mind that management success is primarily based on the cooperation of the patient and the treating physician, as well as the elimination of predisposing factors.

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