Fourth Edition

Quality Resource Guide

Temporomandibular Disorders: Etiology, Diagnostic & Management Considerations

Author Acknowledgements

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Educational Objectives

Following this unit of instruction, the learner should be able to:

1. Recognize the common signs and symptoms related to temporomandibular disorders (TMD).
2. Understand the differences between myogenous and arthrogenous TMD.
3. Appreciate the controversy associated with the etiology of, and the etiological factors related to, TMD.
4. Understand the multifaceted nature of TMD leading to management considerations using multidisciplinary and interdisciplinary approaches designed on a case-specific basis.

MetLife designates this activity for **1.0 continuing education credits** for the review of this Quality Resource Guide and successful completion of the post test.

The following commentary highlights fundamental and commonly accepted practices on the subject matter. The information is intended as a general overview and is for educational purposes only. This information does not constitute legal advice, which can only be provided by an attorney.

Originally published August 2014. Updated and revised December 2017, December 2020 and December 2023. Expiration date: December 2026.

The content of this Guide is subject to change as new scientific information becomes available.

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Introduction

In a general population survey involving 805 individuals having a persistent pain disorder, it was revealed that more than four out of 10 people had not found adequate relief, saying their pain is out of control - despite having the pain for more than 5 years and switching doctors at least once.[1] Therefore, it should not be a surprise the most common reason patients seek medical or dental care in the United States is due to pain. Lipton and others, in a study of 45,711 households, revealed that 22% of the U.S. population experienced orofacial pain on more than one occasion in a six month period. Odontogenic pain was the most frequently reported condition.[2] Non-odontogenic pain involving the orofacial region such as temporomandibular joint (TMJ) pain, face pain, and neuropathic conditions were also commonly reported. Since each pain disorder is unique, establishing an accurate and complete differential diagnosis is fundamental. It is imperative that dental practitioners become educated and develop the necessary scientific and clinical expertise on which he/she may base diagnostic and management approaches.

Temporomandibular disorder (TMD) is currently viewed as a group of musculoskeletal and neuromuscular conditions that involve the TMJs, the masticatory muscles, and all associated tissues.[3] Overall, TMD has a major impact on the quality of life, which refers to an individual's capacity to carry out everyday tasks without difficulty encompassing social, psychological and physical components.[4] TMD has been identified as one of the most common non-odontogenic pain complaints and is the second most frequent cause of musculoskeletal pain and limitation, only preceded by low back pain.[5] According to general population-based studies, TMD are a significant public health problem affecting approximately 5 to 12% of the overall population.[6] The National Institutes of Health reported that 10 million Americans suffer from TMD related complaints each year.[7] However, it should be noted that the actual prevalence of TMD in the population is somewhat debatable as there is a significant lack of homogeneity in the diagnostic criteria adopted in correlated investigations.

TMD Signs and Symptoms

The cardinal signs (objective indicators) and symptoms (subjective experiences) of TMD are: pain in the temporomandibular region; limitation or disturbance in mandibular movement and/or masticatory functional ability; and, TMJ sounds. However, this description is rather simplistic. The complexity of neural pathways in the head and neck region provides dynamic interactions between a number of cranial and cervical nerves, including the trigeminal system, complicating the evaluation of the patient with orofacial pain. This shared neurologic circuitry makes the etiology of orofacial pain difficult to diagnose.[8] Confusion regarding diagnostic and clinical decision-making is compounded by the fact that signs associated with TMD occur quite commonly in the general population. Therefore, decisions regarding those who should or should not be treated may be challenging. Seventy-five percent of those evaluated in a non-patient population study exhibited at least one sign (joint noise or palpation tenderness) and 33% exhibited at least one symptom[9], while only 3.6% to 7% of individuals with TMD were in need of treatment.[9,10]

Pain in other regions of the body and more specifically in the head and neck share commonalities or are comorbid with TMD.[11] Headache and ear-related symptoms are frequent complaints among TMD patients.[12-17] Pain in other regions of the body including other joints have been associated with TMD.[18,19] A study of a TMD patient population indicated that 75% also reported concomitant neck pain. Seventy-two percent of the study group was experiencing pain in areas of the head other than the masticatory region, and 72% reported back pain.[20] Furthermore, it was reported that high pain intensity and long pain duration increase the probability of having co-existing pain and comorbidities in this patient population.[21]

Who is at Risk?

The most common age group found to be affected is between 15 and 45 years of age (mean: 33.9 years).[22] Demographic data from clinically based studies indicate that TMD symptoms are least prevalent in the young and seem to decrease after the age of 45. A significant sex bias exists among patient populations of 6:1 to 9:1, with females more represented than males.[23,24] The literature on experimentally-induced pain indicates sex differences, with females displaying greater sensitivity.[25] Sex differences are also noted in epidemiological studies with females reporting more severe pain, more frequent pain, and pain of longer duration.[26,27]

Arthrogenous (joint related) TMD

The most common sign of TMD has been identified as TMJ clicking, due to displacement of the articular disc. General population based studies have reported clicking, popping or crepitus to occur in about 50% of those studied.[10] A magnetic resonance image (MRI) study identified that 86% of a TMD patient population demonstrated disc displacement. However, 33% of the non-patient controls also had disc displacement indicated this may be considered predominately a physiological variation.[28] According to a general based population systematic review and meta-analyses, it was reported that the overall prevalence of TMJ disorders was 31.1%, disc displacements was 19.1%, and degenerative joint disease was 9.8%.[29] Interestingly, there is a higher incidence, prevalence, and persistence for TMJ catching/locking in females than in males.[30] Although the concept of natural progression of TMD has been purported in the past, there is a lack of evidence supporting the concept that TMJ joint clicking progress to locking and degeneration, or that arthritic changes develop in joints that lock. It has been reported that most degenerating joints tend to become non-painful with time; although, as many as 16% of these individuals may experience pain long-term.[31]

Myogenous (muscle related) TMD

Muscle-related signs and symptoms are very common in the general population and account for the most common subgroup of patients with TMD.[32,33] Definitive theories do not presently exist that totally explain why masticatory muscles become painful, their associated symptomatology, or the cause(s) leading to chronicity. Furthermore,

there is no single identifiable etiologic factor; therefore myogenous pain is considered complex and multifactorial, making it more challenging to identify risk factors and their unique contributions to the process.[34] It is important to recognize the existence of a dynamic relationship between the function of the masticatory and cervical muscles. Due to this relationship, these regions must be thoroughly assessed during routine TMD patient evaluations. In fact, cervical tenderness scores were able to differentiate between TMD patients and controls and between TMD diagnoses.[35] The putative mechanisms behind masticatory myalgia typically include overuse of a normally perfused muscle or ischemia of a normally working muscle, sympathetic reflexes that produce changes in vascular supply and muscle tone, and changes in psychological and emotional states.[36] Individual variations in muscle anatomy, biomechanics, and fiber type/composition potentially related to muscle fatigue/overuse must also be considered. The demands on the musculature in normal function, and excessive function or parafunctional behavior, while awake or asleep must be appreciated. Importantly, age related decline of symptoms may not be as great for patients with muscular involvement compared to those with TMJ conditions.[37]

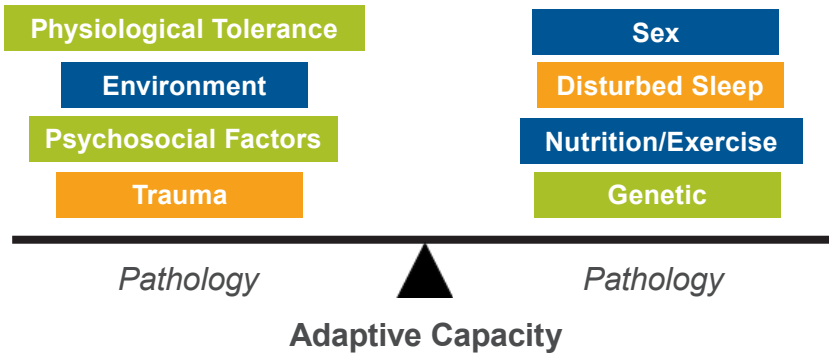
Etiology of TMD

Few areas in dentistry have greater debate and controversy than TMD etiology. The diversity of opinion is explained by the fact that there exists: a lack of scientifically derived evidence in many areas of this complex field; significant clinical/research bias exists; there has been great dependence on anecdotal reports; and, definitive cause and effect relationships have not been established.

A functional homeostatic balance exists between the various components of the masticatory system; the teeth, periodontium (hard and soft tissue supporting structures), masticatory and cervical musculature, TMJ structures, and the physiological tolerance and psyche of the individual. This adaptive balance may be disrupted or dysregulated by a number of factors acting alone or in combination resulting in the expression of signs and symptoms associated with TMD. Newer scientific information has provided enhanced understanding of the pathogenesis, the cellular events and reactions and other pathologic mechanisms occurring in the development and maintenance or recurrence of TMD. "Understanding these interrelationships should improve how we promote health, reduce disease and enhance diagnosis and treatment."[38] A model representing factors suggested to potentially compromise and alter the adaptability of the masticatory system is presented in **Figure 1.**

Figure 1

Factors (alone or in combination) implicated in altering the adaptability of the masticatory system.



Etiological Factors for TMD

Sex

Data indicates a significant sexual disparity in the TMD patient population and in the vast majority of human pain conditions.[39] In a large prospective general population study,[40] it was reported that more females than males reported orofacial pain related to TMD (odds ratio 2.58). Coincidently, there was also a significant increase in the prevalence of reported pain over an 8-year period in both sexes. In this study, longitudinal data for 135,800 individuals were available for incidence analysis. The analysis reported that females were at higher risk of both developing orofacial pain (incidence rate ratio 2.37) and reporting pain in consecutive years (incidence rate ratio 2.56). Conversely, the Orofacial Pain Prospective Evaluation and Risk Assessment (OPPERA) prospective cohort study, which monitored 2,737 males and females aged 18-44 years, recruited at four U.S. study sites during 2.8 years, found that sex differences played a minor role in the early onset of signs and symptoms of TMD, increasing the risk of TMD in only 37%.[41] The aspects of female biology, psychology or social roles which predispose them to have a greater prevalence of TMD compared to males is yet to be elucidated. It is postulated that differences may be related to hormonal factors, cultural and social factors, higher levels of work stress for females, differences in pain sensitivity/vulnerability as well as health-seeking behaviors.[42-44] Studies in which age-matched males and females were exposed to laboratory stressors have found that anxiety impacts both sexes. However, there is a significant difference in the levels of various psychophysiologic responses between males and females. Females demonstrate a more robust response, manifested by a greater decrease in pain tolerance and threshold, more disrupted self-control strategies, increased electromyographic (EMG) activity of the facial and masticatory musculature, and more pain behavior than male subjects.[45] Other researchers have also identified sex differences in response to anxiety, depression as well as laboratory induced pain.[46-48]

Physiologic factors related to sexual structural differences have also been reported. The propensity for females to exhibit a greater ease of masticatory muscle fatigue has been suggested.[49] This phenomenon has been attributed to a greater concentration of fast twitch, easily fatiguing white fibers versus slower twitch, enduring red fibers.[49] Fibromyalgia, a chronic widespread skeletal

muscle condition associated with disruption in pain modulation and found nine times more often in females, is commonly found to co-exist with TMD.[50] An increase in the number of red, ragged fibers (a pathologic fiber state) in areas approximating diagnostic tender points is reported to occur in fibromyalgia.[51] This finding is also noted in post-exercise muscle soreness (myositis).[52] Class II skeletal subtypes (high angle cases) have also been reported to demonstrate greater propensity for masticatory muscle fatigue.[53] Joint laxity has also been reported to be a factor in intracapsular TMD conditions.[54]

Data also suggests hormonal factors may be largely responsible for sex differences in the TMD patient population. TMD appears to peak in incidence during the reproductive years suggesting that either biologic and/or psychosocial factors unique to females in this period of life could increase the risk of developing and maintaining this condition.[55] It has been long recognized that females demonstrate greater pain sensitivity during the menstrual cycle, at ovulation, and following menses.[47] The relationship of estrogen, and to a lesser degree prolactin, to pain sensitivity has been elucidated. It has been reported the use of an estrogen supplement significantly increased the odds of having TMD.[55] Studies have shown that although functional estrogen receptors have been identified in many synovial joints of males and females at equal concentrations, there exists a significant difference in the number of estrogen receptors within the TMJ. Male TMJs have been found to have few, if any, estrogen receptors[56] while female TMJs exhibited significant numbers of these receptors.[57-59] Implications regarding hormonal variables relate to their potential to modify the adaptive capacity of the TMJ.[60] A potential mechanism for these changes towards adaptability may involve estrogen and relaxin whereby they potentially contribute to the degeneration of cartilage homeostasis by disrupting the TMJ and inducing activation of metalloproteinases (MMP) that degrade cartilage matrix macromolecules (collagen and proteoglycans).[61]

Measurement of TM joint pressure differentials in the superior joint space on patients experiencing several subtypes of internal derangement revealed tremendously elevated pressures associated with clenching. These elevated pressures create a hypoxic environment stimulating the production of tissue degrading substances such as free radicals and cytokines.[62] A trend towards significantly greater TM joint pressures associated with clenching was found to occur in females compared to male subjects.[63] This finding is interesting in light of the fact that males have routinely been found to develop greater biting forces than females.[64] Further study in this area may provide additional explanation with regard to the preponderance of female TMD patients.

Psychosocial factors

There is little doubt there is some psychological factor associated with every pain experience. Notwithstanding, psychosocial factors are frequently proposed to be related to the TMD experience. However, the relationship of the psychologic factor(s), either directly or indirectly, as a cause or response must be determined on a case-specific basis. In a systematic review, it was reported that a high prevalence of moderate–to–severe depression was observed to range from 21.4 to 60.1% in patients diagnosed with TMD.[65] Furthermore, despite the correlation between anxiety and TMD being more controversial when compared to that of depression, the higher prevalence of trait-anxiety (one subtype of anxiety) among patients with TMD compared to healthy individuals was consistently determined.[66] It is well-recognized that anxiety, stress, negative affect, and depression may compromise physical and mental well-being, especially when pain becomes chronic. Catastrophizing (thinking the worst) and especially rumination (repetitive thinking or dwelling on negative feelings and distress and their causes and consequences) and fear avoidance have been identified as significant impediments to successful management of pain conditions.[67, 68] Pain severity has been found to be significantly related to degree of life interference and to negative affect (depression, anxiety, and anger).[69] A direct relationship exists between depression and both physical and the psychosocial functioning of orofacial pain patients.[70] Additionally, depressed mood is associated with a decrease in the concentration of the central nervous system neurotransmitters norepinephrine and serotonin.[71] Decrease in these neurotransmitters is associated with impairment of endogenous pain inhibition and disrupted sleep patterns. Anxiety and stress have been found to cause compromise in the immune system, lowering individual host resistance.[72] Overall, current evidence supports interventions for TMD in improving symptoms of depression and anxiety. However, the effect is statistically uncertain and warrants future studies to enable the best synthesis of the evidence.[73]

Importantly, research has identified a relationship between a history of physical, emotional and/or sexual abuse and a range of psychological, functional, and physical factors.[74,75] A history of abuse has been identified as a significant feature of TMD chronic pain patient populations when contrasted to patients with non-chronic TMD. Riley and others, found that an abuse history was likely to increase an individual's tendency to dwell on, amplify, and over-interpret somatic symptoms.[76] Furthermore, Grossi and others, reported that emotional abuse, more than physical and sexual abuse, is an important risk factor for the development of TMD, even when controlling for multiple other factors.[77]

Nutrition and Exercise

Some TMD/orofacial pain patients have withdrawn from normal activities of daily living, including proper eating and exercise, which may compromise not only their mental well-being, but also their neurophysiological well-being.[78] Regular exercise boosts the body's natural pain defense mechanisms by enhancing the production of endogenous opioids (enkephalins, dynorphins, endorphins). It was concluded in a systematic review that various exercise therapies appeared to have a significant effect on both pain intensity and jaw mobility in both myalgia and/or arthralgia patients.[79]

Balanced nutrition can enhance the body's pain defense mechanisms by maximizing anti-eicosinoid effects and aiding in the production of antioxidants, which limit the damage caused by destructive free radicals in both joint and muscle disorders. Chronic muscle pain disorders such as myofascial pain and fibromyalgia have been associated with a decrease in serum magnesium.[80,81] Magnesium deficit is associated with: an enhanced inflammatory process; an enhanced free radical (superoxide) formation; an enhanced excitatory state in the CNS; and, an enhanced calcium mobilizing potential (abnormal calcium handling).[82]

It is now understood that diet strongly influences bidirectional neuroendocrine crosstalk along the microbiota (the trillions of microorganisms within and on our bodies) gut-brain axis (the bidirectional communication system between the central and enteric nervous systems which link the emotional and cognitive centers of the brain with peripheral intestinal functions). Diet is both a source of neuroactive and neuroendocrine molecules as well precursors that can affect host neuroendocrine physiology. Stress can influence food preference and consumption, which can affect host-microbe bidirectional communication. The mechanistic pathways related to the complex relationship between diet, nutrition, and the microbiota gut-brain axis may have profound effects on patients with TMD. These incredibly complex relationships which causally unite these categories remain to be fully elucidated.[83]

Trauma

The role of various types of trauma in the etiology of TMD has been debated for many years. A study of 400 consecutive TMD clinical patients assessed the incidence of jaw injury in relation to onset of symptoms. Approximately 25% of the study population could relate the onset of pain and dysfunction directly to an identifiable macrotraumatic event, primarily extension/flexion injury.[84] Interestingly, patients with the combination of TMD and trauma histories display more severe subjective, objective, and psychological dysfunction compared with typical TMD only patients.[85] Similarly, a study of TMJ degenerative joint disease patients found that only 31.6% felt that a macrotraumatic episode was responsible for their condition.[86] Another macrotraumatic event to be considered as a risk factor for TMD is endotracheal intubation. Any association between endotracheal intubation and the development of short-term TMD symptoms is likely to be found in patients with a history of such dysfunctional symptoms.[87]

The previous data suggest the vast majority of TMD patients experience a more insidious onset of their symptoms likely related to microtrauma or a repetitive stress response. Potential putative microtramatic factors include bruxing/clenching/grinding/bracing/thrusting, postural dysfunction, and other habitual repetitive behaviors. In a study monitoring awake behavior in healthy young adults, it was found that teeth contact (14.5%) and jaw clenching (10.0%) were the most frequent behaviors with no significant sex differences detected.[88] Additionally, awake bruxism behaviors are significantly more frequent in masticatory muscle pain patients than non-patients and are associated with frequent bruxism-related symptoms.[89] Furthermore, it was reported that females with masticatory muscle pain have an increased frequency of both high and low-intense awake clenching episodes when compared to age matched pain free controls.[90] Hence, clinicians should recognize the effects of these awake parafunctional behaviors and tailor their management approaches accordingly.

Postural imbalances have been suggested as an etiologic variable in TMD.[91] In a systematic review and meta-analysis to identify the neck musculoskeletal disorders presented by individuals with TMD, it was reported, with moderate to strong evidence, that individuals with TMD present a reduction in the endurance of the neck extensor muscles, worse self-reported neck disability and global and upper cervical hypomobility. However, when compared to healthy controls, the TMD population did not present cranial-cervical posture alterations.[92] While there is little doubt that craniocervical dysfunction is commonly found in the TMD patient population, a cause and effect relationship has not been definitively established. Studies indicate that a dynamic relationship exists between cervical and masticatory muscles. Injection of an irritating substance into the trapezius muscle in a group of subjects was associated with an increase in the EMG activity of the injected muscle and increased EMG activity of the masseter muscle on the same side.[93] In a review article discussing the potential relationship between TMD and motor vehicular accidents it was suggested that TMJ or masticatory muscle injury may be associated with varying postural issues.[94] It appears that the complex innervations of the head and neck creates an environment in which sensory and motor systems may interact, resulting in musculoskeletal compromise of the masticatory and cervical regions.

Sleep

It is estimated that 1 in 7 Americans suffers from a diagnosable sleep disturbance. Disturbed sleep has significant physiological effects and a number of psychological relationships.[95,96] A number of sleep dependent processes are necessary for health maintenance. During the deeper, restorative stage of sleep, growth hormone is produced. Growth hormone is necessary for repair and regeneration of damaged tissues such as joint or muscle. Additionally, T-cell and lymphocyte function is enhanced by quality, restorative sleep. A compromise in the amount of deeper sleep also results in a decrease in serotonin in the CNS. The ramifications of diminished serotonin levels are widespread, involving altered pain modulation and mood. Disturbed sleep patterns are commonly reported among TMD patient populations.[97,98] Associated with these disrupted sleep cycles may be an increase in masticatory system parafunctional behaviors such as bruxing, clenching, grinding, bracing and thrusting. Sleep bruxism has been reported at levels 3-4 times more forcefully than during the waking hours due to the reduction in inhibitory controls while sleeping.[99] Furthermore,

in a large population-based cohort study, there was a significantly higher incidence of TMD in sleep apnea patients.[100] Due to the significant implications of impaired sleep and sleep bruxism, it is essential that a thorough review of each TMD/orofacial pain patient's sleep history be accomplished.

Results of the OPPERA Study

In 2004, the National Institutes of Health (NIH) sought proposals for a prospective cohort study to "identify the incidence of craniofacial pain and dysfunction and its risk factors." Subsequently, in 2006 the NIH funded a project entitled the OPPERA study. A wide array of putative risk factors were measured, ranging from genotypes to intermediate phenotypes of psychological distress and pain amplification to environmental influences and clinical aspects of TMD itself. Since its inception three study designs have been utilized: a prospective cohort study (to determine the incidence rate of first-onset TMD),[101] a case-control study (comparison between individuals (cases) who already have TMD to a similar group of individuals (controls) who do not have TMD)[102] and a nested case control study (compared those who developed TMD to those who remained symptom free).[103] Several general themes have emerged from this study that should be applied judiciously to guide patient care. Firstly, individuals who experience relatively poor health, whether in the form of comorbid disease, other pain conditions, poor sleep quality, or cigarette smoking have a disproportionately high rate for development of TMD. Therefore, as health care practitioners, efforts to promote general health should be supported as a method of primary prevention for TMD. Secondly, some of the strongest predictors of developing TMD are also the easiest to assess, including simple participant completed checklists. Lastly, even though TMD is a multifactorial condition with many risk factors, by applying cluster analysis, there exists only a few relevant subgroups ("adaptive," "pain sensitive," and "global symptoms" groups) with specific membership being strongly associated with odds of chronic TMD and with risk of developing first-onset TMD. To further advance this agenda, the OPPERA II study (2020) investigated five chronic overlapping pain conditions (COPC – TMD, headache, back pain, irritable bowel syndrome, and fibromyalgia) by assessing their associations among six biopsychosocial domains. Overall, it was determined that each of the COPC can occur as a local condition and as a part of a centralized pain condition.[104] Ultimately, a better understanding of this may allow for specifically targeted and individualized patient-centered management approaches.[105-108]

Diagnostic Considerations

In order to deliver accurate and reliable diagnosis(es) it is important to have a validated and reliable classification system to be used as a guide. The first dual axis criteria, incorporating both physical and psychosocial findings, was the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD), originally published in 1992.[109] This has since evolved into the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD)[110] which is a more validated clinically oriented classification system for the most common

Table 1 - Team members and their respective roles in the diagnosis and management of TMD/orofacial pain

Dentist	Physical Therapist	Clinical and Health Psychologist	Other Healthcare Consultants (if required)
Perform evaluation/diagnosis	Perform evaluation/ diagnosis	Perform evaluation/ diagnosis	Pharmacy
Provide patient education/ reassurance	Provide patient education/reassurance	Identification of underlying and resultant psychological issues	Neurology
Provide coordinated pharmacologic management	Deliver modalities/ techniques	Provide cognitive-behavioral therapy training	Otolaryngology/ ENT
Provide dental care (when necessary for specific dental issues)	Encourage and enhance rehabilitation	Provide pain and stress management education and skills	Rheumatology
Occlusal orthosis (intraoral appliance) therapy	Facilitate team interaction	Entrainment of enhanced coping skills	Internal Medicine
Coordinate appropriate consults		Facilitate team interaction	Neurosurgery
Facilitate team interaction			Anesthesia Pain Disciplines
Participate in the normalization of sleep quantity and quality			Sleep Medicine

joint and muscle conditions. To date, it is the only classification system that incorporates standardized and reliable self-report questionnaires, clinical examination procedures, scoring systems, and decision trees. Furthermore, no other system integrates biophysical diagnosis to a disability index that measures the impact that pain has on the patient's behavior. A supplementation and extension of the DC/TMD, to include less common masticatory muscle and temporomandibular joint conditions, is the expanded DC/TMD.[111] This system incorporates thirty seven conditions that have operationalized diagnostic criteria. Another classification system known as the International Classification of Orofacial Pain (ICOP)[112] was developed in 2020. This classification system emphasizes the characteristics of the pain disorders rather than the anatomic location. Included in ICOP are TMD diagnostic criteria which have been adopted from the DC/TMD by including only painful TMD conditions. Additionally, ICOP incorporates a time component to diagnosis as well as distinguishing primary from secondary pain.

To assist the clinician in the diagnostic process, a validated TMD screener has been developed which may be administered in either a short (three-item) or long (six-item) version. This psychometric instrument has excellent levels of reliability, sensitivity, and specificity thus supporting its usefulness in any clinical office setting.[113]

Management Considerations

Management of TMD/orofacial pain must be viewed on a case-specific basis. To achieve optimum outcomes, the practitioner(s) must address the specific pathophysiology. The traditional model of monodisciplinary management has proven to be effective in cases where definitive cause and effect relationships may be established. However, the multifaceted nature of these conditions, in combination with the associated features and comorbidities of recurrent and/or chronic pain, add a significant degree of complexity to management decisions and interventions. Utilization of multidisciplinary (imparts knowledge from different disciplines but stays within their boundaries - work performed by multiple members who work in the same field) and interdisciplinary (analyzes, synthesizes and harmonizes links between disciplines into a coordinated and coherent whole - work performed by team members from multiple specialties or disciplines) models of diagnosis and management encourages the integration of a management plan with input from a cadre of health practitioners (**Table 1**).[114,115] This approach will enhance outcomes by addressing physical, somatic, psychological, social, environmental, and behavioral factors in a well-orchestrated fashion. The goals of management include: 1) reduce or eliminate pain; 2) halt the disease process when possible; 3) normalize function; 4) improve quality of life; and, 5) reduce the need for long-term care.[116]

Implementation of a multimodal strategy requires adherence to a biopsychosocial model by which the therapy team develops a complete and definitive diagnosis encompassing all physical and psychosocial factors. Goals must be established with regard to treatment duration, pain management approaches, patient involvement, and a plan for the patient to return to activities of daily living. Success is dependent on regular communication between all the team members.

Conclusions

TMD represents a multitude of conditions afflicting the masticatory region with implications that transcend anatomic and neurologic boundaries. TMDs are multifactorial in nature, encompassing both physical and psychosocial domains. Significant variability exists among patients indicating there may be predisposition in some cases. Scientific studies suggest the involvement of both peripheral and central mechanisms (sympathetic nervous system and immune system) which compromise the individual's pain dampening (modulating) system, playing a major role in recurrent and chronic cases. Therefore, it is essential that a complete evaluation of the patient from historical, clinical presentation, and physical/psychosocial examination perspectives be accomplished. Finding all the components of TMD/orofacial pain on a case-specific basis is necessary for a complete and accurate diagnosis, and effective management. Highlighting this suggestion, is a 400-page report from the National Academies of Sciences, Engineering, and Medicine (NASEM) entitled "*Temporomandibular Disorders: Priorities for Research and Care*".[117] The aim of the report was to provide recommendations that would lead to improved health and well-being of individuals with TMDs. By following these approaches and initiatives we can hopefully achieve the goal stated by Liebeskind and Melzack: "By any reasonable code, freedom from pain should be a basic human right limited only by our knowledge to achieve it."[118]

Acknowledgement

The first three editions of this Guide were co-authored by Henry Gremillion, DDS and Gary Klasser, DMD. Dr. Klasser reviewed and updated the material for the 4th edition.

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POST-TEST

Internet Users: This page is intended to assist you in fast and accurate testing when completing the "Online Exam." We suggest reviewing the questions and then circling your answers on this page prior to completing the online exam.

(1.0 CE Credit Contact Hour) Please circle the correct answer. 70% equals passing grade.

1. **The etiology of most TMDs:**
   a. Is most likely related to some type of recognizable traumatic event.
   b. Most likely can be determined by careful exam and history taking.
   c. Is most likely related to psychosocial factors.
   d. Is generally idiopathic, and cannot be clearly determined.
   e. Is generally due to a singular event which is often identifiable.

2. **Compared to a person having normal, non-painful jaw joints, a subject with a painful TM joint may have:**
   a. Limitation of jaw motion.
   b. Painful or tender jaw muscles.
   c. Intracapsular sounds.
   d. Deviation upon opening.
   e. a + b only

3. **The objective of most interventions for TMD is/are to:**
   a. Control or eliminate pain and increase functional range of motion.
   b. Control or eliminate etiologic factors.
   c. Correct the occlusion to produce harmony in the masticatory system.
   d. Restore normal anatomy and histology of the TMJ structures.
   e. All of the above.

4. **It is important to differentiate acute from chronic pain because:**
   a. Acute pain is associated with persisting psychological stress.
   b. Acute pain has no biologically adaptive value.
   c. The difference between acute and chronic pain is purely temporal.
   d. Psychological factors may modulate the pain experience and modify pain perception.
   e. Psychological factors are most often the sole cause of chronic pain.

5. **Studies of patients with pain disorders that have sex-specific signs and symptoms suggest that:**
   a. Females report less pain disorders than males, but seek help more often.
   b. Males have more pain related ailments than females, but seek help less often.
   c. Male hormones are a major contributor to pain related ailments.
   d. Female pain disorders are predominantly a function of menstrual cycles.
   e. According to the Orofacial Pain Prospective Evaluation and Risk Assessment (OPPERA) study, it was reported that sex differences played a minor role in the early onset of signs and symptoms of TMD.

6. **Depressed mood is associated with the following neurotransmitters except for:**
   a. Serotonin + norepinepherine.
   b. Norepinepherine + dopamine.
   c. Estrogen + prolactin.
   d. Dynorphin + endorphin.
   e. All of the above

7. **Characteristics of myofascial pain include:**
   a. Sharp, piercing quality of the pain.
   b. No pain with function.
   c. Pain easily localized to a specific site.
   d. The presence of trigger points.
   e. Temporomandibular joint sounds.

8. **Macrotraumatic events related to TMD consist of the following:**
   a. Bruxism
   b. Extension/flexion injury
   c Endotracheal intubation
   d. Only b + c
   e. All of the above

9. **It is recognized that females demonstrate greater pain sensitivity:**
   a. During the menstrual cycle.
   b. At ovulation.
   c. Following menses.
   d. None of the above
   e. All of the above

10. **Management strategies for TMD should include nutrition and exercise because:**
    a. TMD patients often withdraw from healthy daily activities.
    b. Chronic muscle pain disorders have been associated with an increase in serum magnesium accounting for neuroprotection.
    c. Regular exercise enhances the production of endorphins.
    d. a + c only.
    e. All of the above.

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Evaluation - Temporomandibular Disorders: Etiology, Diagnostic and Management Considerations 4th Edition

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