Management of Masticatory Myofascial Pain

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Masticatory myofascial pain is a relatively frequent occurrence in patients seen by the orthodontist. Thus it is important to understand the management of this condition. Treatment is generally directed toward the restoration of a more physiological state in the muscles of mastication and involves medications, appliances, various forms of behavioral modification, as well as the use of muscle exercises and trigger point therapy. This article focuses on the role of the latter modalities in the management of myofascial pain and dysfunction. (Semin Orthod 1995;1:229-243.)

Myofascial pain (MFP) is a regional muscle pain disorder characterized by localized muscle tenderness and pain. It is the most common cause of persistent regional pain such as back pain, shoulder pain, tension-type headaches, and facial pain. Two studies of pain clinic populations have revealed that MFP was cited as the most common cause of pain and that it was responsible for 54.6% of a chronic head and neck pain population[1] and 85% of a back pain population.[2] In addition, Skootsky et al[3] studied myofascial pain in a general internal medicine practice and found that among those patients that present with pain, 29.6% had myofascial pain as the cause. In an epidemiological study of orofacial pain in a young female general population (age 20 to 40 years) using specific criteria, Schiffman et al[4] found that myofascial pain in the masticatory muscles occurred in about 50% of this population, with 6% having symptoms severe enough to be comparable to patients seeking treatment.

The clinical characteristics of myofascial pain include trigger points in muscle bands, pain in a specific zone of reference, occasional associated symptoms, and the presence of contributing factors (Table 1). A trigger point is defined as a localized, deep tenderness in a taut band of skeletal muscle that is responsible for the pain in the zone of reference and, if treated, will resolve the resultant pain.[1,5-9] The zone of reference is defined as the area of perceived pain referred by the irritable trigger point. It is usually located over the trigger point but can spread from the trigger point to a distant site (Fig 1). There are generally no neurological deficits associated with the disorder unless a nerve entrapment syndrome, with weakness and diminished sensation, coincides with the muscle trigger points.[8] Blood and urine studies are generally normal unless there are changes caused by a concomitant disorder. Imaging studies, including radiographs and magnetic resonance imaging, do not show any pathological changes in the muscle or connective tissue.

Because of this lack of objective findings, as well as confusion about diagnostic criteria, MFP is often overlooked as a common cause of persistent pain.[8,10-16] This article discusses the most recent information on diagnostic criteria, clinical characteristics, and treatment strategies for myofascial pain.

Diagnostic Criteria

The development of diagnostic criteria is a critical step in improving our understanding of MFP. Because MFP can occur in muscles throughout the body, the criteria need to be broad enough to allow application to different regional muscle groups and to distinguish MFP from systemic disorders affecting the muscles, such as fibromyalgia. For each regional MFP syndrome, such as headache, neck

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Table 1. Clinical Characteristics of Myofascial Pain

Trigger points in taut band of muscle
Tenderness on palpation
Consistent points of tenderness
Palpation alters pain locally or distally
Associated symptoms
Otologic
Paresthesias
GI distress
Visual disturbances
Dermatographia
Pain in zone of reference
Constant dull ache
Fluctuates in intensity
Consistent patterns of referral
Alleviation with extinction of trigger point
Contributing factors
Traumatic and whiplash injuries
Occupational and repetitive strain injuries
Physical disorders
Parafunctional muscle tension-producing habits
Postural and repetitive strains
Disuse
Metabolic/nutritional
Sleep disturbance
Psychosocial and emotional stressors

pain, or orofacial pain, experts in the area need to obtain a consensus on the definition of MFP and ensure construct validity of the clinical items that are potentially used to diagnose the condition. Studies also need to be accomplished using discriminate analysis between various populations and disorders to determine which items best predict MFP of each region. In establishing these diagnostic criteria, care must be taken to minimize false positives and false negatives so that the sensitivity and specificity are acceptable and repeatable by the same and different investigators. Using this developmental process, diagnostic criteria for the masticatory muscles have been developed and the disorder has been termed masticatory myofascial pain (MMFP).

Thirty-one patients with MMFP and 31 subjects who met the criteria for being normal were each examined by a rater who was blind to their status.[17] Measures included a muscle index of 44 extraoral, intraoral, and cervical muscle sites to assess the scope of tenderness in the muscles involved in masticatory function; pressure algometry to measure the absolute and relative pressure pain thresholds of the muscles; and determination of the presence of taut muscle bands, twitch response, and pain radiation on palpation. The techniques used for examination were defined and their reliability and validity were confirmed. Validity of the original MMFP diagnosis or the normal status of the subjects was determined based on all relevant clinical data by another independent examiner different than the rater.

The results confirmed that the scope of tenderness (percentage of tender muscle sites) is the most valid predictor of the presence of MMFP. Other items, including pressure algometry to measure the absolute pressure pain thresholds of the muscles, the twitch response, and pain radiation on palpation were predictive but not to the same extent as scope of tenderness. Items that showed no difference between the groups included taut muscle bands and relative pain thresholds. Different cutoff levels of scope of tenderness were analyzed to determine which level provided the best sensitivity and specificity and it was found that 28% best distinguished clinical cases from normal subjects. However, this clinical population had higher levels of tenderness than subjects with MMFP in the general population and, thus, the definition for general populations will show a lower percentage of tender sites. In addition, it is possible that the definition of myofascial pain in other areas of the body may also have a different level of tenderness as the most accurate definition.

Clinical Characteristics

The major characteristics of myofascial pain include trigger points in muscles and local and referred pain. However, MFP, particularly in the head and neck, has numerous ancillary findings and common associations with joint disorders and other pain disorders. In addition, despite trauma being the major initiating factor, there are a multitude of other contributing factors that perpetuate the condition and make it more difficult to treat (Table 1). Each of these will be discussed, along with current knowledge of their prevalence.

Trigger Points

Trigger points are a 2 to 5 mm diameter point of increased hypersensitivity in palpable bands of skeletal muscle, tendons, and ligaments, which have decreasing hypersensitivity as one palpates the band further away from the trigger point. The points may be active or latent.[9]

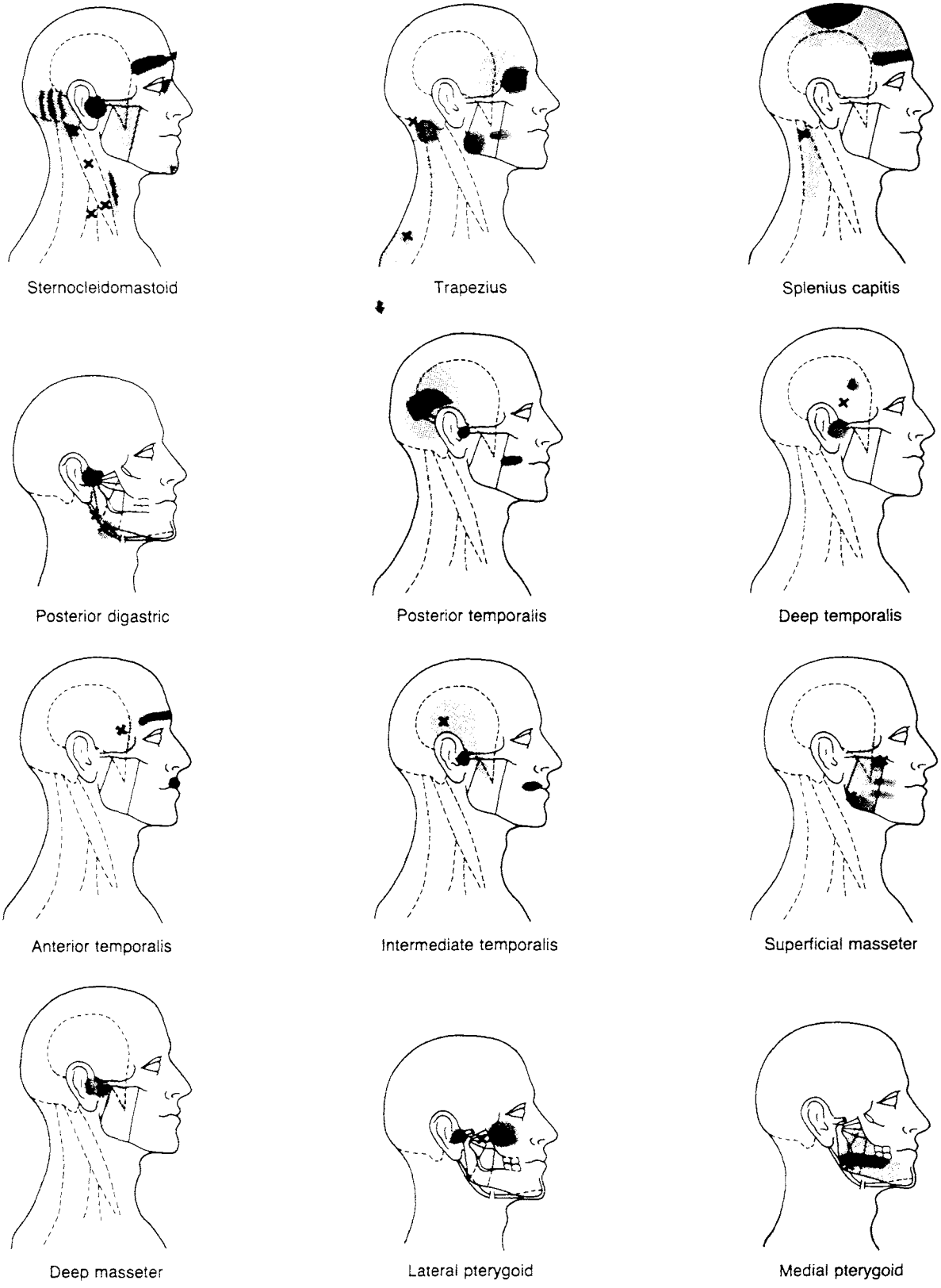

Figure 1. Trigger points with associated patterns of referral in the head and neck. ■ Primary pain referral; □ secondary pain referral; ×, trigger area.

Active trigger points are hypersensitive and display continuous pain in the zone of reference, which can be altered with specific palpation. Latent trigger points display hypersensitivity but no continuous pain. This localized tenderness has been found to be a reliable indicator of the presence and severity of MFP with both manual palpation and pressure algometers.[18-20] However, the presence of taut bands appears to be a characteristic of skeletal muscles in all subjects regardless of the presence of MFP.[17]

Palpating the active trigger point with sustained, deep, single-finger pressure on the taut band will elicit an alteration of the pain (intensify or reduce) in the zone of reference (area of pain complaint) or cause radiation of the pain toward the zone of reference. This can occur immediately or be delayed a few seconds. The pattern of referral is both reproducible and consistent with patterns in other patients with similar trigger points (Fig 1). This enables a clinician to use the zone of reference as a guide to locate the trigger point for purposes of treatment.

The patient's behavioral reaction to this firm palpation is a distinguishing characteristic of MFP and is termed a "jump sign." This reaction may include withdrawal of the head, wrinkling of the face or forehead, or a verbal response such as, "That's it" or, "Oh, yes." The "jump sign" should be distinguished from the "local twitch response," which can also occur with palpation. The latter response can be elicited by placing the muscle in moderate passive tension and snapping the band containing the trigger point briskly with firm pressure from a palpating finger moving perpendicularly across it at its most tender point. This can produce a reproducible shortening of the muscle band (visible in larger muscles) and associated electromyographic changes characteristic of the "local twitch response" described later.[12,21-23] In locating an active trigger point, the "jump sign" should be elicited and, if possible, alteration of the patient's complaint by the palpation.

Local and Referred Pain

In examining the basic concept of MFP, namely local and referred pain from trigger points, there must be evidence that supports the concept that the pain is related to and/or generated by the trigger point, particularly if it is distant from the trigger point. This evidence primarily stems from clinical observation and needs to be studied more rigorously in well controlled scientific studies. First, clinical examination of trigger points shows that palpation of the active trigger points in accessible muscles will alter the referred pain (usually intensification). In addition, injection of a local anesthetic into the active trigger point will reduce or eliminate the referred pain and the tenderness.[24-26] Treatment such as spray and stretch, exercises, or massage directed at the muscle with the trigger point will also predictably reduce the referred pain.[27] Other evidence to confirm the relationship includes the use of pressure algometry to show a positive correlation between both the scope of tenderness and the severity of pain.[28] In addition, the change in scope of tenderness in response to treatment correlates positively with the change in symptom severity ($r = .54$).[28]

Ancillary Findings and Relationship with Other Disorders

The affected muscles may also display an increased fatigability, stiffness, subjective weakness, pain on movement, and cause slightly restricted range of motion that is unrelated to joint restriction.[1,6-9] The muscles are painful when stretched, causing the patient to protect the muscle through poor posture and sustained contraction.[29] For example, a study of range of jaw motion in patients with MFP and no joint abnormalities showed a slightly diminished range of motion (approximately 10%) compared with normal subjects and pain on full range of motion. This is considerably less limitation than was found with joint locking caused by a TMJ internal derangement.[17] This restriction may perpetuate the trigger point and cause other trigger points in the same muscle and agonist muscles. As mentioned previously, this can result in multiple trigger points with overlapping areas of pain referral and changes in pain patterns as different trigger points are inactivated.

Although routine electromyographic (EMG) studies show no significant abnormali-

ties associated with trigger points, some specialized EMG studies show differences.[12,21-23] A burst of electrical activity is found with needle insertion into the trigger point and not in adjacent muscle fibers.[30] In two experimental EMG studies of trigger points, Simons[23] and Fricton et al[21] found abnormal electrical activity associated with the local muscle twitch response when specifically snapping the tense muscle band containing a myofascial trigger point. The consistency of soft tissues over the trigger points has been found to be more than over the adjacent muscle.[31,32] Skin overlying trigger points in the masseter muscle seems to be warmer as measured by infrared emission.[33,34] Although each of these findings are, by and large, from solitary studies, they do provide preliminary evidence of a broad range of objective characteristics that may prove important in the diagnosis of MFP.

Myofascial pain, particularly in the head and neck, is frequently overlooked as a diagnosis because it is often accompanied by signs and symptoms in addition to pain, coincidental pathological conditions, and behavioral and psychosocial problems. Table 2 lists the percentage of patients with MFP who had other specific neurological, musculoskeletal, and otologic signs and symptoms.[1] These signs and symptoms may appear to mimic many other conditions, including arthritis, fibromyalgia, migraine headache, neuralgia, temporal arteritis, causalgia, temporomandibular joint disorders, spinal disc disease, and sinusitis, and cause confusion in diagnosis.

However, the characteristics of MFP also appear to accompany many other pain disorders. For example, trigger points often develop in association with joint pathology such as disc derangements, osteoarthritis, and subluxation.[1,20] Table 3 lists the number of concomitant diagnoses found in a study of 164 patients with head and neck MFP, with joint problems being most frequent at 42%.[1] MFP has also been reported to be found with systemic or local infections of viral or bacterial origin; with lupus erythematosus, scleroderma and rheumatoid arthritis; and along the segmental distribution of nerve injury, nerve root compression, or neuralgias. Moreover, pathology of specific viscera has been associated with the development of specific trigger points and patterns of pain referral, such as the trigger points in the pectoralis major found with acute myocardial infarction.[22]

Table 2. Additional Signs, Symptoms, and Disorders that Have Been Found with MFP of the Head and Neck

	N	%
Neurological		
Tingling	45	27.4
Numbness	43	26.2
Blurred vision	23	14.0
Twitches	20	12.2
Trembling	13	7.9
Excess lacrimation	12	7.3
Musculoskeletal		
Fatigue	65	39.6
Tension	60	36.6
Stiff joints	32	19.5
Swelling	20	12.2
Otologic		
Tinnitus	69	42.1
Ear pain	68	41.5
Dizziness	38	23.1
Diminished hearing	29	17.7

n = 164.
Data from Fricton et al.[1]
Note. Additional signs such as excessive sweating, skin flushing, muscle twitching, and swelling have also been observed. The numerous otologic symptoms such as ear pain, tinnitus, diminished hearing, dizziness, vertigo, and fullness in the ear have been reported despite negative examinations of the ear.[10,12,14,29,49,50] In addition, other symptoms may include scratchy sensations, cutaneous hyperesthesia, and tooth sensitivity.[50,51]

It is unclear whether MFP develops in response to other pathological conditions or coincidentally. There is a common belief that muscle tenderness and pain are only a reaction to these other disorders and do not represent specific disorders by themselves. However, treatment of the concomitant disorder will reduce the MFP in some cases and in other cases will not. It is possible that in associated cases, "muscle splinting" may occur as a central nervous system response to a barrage of periph-

Table 3. Concomitant Diagnoses Found With MFP of the Head and Jaw[1]

Other diagnoses	*N*	%
TMJ internal derangement	50	30.4
TMJ degenerative joint disease	19	11.6
Paroxysmal trigeminal neuralgia	4	2.4
Sinusitis	2	1.2
Cluster headache	2	1.2
Total		46.8

Data from Fricton et al.[1]

eral nociceptive input from other disorders that cause pain, particularly in other parts of the motor system such as the joints. Reducing this barrage of input may have an effect in reducing the "splinting." In other cases, it is possible that splinting of agonist muscles may stem from pain in a specific muscle contributing to regional tenderness and pain. If this does occur, it may explain the common regional patterns that occur in myofascial pain and why long-term success in treatment depends on reducing trigger points in a specific muscle.

Many of the same characteristics of MFP are also found in other muscle pain disorders such as fibromyalgia, tension-type headaches, myositis, and muscle spasm. Perhaps the most pragmatic taxonomy related to differentiating muscle pain disorders is in the Academy of Orofacial Pain Guidelines for Diagnosis and Management of Temporomandibular Disorders. In this classification, different muscle disorders are descriptively defined by their characteristics and classified as myofascial pain (regional pain and localized tenderness), fibromyalgia (widespread pain with tender points), myositis (regional pain and diffuse tenderness), muscle spasm (brief painful contraction with limited range of motion), contracture (longstanding limited range of motion), and muscle splinting (regional pain and localized tenderness accompanying a joint problem). Other terms used in the past for the broad category of muscle pain syndromes such as fibrositis, myofascial pain dysfunction (MPD), myelogelosen, interstitial myofibrositis, musculofascial pain dysfunction, TMJ dysfunction, nonarticular rheumatism, and myalgia are poorly defined and confusing and, thus, should be avoided.

In most recent classifications, the regional pain found with MFP is distinguished from the widespread muscular pain associated with fibromyalgia (FM). These two disorders have many similar characteristics and may represent two ends of a continuous spectrum. For example, as Simons[35] notes, 16 of the 18 tender point sites in FM lie at well-known trigger point sites. Many of the clinical characteristics of FM, such as fatigue, morning stiffness, and sleep disorders, can also accompany MFP. Bennett[36] compares these two disorders and concludes that they are two distinct conditions, but which may have the same underlying pathophysiology. The clinical significance of distinguishing between them lies in the more common centrally generated contributing factors in FM (sleep disorders, depression, and stress) versus the more common regional contributing factors in MFP (trauma, posture, and muscle tension habits), as well as the better prognosis in the treatment of MFP as compared with FM.

Contributing Factors

As with all chronic pain conditions, concomitant social, behavioral, and psychological disturbances often precede or follow the development of MFP.[37] Patients report psychological symptoms such as frustration, anxiety, depression, and anger when acute cases become chronic. Maladaptive behaviors such as pain verbalization, poor sleep and dietary habits, lack of exercise, poor posture, bruxism, and other tension producing habits and medication dependencies can also be observed when pain becomes prolonged. Each of these may complicate the clinical picture by perpetuating the pain, preventing compliance with the treatment program, and causing self-perpetuating chronic pain cycles to develop. Although a number of factors can complicate identification and management, IMPATH is a psychometrically derived instrument that facilitates assessment of the contributing factors.[37]

Parafunctional muscle tension-producing habits, such as back bracing, neck tensing, and teeth clenching, can be generated as a form of tension release as well as a learned behavioral response. The relationship between stress and MFP is difficult to assess because of the difficulty in defining stress and the major methodological problems that exist in studying stress. Although no evidence suggests a direct causal relationship between stress and myofascial pain, some studies suggest that a correlation does exist between them. There is a higher than normal incidence of psychophysiologic disorders such as migraine headaches, backache, neck pain, nervous asthma, and ulcers in patients with myofascial pain, which suggests similar etiologic factors.[38,39] Also, higher than normal levels of urinary catecholamines and 17-hydroxysteroids, commonly associated with

a high number of stressful events, were found in a group of myofascial pain dysfunction syndrome patients compared with controls.[40] In addition, stress management interventions frequently provide significant benefit for patients with MFP.

Poor muscle health caused by a lack of exercise, muscle disuse, or poor posture has also been suggested to predispose the muscle to the development of trigger points.[41,42] They often develop after muscles have been weakened through immobilization caused by, for example, the prolonged use of cervical collars or extended bedrest. Postural discrepancies may also contribute to joint displacement and abnormal functional patterns, and both can contribute to abnormal proprioceptive input and sustained muscle contraction. Poor posture caused by a unilateral short leg, small hemipelvis, increased cervical or lumbar lordosis, noncompensated scoliosis, occlusal abnormalities, and poor positioning of the head or tongue have also been implicated.[35] Table 4 lists common postural problems found with myofascial pain of the head and neck.

Table 4. Postural Problems of the Head and Neck in 164 Patients With MFP as Noted on Examination[1]

	n	%
Body		
Poor sitting/standing posture	157	96.0
Forward head tilt	139	84.7
Rounded shoulders	135	82.3
Poor tongue position	111	67.7
Abnormal lordosis	76	46.3
Scoliosis	26	15.9
Leg length discrepancy	23	14.0
Occlusion		
Slide from retruded contact position to intercuspal contact position of >1 mm	140	85.5
Unilateral occlusal prematurities in intercuspal contact position	113	68.9
Class II, Division 1 malocclusion	51	31.1
Class III malocclusion	16	9.8

Treatment of Masticatory Myofascial Pain

Myofascial pain can range from simple cases with transient single muscle syndromes to complex cases involving multiple muscles and many interrelating contributing factors. Many investigators have found success in the treatment of MFP using a wide variety of techniques such as exercise, trigger point injections, vapocoolant spray and stretch, intraoral appliances, TENS, biofeedback, posture correction, tricylic antidepressants, analgesic and muscle relaxant medications, and addressing perpetuating factors.[5-9,43,44] However, the difficulty in managing MFP lies in the critical need to match the level of complexity of the management program with the complexity of the patient. Failure to address the entire problem, including all involved muscles, concomitant diagnoses, and contributing factors, may lead to failure to resolve the pain and perpetuation of a chronic pain syndrome (Table 5).

Although there are no controlled studies examining progression of chronic pain syndromes, results from clinical studies show that many patients with MFP have seen multiple clinicians and received numerous medications and various other singular treatments for years without having more than temporary improvement. In one study of 164 MFP patients, the mean duration of pain was 5.8 years for men and 6.9 years for women, with a mean of 4.5 past clinicians seen.[1] In another study of 102 consecutive TMJ and craniofacial pain patients, which included 59.8% MFP patients, the mean duration of pain was 6.0 years, with 28.8 previous treatment sessions, 5.1 previous doctors, and 6.4 previous medications.[1]

These and other studies of chronic pain suggest that regardless of the pathogenesis of muscular pain, a major characteristic of some

Table 5. The Problem List Associated With Patients With MFP Should Include the Symptoms, the Diagnoses, and Contributing Factors

Symptoms
Physical
Functional
Emotional
Diagnosis
Primary (responsible for the chief complaints)
Secondary (responsible for the associated symptoms or aggravate the primary diagnosis)
Contributing factors (those factors that initiate, perpetuate, or result from the disorders and in some way may complicate management)
Emotional
Cognitive
Social
Behavioral
Physical
Environmental

of these patients is the failure of traditional approaches to resolve the problem. Each clinician confronted with a patient with MFP needs to recognize and address the whole problem to maximize the potential for a successful outcome. Strategies can differ depending on whether the condition is acute, simple, or complex (Fig 2). Acute cases can often be managed with palliative care strategies designed to protect the muscles and encourage healing (Table 6). Simple cases with minimal behavioral and psychosocial involvement can typically be managed by a single clinician with home care, exercises, a stabilization appliance, and spray and stretch. Complex patients can be most effectively managed within an interdisciplinary pain clinic setting that uses a team of clinicians to address different aspects of the problem in a concerted fashion. This team approach often requires shifting the paradigms implicit in patient care and are listed in Table 7.

Regardless of the complexity, evaluation of myofascial pain includes locating the trigger points and muscles involved as well as recognition of all contributing factors. Management of the syndrome follows with muscle exercises, bite appliances, therapy to the trigger points, and reducing all contributing factors. The short-term goal is to restore the muscles to normal length, posture, and achieve full range of joint motion with exercises and trigger point therapy (Table 6). This is followed long-term with a regular muscle stretching, postural, and strengthening exercise program as well as control of the contributing factors. Each of these major interventions will be discussed in more detail.

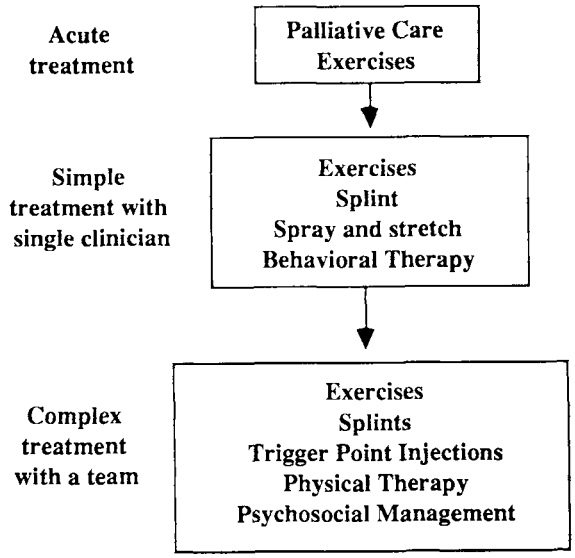

Figure 2. Treatment triaging of patients with masticatory myofascial pain.

Table 6. Short and Long-term Goals in Treatment of Myofascial Pain

Short-term goals
Reduce pain
Restore muscles to normal length and achieve a full range of joint motion
Restore muscles to normal posture
Reduce sustained muscle activity
Long-term goals
Restore normal lifestyle activities
Reduce contributing factors
Regular stretching, postural, and conditioning exercises
Proper use of muscles

Muscle Exercises

The most useful techniques for muscle rehabilitation include muscle stretching, posture, and strengthening exercises. A home program of active and passive muscle stretching exercises will reduce the activity of trigger points, whereas postural exercises will reduce the susceptibility to reactivation of trigger points by physical strain. Strengthening and conditioning exercises will improve circulation, strength, and durability of the muscles.

Evaluating the range of motion of muscles is the first step in prescribing a set of exercises to follow. For example, in the head and neck,

Table 7. Shifting the Doctor/Patient Paradigms Involves Each Member of the Team Following the Same Concepts by Conveying the Same Messages in Their Dialogue with the Patient

Concept	*Statement*
Self-responsibility	You have more influence on your problem than we do.
Self-care	You will need to make daily changes in order to improve your condition.
Education	We can teach you how to make the changes.
Long-term change	It will take at least 6 months for the changes to have an effect.
Strong doctor-patient relationship	We will support you as you make the changes.
Patient motivation	Do you want to make the changes?

range of motion should be determined for the jaw and neck at the initial evaluation. A limited mouth opening will indicate if there are any trigger points within the elevator muscles: temporalis, masseter, and medial pterygoid. If mandibular opening is measured as the interincisal distance, the maximum range is generally between 42 and 60 mm or approximately three knuckles' width (nondominant hand). Mouth opening with trigger points in the masseter will be between 30 mm and 40 mm or two knuckles' width. If contracture of the masticatory muscles is present, mouth opening can be as little as 10 to 20 mm. Other causes of diminished mouth opening include structural disorders of the temporomandibular joint such as ankylosis, internal derangements, and gross osteoarthritis.

Passive and active stretching of the muscles will increase the opening to the normal range as well as decrease the pain. Passive stretching of the masticatory muscles during counterstimulation of the trigger point can be accomplished through placing a properly trimmed, sterile cork, tongue blades, or other object between the incisors while the spray and stretch technique is accomplished. Active stretching at home and in the office can be accomplished using the exercises noted in Figures 3 and 4. It must be emphasized that rapid, jerky stretching or overstretching should be avoided to reduce potential injury to the muscle.

Figure 3. Jaw stretching exercise. This exercise can be performed gradually and gently six times daily for 1 minute each time. The mouth should be stretched slightly beyond the point of tightness and pain. Precaution should be taken to avoid overstretching when an acutely strained jaw or severe capsulitis of the temporomandibular joint are present.

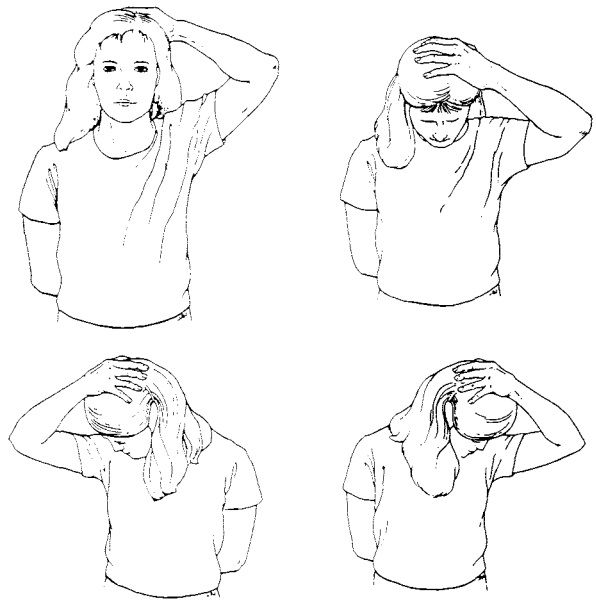

Figure 4. Neck stretching exercise. This exercise can be performed gradually and gently six times daily for 1 minute each time. Precaution should be taken to avoid stretching when there is an acutely strained neck, severe cervical osteoarthritis with nerve compression, recent surgery in the area or other structural cervical disorders.

Postural exercises for MFP are designed to teach the patient mental reminders to hold the body in a balanced, relaxed position and to use the body with positions that afford the best mechanical advantage. This includes patients with static postural problems such as unilateral short leg, small hemipelvis, occlusal discrepancies, scoliosis, or functional postural habits such as forward head, jaw thrust, shoulder phone bracing, and lumbar lifting. In a study of postural problems in 164 head and neck MFP patients, Fricton and associates[1] found poor sitting/standing posture in 96%, forward head position in 84.7%, rounded shoulders in 82.3%, lower tongue position in 67.7%, lordosis in 46.3%, scoliosis in 15.9%, and leg length discrepancy in 14.0%. In improving posture, specific skeletal conditions such as structural asymmetries or weakness of certain muscles need to be considered. In the masticatory system, the patient should be instructed to place the tongue gently on the roof of the mouth and keep the teeth slightly apart. In the cervi-

cal spine, a forward or lateral head posture must be corrected by guiding the chin in and the head vertex up. The shoulders will naturally fall back if the thorax is positioned up and back with proper lumbar support. Patients need to be instructed in proper posture for each position, sitting, standing, and lying down, as well as in movements that are performed repetitively throughout the day such as lifting or turning the head to the side. Sleeping on the side or back is particularly important for patients who wake up with muscle soreness.

Improved posture is also facilitated by regular physical conditioning. Patients need to be placed on a conditioning program to increase aerobic capacity and strength. Aerobic programs, such as becoming involved in an exercise class, regular running, walking, biking, or swimming will improve the comfort, endurance, and functional status of patients with MFP.[9]

Occlusal Appliances

Occlusal appliance therapy can be effective alone or in combination with other treatments for MMFP. The full-arch stabilization appliance is the most common one used for MMFP. This appliance, also termed a flat-plane, gnathologic, or full-coverage splint, is an appliance that covers all of the mandibular or maxillary teeth. It is designed to provide postural stabilization and to protect the TMJ, muscles, and teeth. The occlusal surface can be adjusted to provide a stable jaw posture by creating single contacts of all posterior teeth in centric relation and centric occlusion. Anterior guidance is provided by an incisal plane, and lateral guidance is provided by a canine ramp. Complications that can occur with the use of any appliance include caries, gingival inflammation, mouth odors caused by poor oral hygiene, speech difficulties, and psychological dependence on the appliance.

Trigger Point Therapy

There are many methods suggested for providing repetitive stimulation to inactivate trigger points. Massage, acupressure, and ultrasound provide noninvasive mechanical disruption to inactivate the trigger point. Moist heat ice packs, fluorimethane, and diathermy provide skin and muscle temperature change as a form of trigger point counterstimulation. Transcutaneous electrical nerve stimulation (TENS), electroacupuncture, and direct current stimulation provide electric currents to stimulate the muscles and trigger points. Acupuncture and trigger point injections of local anesthetic, corticosteroids, or saline cause direct mechanical or chemical alteration of trigger points. However, the two most common techniques for treating a trigger point are the spray and stretch technique and trigger point injections.

With the spray and stretch technique, application of a vapocoolant spray such as fluorimethane over the muscle and simultaneous passive stretching can provide immediate reduction of pain, although lasting relief requires a full management program (Fig 5).[8] The technique involves directing a fine stream of fluorimethane from the finely calibrated nozzle toward the skin directly overlying the trigger point in the muscle. A few sweeps of the spray are first passed over the trigger point and zone of reference before adding sufficient manual stretch to the muscle to elicit pain and discomfort. The muscle is put on a progressively increasing passive stretch while the jet stream of spray is directed at an acute angle

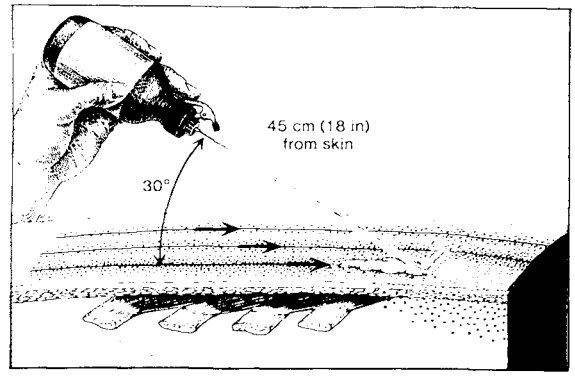

Figure 5. Spray and stretch procedure. The technique involves directing a fine stream of fluorimethane from the finely calibrated nozzle toward the skin directly overlying the muscle with the trigger point. The muscle is put on a progressively increasing passive stretch while the spray is directed at an acute angle from 30 to 50 cm (1 to 1.5 feet) away. This sequence can be repeated up to four times if the clinician warms the muscle with his or her hand or warm moist packs to prevent overcooling after each sequence. Precaution should be taken to avoid frosting the skin, lowering the underlying skeletal muscle temperature, and overstretching to avoid aggravating the muscle pain. (Reprinted with permission from Travell and Simons, Ref 9)

from 30 to 50 cm (1 to 1.5 feet) away. It is applied in one direction from the trigger point toward its reference zone in slow even sweeps over adjacent parallel areas at a rate of about 10 cm per second. This sequence can be repeated up to four times if the clinician warms the muscle with his or her hand or warm moist packs to prevent overcooling after each sequence. Frosting the skin and excessive sweeps should be avoided because they may lower the underlying skeletal muscle temperature, which tends to aggravate trigger points. The range of passive and active motion can be tested before and after spraying as an indication of responsiveness to therapy. Failure to reduce trigger points with spray and stretch may be caused by (1) inability to secure full muscle length because of bone or joint abnormalities, muscle contracture, or the patient avoiding voluntary relaxation; (2) incorrect spray technique; or (3) failure to reduce perpetuating factors. If spray and stretch fails with repeated trials, direct needling with trigger point injections may be effective.

Trigger point injections have also been shown to reduce pain, increase range of motion, increase exercise tolerance, and increase circulation in muscles.[24-26] The pain relief may last for the duration of the anesthetic to many months, depending on the chronicity and severity of the trigger points, and the degree of reduction in perpetuating factors. Because the critical factor in relief seems to be the mechanical disruption of the trigger point by the needle, precision in needling the exact point and the intensity of pain during needling appear to be the major factors in trigger point inactivation[22] (Fig 6). Trigger point injections with a local anesthetic are generally more effective and comfortable than dry needling or injecting other substances such as saline, although acupuncture may be helpful for patients with chronic trigger points in multiple muscles. The effect of needling can be complemented with the use of local anesthetics in concentrations less than those required for a nerve conduction block. This can markedly lengthen the relative refractory period of peripheral nerves and limit the maximum frequency of impulse conduction. Local anesthetics can be chosen for their duration, safety, and versatility. Three percent chlorprocaine (short acting) and 5% procaine (medium acting), without vasoconstrictors, are suggested.

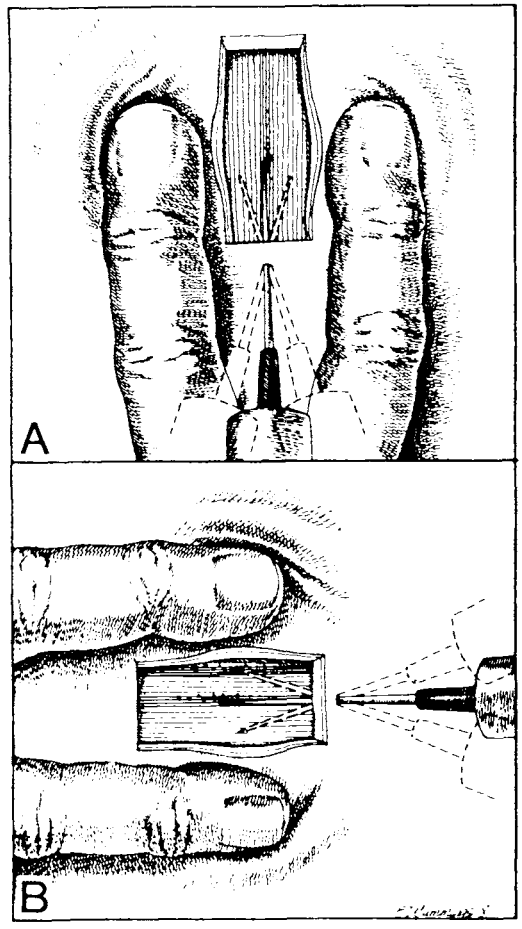

Figure 6. Trigger point injection. The technique of trigger point injection involves mechanical disruption by precision needling of the exact point. Both the intensity of the dull pain and a twitch response are indicators of the accuracy of the injection. After the initial needling and injection, the needle should be withdrawn from the muscle, but not the skin, and redirected to adjacent muscle bands. (Reprinted with permission from Travell and Simons, Ref 9)

Behavioral Therapy to Control Contributing Factors

One of the common causes of failure in managing MFP is the inability to recognize and subsequently to control contributing factors that may perpetuate muscle restriction and tension. As noted previously, postural contributing factors, whether behavioral or biological, perpetuate trigger points if not corrected. In general, a muscle is predisposed to developing prob-

lems if it is held in sustained contraction in the normal position and, especially, if it is held in an abnormally shortened position. Behavioral factors causing sustained muscle tension are the most common contributing factors, and can involve habits such as tooth clenching and grinding, cradling a phone between the head and shoulder for hours each day, studying with the head forward for a long time, or gum-chewing and other oral parafunctional habits. Correcting poor habits through education and long-term reinforcement is essential in preventing a reduced trigger point from returning. Approaches to change maladaptive habits and behaviors need to be addressed and presented as an integral part of the overall treatment program for all patients with MMFP and oral habits.

Behavioral therapy strategies are commonly used to change habits. These include a range of techniques such as habit reversal, massed practice, and over-correction. Although many simple habits can be changed by making the patient aware of them, changing persistent habits requires a structured program that is facilitated by a clinician trained in behavioral strategies. Patients should be aware that the habits will not change by themselves and that they are responsible for initiating and maintaining the behavioral change.

Habit change using a habit reversal technique can be accomplished by becoming more aware of the habit, knowing how to correct it (ie, what to do with the teeth and tongue), and knowing why it needs correction. When this knowledge is combined with a commitment to conscientious monitoring, most habits will change. Progress with changing habits should be addressed at all appointments with the patient. The habits need to be addressed in this manner for more than 6 months for the change to be maintained long-term.

Supplemental behavioral strategies such as biofeedback may also be helpful.[43-45] Biofeedback is a structured therapy based on the theory that when an individual receives information about a desired change, and is reinforced for making it, the change is more likely to occur. Generally, biofeedback training uses equipment to measure biological activity (eg, surface electromyography to measure muscle activity). The equipment is designed with a "feedback" loop so that a patient can receive immediate information or feedback about the biological activity. When this information is available, individuals can voluntarily make changes in functions that were previously thought to be involuntary. For example, muscle tension in the jaw can be reduced on receiving information about how postural changes can reduce muscle activity.

In some cases, patients may have significant psychosocial problems that accompany MMFP and may benefit from antidepressant or antianxiety medication, counseling, or psychotherapy with a mental health professional. A decision needs to be made before initiating treatment regarding whether the psychological distress is the primary problem. If this is the case, treatment of the psychological problem is best accomplished first, as a problem separate from the MMFP disorder. If it is not, simultaneous treatment of both the physical and the psychosocial problems is best done by a team.

Team Management

Although each clinician may have limited success in managing the "whole" patient alone, the assumption behind a team approach is that it is vital to address different aspects of the problem with different specialists to enhance the overall potential for success.[11,45,46] Although these programs provide a broader framework for treating the complex patient, they have added another dimension to the skills needed by the clinician: those of working as part of a coordinated team. Failure to adequately integrate care may result in poor communication, fragmented care, distrustful relationships, and eventually confusion and failure in management. However, team coordination can be facilitated by a well-defined evaluation and management system that clearly integrates team members.

A prerequisite to a team approach is an inclusive medical model and conceptual framework that places the physical, behavioral, and psychosocial aspects of illness on an equal and integrated basis.[47,48] With an inclusive theory of human systems and their relationship to illness, a patient can be assessed as a whole person by different clinicians from diverse backgrounds. Although each clinician understands a different part of the patient's problem, he or

she can integrate them with other clinicians' perspectives and see how each part is interrelated in the whole patient. For example, a physician or dentist will evaluate the physical findings, a physical therapist will evaluate postural habits, and a psychologist will evaluate behavioral problems or social stressors. Each factor will become part of the problem list to be addressed in the treatment plan. In the process, the synergism of each factor in the etiology of the disorder can become apparent to clinicians. For example, social stressors can lead to anxiety, anxiety can lead to poor posture and muscle tension, the poor posture and muscle tension can lead to a myofascial pain syndrome, the pain contributes to more anxiety, and the cycle continues. Likewise, a reduction of each factor will work synergistically to improve the whole problem. Treatment of only one factor may improve the problem, but relief may be partial or temporary. Treatment of all factors simultaneously can have a cumulative effect that is greater than the effects of treating each factor individually.

The problem list for a patient with a specific chronic illness includes both a physical diagnosis and a list of contributing factors (Table 5). In establishing the problem list, the clinician needs to determine if the patient is complex and requires a team approach. Recommended criteria for determining complexity include any one of the following: multiple diagnoses, persistent pain longer than 6 months in duration, significant emotional problems (depression, anxiety), frequent use of health care services or medication, daily oral parafunctional habits, and significant lifestyle disturbances. The use of a screening instrument such as IMPATH can readily elicit the degree of complexity of a case at the initial evaluation.[37] The more complex the case, the greater the need for a team approach. The decision to use a team must be made at the time of evaluation and not part way through a singular treatment plan that is failing. If a team is needed, the broad understanding of the patient is then used to design a long-term management program that both treats the physical condition and helps reduce the contributing factors.

The primary goals of the program include reducing the symptoms and their negative effects, while helping the patient return to normal function without the need for future health care. The patient first participates in an educational session with each clinician to learn about the diagnoses and contributing factors, why it is necessary to change these factors, and how to do it. The dentist or physician is responsible for establishing the physical diagnosis, providing short-term medical or dental care, and monitoring medication and patient progress. The psychologist or behavioral therapist is responsible for providing instruction about contributing factors; diagnosing, managing, or referring for primary psychological disturbances; and establishing a program to support the patient and family in making changes. The physical therapist is responsible for providing support, instruction, and a management program on specifically assigned and common contributing factors. Depending on the therapist's background and the patient's needs, this person may also provide special care such as physical therapy modalities or occupational therapy. Each clinician is also responsible for establishing a trusting, supporting relationship with the patient while reaffirming the self-care philosophy of the program, reinforcing change, and assuring compliance. The patient is viewed as responsible for making the changes (Table 6). The team meets regularly to review current patient progress and discuss new patients.

Summary

Myofascial pain (MFP) is a regional muscle pain disorder characterized by localized muscle tenderness and pain. The affected muscles may also display an increased fatigability, stiffness, subjective weakness, pain on movement, and cause a slightly restricted range of motion that is unrelated to joint pathology. MFP is frequently overlooked as a diagnosis because it is often accompanied by signs and symptoms in addition to pain, coincidental pathological conditions, and behavioral and psychosocial problems. As MFP persists, chronic pain characteristics often occur.

Evaluation of myofascial pain includes locating the trigger points and muscles involved as well as recognition of the contributing factors. Depending on the complexity of the case, management of the syndrome involves palliative

care, appliance therapy, muscle exercises, therapy to the trigger points, and behavioral therapy. The short-term goal is to restore the muscle to normal length and posture, and establish a full range of joint motion with exercises and trigger point therapy. The long-term goals include reducing the symptoms and their negative effects while helping the patient return to normal function without the need for future health care. The difficulty in managing MFP lies in the critical need to match the level of complexity of the program with the complexity of the patient's problem. Failure to address the entire problem through a team approach, when needed, may lead to failure to resolve the pain and perpetuation of a chronic pain syndrome.

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