Chapter 14
Masticatory Myofascial Pain

Subha Giri

Introduction

Masticatory myalgia is characterized by pain and dysfunction arising from pathologic and functional processes in the masticatory muscles. There are a number of distinct muscle disorder subtypes in the masticatory system including myofascial pain, myositis, muscle spasm, and muscle contracture [1]. Among these, myofascial pain is expressed as the most common muscle pain disorder [2]. It presents as an acute to chronic condition that includes regional pain associated with tender areas called *trigger points*, which are expressed in taut bands of skeletal muscles. Although the pain is most often expressed in the region over the trigger point, pain can be referred to areas distant from the trigger points such as temporalis muscle trigger point referring to the frontal area and masseter muscle trigger point referring to the ear and/or the posterior teeth. Reproducible duplication of pain complaints with specific palpation of the tender area is often diagnostic. Pain disorders that are muscular in origin are the most common cause of chronic pain in the head and neck region affecting about 50 % of a chronic head and neck pain population [3]. It is also a common cause of pain in the general population with 20–50 % having the disorder with about 6 % having symptoms severe enough to warrant treatment [4, 5].

S. Giri, B.D.S., M.S. (✉)
Minnesota Head and Neck Pain Clinic, Twin Cities, MN, USA
e-mail: giri0002@umn.edu

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Clinical Presentation

The major characteristics of masticatory myalgia include pain, muscle tenderness, limited range of motion, other symptoms such as fatigability, stiffness, and subjective weakness. Comorbid conditions and complicating factors are also common and discussed.

Pain

The common sites of pain in the masticatory system include jaw, facial, temple, frontal or occipital, pre-auricular, ear, and neck. The pain is often a constant steady dull ache that fluctuates in intensity and can be acute to chronic. The duration may vary from hours to days.

Muscle Tenderness

With myofascial pain, the tenderness is deep and localized (2–5 mm) in a taut band of skeletal muscle called *trigger points* [6]. Myofascial trigger points are very common and may be active or latent. A trigger point that is tender to palpation with a single finger and deep pressure and palpation of which results in pain that is continuous at the site of the pain is called an active trigger point. A trigger point which is only tender to single-finger palpation but palpation of which does not result in continuous pain is called a latent trigger point. By definition, when an active trigger point is palpated it must elicit either aggravation or alleviation of pain at the site of pain. Such a site, a specific region of the body, where the phenomena caused by trigger points are observed is called the "zone of reference." When a trigger point is palpated, the referral pattern of pain is usually reproducible across patients. Hence, this predictable referral pattern of pain is clinically used to identify the specific trigger point that is contributing to the patient's symptoms.

Limited Range of Motion

With myofascial pain, limitation in the range of motion may be slight (10–20 %) and unrelated to joint restriction. This mild restriction in the range of motion can result in the aggravation of the existing trigger point and can contribute to the development of new trigger points in the region. The new trigger points along with the existing trigger point can influence the presentation of pain, now contributing to the zone of reference.

Other Symptoms

The patient may present other signs and symptoms including increased fatigability; stiffness; subjective weakness; pain with movement; otological symptoms including

dizziness, tinnitus, and plugged ears; paresthesias including numb feelings; decreased sensation and tingling; and dermatographia including increased redness of the skin upon palpation or rolling. The restriction in the range of motion of the affected muscles is associated with the subjective symptoms of stiffness or tightness in the muscle. The patient experiences pain with function and usually guards the muscle from stretching. Prolonged periods of muscle guarding can contribute to poor posture.

Comorbid Conditions and Contributing Factors

There are many comorbid conditions to masticatory myofascial pain that reflect both common etiologic factors and mechanisms of pain. Fibromyalgia is one such condition with widespread muscle pain presentation. As many as 16 locations of the "tender points" associated with fibromyalgia overlap with the location of myofascial trigger points [7]. Hence, fibromyalgia needs to be differentiated from myofascial pain in order to treat these conditions effectively. Fibromyalgia is associated with other clinical findings such as sleep disorder, fatigue, and morning stiffness, while myofascial pain is associated with localized contributing factors such as parafunctional habits and postural factors. Clinically, patients with fibromyalgia are tender in widespread areas of the body, while patients with myofascial pain report tenderness restricted to taut bands of muscular trigger points and along the referral pattern for those trigger points.

Other comorbid conditions that have often been cited to accompany a myogenous disorder like myofascial pain are joint disk displacement and osteoarthritis, malocclusion and functional occlusal dysfunction, connective tissue diseases, neuropathic pain disorders, migraine and tension-type headaches, gastrointestinal disorders, and hypothyroidism. The underlying mechanisms for the coexistence of these comorbid conditions are not yet understood. Common underlying central and peripheral mechanisms and etiologies may play a role.

Furthermore, many associated behavioral and psychosocial factors can accompany the chronic pain associated with a myogenous disorder like myofascial pain. Some examples of behavioral contributing factors are oral parafunctional habits, maladaptive postural habits, and habitual muscle guarding. Some examples of psychological contributing factors are anxiety and depression.

Etiology and Epidemiology

Etiologic Factors

Myofascial pain can be induced by direct or indirect macro-trauma to the muscle or by activities that produce repetitive strain to the muscle [8]. Macro-trauma to the muscle can be from a direct blow to the jaw or from opening the mouth too wide or

for too long a period during activities such as dental visits, eating, yawning, and sexual activity. Indirect macro-trauma to the muscle can result from a whiplash type of injury. Local infection and trauma may result in myositis and lead to muscle contracture if not resolved. Occupational and repetitive strain injury can also result in myofascial pain and muscle spasm. Sleep disturbance and nocturnal habits can also contribute to myofascial pain.

Oral parafunctional habits such as teeth clenching, jaw thrust, gum chewing, and jaw tensing and additionally postural factors such as forward head posture, increased spinal curvature, malocclusion, and poor resting posture of the tongue have also been known to contribute to myofascial pain. Psychosocial stressors such as relationship conflicts, monetary problems, and poor pacing skills can play an indirect role.

Pathophysiology and Mechanisms

Since there are no specific anatomical changes in myofascial pain, there are no conclusive mechanisms identified in non-traumatic situations. Thus, there are several processes that may explain the development and persistence of masticatory myofascial pain [8].

Repetitive Strain Hypotheses

According to this hypothesis, repetitive strain from oral parafunctional habits can contribute to increase in oxidative metabolism in localized regions within the muscle which in turn can result in decreased levels of ATP, ADP, and phosphoryl creatinine and abnormal tissue oxygenation, thus depleting the muscular energy. In such a localized region of muscle where the energy is depleted, the nociceptive afferent nerve endings in muscles (type III and type IV), when exposed to substances such as prostaglandins and histamine, can result in pain and tenderness to palpation of the muscle.

Neurophysiological Hypothesis

Tonic muscular hyperactivity may be a normal protective adaptation to pain instead of its cause. As per this hypothesis, phasic modulation of excitatory and inhibitory interneurons supplied by high-threshold sensory afferents may be involved.

Central Hypotheses

Convergence of multiple afferent inputs from the muscle and other visceral and somatic structures in the dorsal horn (Lamina I or V) of the spinal cord can result in perception of local and referred pain [9].

Central Biasing Mechanism

Multiple peripheral and central factors may inhibit or facilitate central input through modulatory influence of the brain stem. This may explain the diverse factors that can exacerbate or alleviate the pain such as stress, repetitive strain, poor posture, relaxation, medications, temperature change, massage, local anesthetic injections, and electrical stimulation.

Diagnostic Tests

Radiographic assessment of the region of muscle pain appears within normal range in patient with myofascial pain. Laboratory investigations of blood and urine samples also are normal unless the patient has concurrent systemic diagnoses that could influence those studies. Trigger point injections with local anesthetic agents can be used as a diagnostic test to identify active trigger points. When a local anesthetic agent is injected into the active trigger point, it results in alleviation of the tenderness and referred pain, either partially or completely. While routine clinical electromyographic (EMG) studies appear abnormal in muscle spasm only, occasionally in myofascial pain, electromyography of the localized region of muscle pain may reveal altered muscle tone. Pain questionnaires such as the Chronic Pain Battery and TMJ Scale may identify contributing factors including emotional issues, somatization, secondary gain, and disability.

Treatment

Simple to Complex

Treatment of myofascial pain can range from simple to comprehensive treatment programs, depending upon the clinical severity of the condition. A wide array of treatment options are available to address myofascial pain ranging from home care exercises and postural correction to trigger point injections, spray and stretch with vapocoolant sprays, and transcutaneous electrical nerve stimulations (TENS).

Medications including tricyclic antidepressants and muscle relaxant also are available as adjunct therapeutic agents. Cognitive behavioral therapy (CBT) along with biofeedback also complements the other treatment options mentioned above. In order to achieve optimal outcomes with the treatment approaches, it is imperative to address the symptoms only after assessing the patients' need and defining it in terms of the clinical severity of the condition being simple to complex. Prognosis and outcomes to treatment approaches are influenced by the identification and management of the variety of contributing factors affecting the clinical severity of the condition.

When the clinical severity of the condition is mild to moderate, with pain being limited to a localized region of the body, along with limited contributing factors and/or comorbidities, the treatment approach can be tailored to be conservative and outcomes tend to be predictable with good prognosis. When the clinical severity of the condition is moderate to severe, with pain diffused in widespread regions of the body, with multiple contributing factors and/or comorbidities, a multidisciplinary team with a comprehensive treatment program is warranted in order to optimally manage the symptoms. Treatment goals also need to be defined for both simple and complex clinical conditions. The short-term goals would be to improve muscle tone, establish pain-free muscle function, and restore normal range of motion. The long-term goals would be to maintain muscle tone and function, using daily maintenance exercise routines and postural awareness and correction on a day-to-day basis. It is imperative to engage patients and have them communicate their personal goals, as it pertains to clinical care, with the assigned multidisciplinary treatment team so as to best position them to gain independence in managing the condition.

Addressing the contributing factors is of utmost importance as this influences the long-term outcome with the treatment approaches. Contributing factors are usually integrated to the patient's lifestyle and environment and hence are difficult to address without the patient's compliance with the multidisciplinary treatment approach. For example, patients need to be compliant with guidelines for postural correction, parafunctional habit reversal techniques, biofeedback, and stress management approaches, all of which integrate to form a comprehensive treatment program.

Treatment approaches directed at the site of muscle pain including physical therapy exercises and modalities, home care strategies, trigger point injections, and use of TENS help address the peripheral component of myofascial pain. Treatment approaches directed at addressing the contributing factors, stress, comorbidities, and systemic health factors help address the central modulating components of the condition.

Self-Care

Most acute symptoms are self-limited and resolve with minimal intervention. Initial treatment should be a self-care program (Table 14.1) to reduce repetitive strain of the masticatory system and encourage relaxation and healing of the muscles. This

Table 14.1 Palliative self-care program for acute episodes of masticatory myofascial pain

1. Eat a soft diet and avoid caffeine.
2. Keep your tongue up gently resting on the palate with your teeth apart and jaw relaxed.
3. Chew on both sides at the same time or alternate sides to minimize strain to muscles.
4. Avoid oral parafunctional habits such as clenching and grinding the teeth, jaw tensing, or gum chewing.
5. Avoid excessive or prolonged opening of mouth.
6. Avoid sleeping on your stomach to minimize strain to the jaw during sleep.
7. Use over-the-counter analgesics or nonsteroidal anti-inflammatory drugs as needed for pain.
8. Apply heat or ice over the tender muscles.

strategy includes jaw range of motion exercises, oral habit change, and protective gentle use of the jaw. Most patients respond well to self-care in 4–6 weeks; if not, further assessment and treatments are indicated.

Orthopedic Intraoral Splints

Intraoral splints can encourage relaxation of the muscles, alter muscular recruitment patterns, and reduce oral habits. Stabilization splints allow passive protection of the jaw and reduction of oral habits due to the flat passive occlusal surface on mandibular or maxillary teeth. Mandibular splints can be smaller and are associated with higher patient satisfaction in some cases. It should be adjusted to achieve mutually protected occlusion with bilateral balanced contact on all posterior teeth with the condyles in their most seated positions, with anterior guidance (lateral and protrusive) provided by the cuspids and/or incisors.

Anterior repositioning splints can be efficacious for concomitant joint problems with intermittent jaw locking with limited range of motion, especially upon awakening, and are recommended for short-term, part-time use, primarily during sleep, because they can cause occlusal changes if worn continuously or chronically. Partial coverage splints may cause occlusal changes in some patients. Splints should cover all of the mandibular or the maxillary teeth to prevent movement of uncovered teeth, with malocclusion.

Cognitive Behavioral Therapy

CBT approaches can help change maladaptive habits and behaviors that contribute to myofascial pain such as jaw tensing, teeth clenching, and teeth grinding. Although many simple habits are easily abandoned when the patient becomes aware of them, changing persistent habits requires a structured program that is facilitated by a clinician trained in behavioral strategies. Habits do not change themselves. Patients are responsible for initiating and maintaining behavior changes.

Habit reversal can be accomplished by (1) becoming more aware of the habit, (2) knowing how to correct it (i.e., what to do with the teeth and tongue), and (3) knowing why to correct it. Patient's commitment to conscientious self-monitoring and focus upon the goal are required for habit reversal to be accomplished. Patients should attempt to correcting the habit during the day and then help reduce it at night. Supplementing with additional behavioral strategies such as biofeedback, meditation, stress management, or relaxation techniques can also help. It is also important to address poor pacing or hurrying related to a day overloaded with commitments and depression, anxiety, sleep disorders, and emotional problems through behavioral and psychological therapy and/or medications.

Physical Therapy Exercises

The most useful exercise techniques for muscle rehabilitation include muscle-stretching, posture, and strengthening exercises [10–13]. A home exercise program directed at reducing pain with muscle function usually involves passive and active muscle stretching. Postural awareness and training are used to address the risk of muscle re-injury. Additionally, strengthening exercises influence the general conditioning of the muscle, thus becoming a component of the long-term maintenance strategy.

At the time of clinical evaluation, the range of motion and functional health of the muscle are baselined. With respect to myofascial pain of the head and neck, both oro-mandibular range of motion and cervical range of motion are evaluated. Myofascial pain of the masticatory muscles, when involving the elevator muscles of the mandible (temporalis, masseter, and medial pterygoid), can result in reduced oro-mandibular range of motion. The oro-mandibular range of motion is measured inter-incisally and ranges between 42 and 60 mm in normal individuals and can be as limited as 10–20 mm in the presence of muscular contracture. While assessing for myofascial pain, other causes of restricted oro-mandibular range of motion including temporomandibular disc disorders need to evaluated to establish or exclude comorbidities. Once myofascial pain is established as the etiology for the restricted oro-mandibular range of motion, stretching exercises, both passive and active, are used to improve it. Patients are always guided with stretching exercises with increasing increments of exercise intensity to avoid re-injury risks.

Physical therapy exercises can also influence the resting posture of the masticatory and cervical musculature. During initial evaluation the resting cervical posture and oro-mandibular posture are noted, and the postural errors are brought to the attention of the patient. Corrective postural guidance with exercises is provided to the patient to establish the most-balanced rest posture. The correct oro-mandibular rest posture is achieved when the tip of the tongue gently rests on the roof of the mouth with the teeth being apart and jaw relaxed. The optimal cervical rest posture is achieved with the chin tucked in and the vertex of the head being held upright. With this, the shoulders relax and sit back instead of being rotated forward. Postural

errors with sitting, standing, and walking all need to be evaluated, and correctional postures need to be provided for optimal treatment outcomes.

Physical Therapy Modalities

Therapeutic modalities for myofascial pain include thermal modalities, ultrasound, massage, and electrical stimulation. Use of moist heat and ice pack provides for counterstimulation and changing the temperature of the localized region of pain. Mechanical stimulation of the region with massage and ultrasound helps to reduce tenderness in the muscle, as they improve circulation in the region of pain. Electrical stimulation, TENS, and electro-acupuncture techniques are modalities that address the tenderness and pain by directly stimulating the trigger point. The *spray and stretch* technique with the use of a vapocoolant agent such as fluorimethane or ethyl chloride is also used as a modality that improves the effectiveness of the muscle stretch that accompanies the cooling effect of the agents used. In this technique a fine stream of the vapocoolant is sprayed towards the skin over the trigger point at an acute angle of approximately 30°, and as the stream of vapocoolant is sprayed in a sweeping motion, the patient is guided to do a passive stretching exercise of the muscle to complement the gentle repetitive sweeps of the spray.

Trigger Point Dry Needling and Trigger Point Injections

Generally, the placement of a local anesthetic agent in an active trigger point is called as a *trigger point injection*. Patients receiving trigger point injections may notice improvement in symptoms, that could last from few hours to few days and even few months with a single delivery of the local anesthetic. Other agents that have been used with the trigger point injection include dexamethasone and saline. The effectiveness of the trigger point injection is influenced by accurately locating the active trigger point with the needle. When accurately located, the needling of the trigger point elicits a twitch response in the taut band. Trigger point dry needling is a technique where the accurately placed needle can be manipulated in itself to produce the effect of reduced tenderness and pain in the localized region of pain. For the trigger point injection with a local anesthetic, the commonly used anesthetics are bupivacaine hydrochloride (Marcaine) and carbocaine (mepivacaine).

Pharmacotherapy

Pharmacotherapy is a useful adjunct to initial treatment of muscle pain. The most commonly used medications for pain are classified as nonnarcotic analgesics (nonsteroidal anti-inflammatories), narcotic analgesics, muscle relaxants, tranquilizers,

nonsteroidal sedatives, and antidepressants. Analgesics are used for addressing pain, muscle relaxants and tranquilizers for anxiety, fear, and muscle tension; sedatives for enhancing sleep; and antidepressants for pain, depression, and enhancing sleep [14]. Randomized clinical trials on anti-inflammatory medications (NSAIDs) such as ibuprofen or piroxicam for the management of myalgia, recommend, short-term use of these medications for analgesic and/or anti-inflammatory effects. For muscle pain, especially with stress and sleep disturbance, benzodiazepines, including diazepam and clonazepam, have been shown to be effective. Experience suggests that these are best used before bedtime to minimize sedation while awake. Cyclobenzaprine (Flexeril) has also been shown, in clinical trials of myalgia, to be efficacious in reducing pain and improving sleep and can be considered when a benzodiazepine is too sedating [15, 16]. These medications, with or without NSAIDs, can be considered for a 2–4-week trial with minimal habitual potential. However, long-term use has not been adequately tested.

Research on medications for fibromyalgia, especially with sleep disturbances, indicates that tricyclic antidepressants, such as amitriptyline (Elavil), have a significant impact on sleep disturbances, anxiety, and pain presentation in the patient. As such, long-term use of these medications has to be carefully evaluated and restricted for use in appropriate cases alone [17]. If the side effects with amitriptyline (Elavil) are significant, then nortriptyline (Pamelor) can be considered with fewer side effects. Typically, the dosage for either of these medications in these patients, without depression, is in the 25–75 mg range at bedtime. The use of selective serotonin reuptake inhibitors (SSRIs) has been suggested for depression and pain but may also have the common side effect of increasing muscle tension and aggravating the pain.

For chronic pain conditions that are resistant to interventions, use of opioids can be considered. Tramadol has been shown to be effective in fibromyalgia. Presently, chronic opioid use is mainly indicated for patients with chronic intractable severe pain conditions that are refractory to all other reasonable treatments because of their side effects, including constipation, sedation, potential for dose escalation, and unknown effects with long-term use.

Despite the advantages of medications for pain disorders, there exists an opportunity for problems to occur due to their misuse. The problems that can occur from the use of medications include chemical dependency, behavioral reinforcement of continuing pain, and inhibition of endogenous pain relief mechanisms, side effects, and adverse effects from the concurrent use of multiple medications.

Control of Contributing Factors

Identifying and addressing the contributing factors associated with myofascial pain is a very important step in the management of the condition with significant prognostic implication.

Behavioral Factors

There are spinal postural factors as well as oro-mandibular postural factors that play a significant role in influencing myofascial pain. Postural factors could be behavioral or biological in origin. For example, prolonged periods of sustaining forward head posture can result in foreshortening of the muscles and hyperextension of ligaments and muscles, and the resulting misalignment can predispose the head and neck region to injury. The oro-mandibular posture, wherein the mandible rests in a protrusive and/or clenched occlusal relationship with the maxilla, can result in significantly altered muscle tone at rest also predisposing the masticatory unit to myofascial injury. Behaviorally, altered spinal posture can occur with poor computer station ergonomics, phone-cradling between the head and the shoulder, and texting and operating digital media in forward head posture. Altered oro-mandibular posture could result from oral parafunctional habits such as teeth clenching bruxism, nail-biting, lip-biting, and cheek biting. Repetitive strain from activities such as gum chewing could also influence the masticatory myofascial pain.

Elevated muscle tone and muscle tension being the underlying factors that tie these behavioral factors to myofascial pain, treatment approaches aimed at addressing muscle tension such as the management of stress and anxiety with the use of counseling, relaxation techniques and biofeedback needs to be front and center in the overall management strategy. While the awareness about these behavioral factors is the first step to addressing these contributing factors, long-term success cannot be ensured with habit reversal technique alone and needs to be supplemented with a comprehensive array of treatment approaches that address the above mentioned conditions influencing the underlying muscle tension.

Summary

Myofascial pain is a chronic recurrent condition. Setting short-term and long-term goals with appropriate treatment approaches is necessary given the risk of chronicity with the condition. After establishing the complexity of the condition based on its clinical severity, an array of treatment options are available to carefully tailor to the patient's needs. A positive doctor–patient relationship with a multidisciplinary team of healthcare professionals, addressing both the clinical symptoms and the contributing factors, is important to achieve success with the treatment. Success with the treatment is accomplished when the patient becomes independent in the day-to-day management of the condition, as he or she integrates the skills gained with the various treatment approaches to his or her lifestyle.

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Conflict of Interest None declared.

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