Temporomandibular Disorders: Epidemiologic and Etiologic Considerations (Part 1)

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Temporomandibular disorder is a collective term embracing a number of clinical problems that involve the masticatory musculature, the temporomandibular joint (TMJ), associated structures, or both that have many common symptoms. The term is synonymous with others frequently utilized such as myofascial pain and dysfunction syndrome, temporomandibular joint syndrome and craniomandibular disorders. Temporomandibular disorders are currently recognized as a major cause of non-dental pain in the orofacial region and are considered a subclassification of musculoskeletal disorders.[1]

Classic signs and symptoms associated with TMD are pain in the pre auricular region and contiguous areas to include, TM joint and masticatory and cervical muscles: limitation or deviation in mandibular movements; and TM joint sounds (clicking, popping, crepitus). The pain is usually aggravated by chewing or other jaw function.

Commonly associated co-existing/co-morbidity factors with TMD are headache, neckache, facial pain, ear and jaw ache. Non-painful masticatory muscle hypertrophy and abnormal occlusal wear resulting from oral parafunction activities such as bruxism may be related problems.[1, 2]

A functional homeostatic balance between the various components of the masticatory system must be maintained for long-term stability. In addition, there are other contributing factors that can disrupt this dynamic balance. Anatomical, neurologic, physiologic and psychologic factors can, alone or in combination, be sufficient to disrupt this balance; thus reducing the adaptive capacity of the masticatory system with subsequent expression of symptoms of TMD.[3]

Epidemiology, the study of the distribution and determinants of health-related states and events in populations,[4] should have a definitive application to the problem in question. Epidemiologic studies related to TMD have been primarily focused on prevalence and the associated signs and symptoms. Most of the studies are cross-sectional samples, meaning they are not necessarily representative of the general population. Therefore, their prevalence on a case-specific basis must be questioned.

Signs and symptoms of TMD are very common in the general population. They suggest that 40 to 75% of the general population have at least one sign of TMD (joint noise, tenderness, etc), 33% of the general population have at least one symptom (face pain, joint pain, etc.).[5–8] The prevalence of signs and symptoms of TMD in childhood has been assessed but tends to be significantly lower than in adults.[10–12] Signs and symptoms of TMD are more prevalent in the third or forth decade of life.[13–17] Studies related to the severity of pain between age groups have demonstrated no difference across all age groups.[18] However, the frequency of the morphologic changes and a marked continuous decrease in signs and symptoms is observed with advancing age.[19–25]

Data indicate that significant gender differences in the TMD population exist. Importantly, this trend is observed in most chronic pain conditions. Factors that must be taken into consideration are behavioral factors such as the more stoic nature of males; social conditioning and care seeking behaviors have been proposed as possibly being responsible for the gender differences. Physiological factors related to hormonal influences are also reported. A natural tendency is for females to exhibit a greater potential of masticatory muscle fatigue has been suggested. This phenomenon has been attributed to a greater concentration of fast twitch, easily fatiguing white fibers versus slower twitch, endurant red fibers in the females.[26–28] Recent data also suggests hormonal factors may be largely responsible for gender differences in the TMD population.

Exercise-induced fatigue must also be considered in gender differences associated with TMD. During moderate-intensity long-duration exercise, females demonstrated greater lipid utilization and less carbohydrate and protein metabolism than males, indicating differences in muscular physiology.[30] TMD appears to peak in incidence during the reproductive years suggesting that either biologic, neurological or psychological factors unique to women in this period of life could increase the risk of developing or maintaining this condition. It has been long recognized that females demonstrate a greater pain sensitivity during the menstrual cycle, at ovulation, and following menses. Functional estrogen receptors have been identified in most synovial joints of males and females in equal concentrations, and there exists a significant difference in the number of estrogen receptors within the TM joint. Male TM joints have been found to have few, if any, estrogen receptors while female TM joints exhibited significant numbers of these receptors.[34–36]

Psychosocial factors have been proposed to be related to TMD experience. The relationship of the psychological factor(s) either directly or indirectly as causative must be determined on a case-specific basis. Catastrophizing (thinking of the worst) has been identified as a significant impediment to successful management of pain conditions. Studies have demonstrated that pain severity to be significantly related to the degree of life interference and to negative affect (depression, anxiety, anger).[37,38] Additionally, depressed mood is associated with a decrease in the concentration of central nervous system neurotransmitters norepinephrine and serotonin. A 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, thus lowering individual host resistance.

A relationship between a history of physical and/or sexual abuse and a range of psychological, functional, and physical factors has been suggested. Abuse history has been identified as a significant feature of TMD chronic pain patients populations as contrasted to non-chronic TMD patients. Research have found that an abuse history was likely to increase an individual's tendency to dwell on, amplify, and over interpret somatic symptoms.[39]

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The value of proper nutrition and exercise must be recognized, particularly in patients living with chronic pain where withdrawal from normal daily activities may have compromised not only their mental well-being, but also their neurophysiological well-being. Exercise on a regular basis boosts the body's natural pain defense mechanisms, enhancing the production of endogenous opiods (enkephalins, dynorphins, endorphins). Balanced nutrition can enhance the body's pain mechanism by maximizing anti-eicosanoid effects and aiding in the production of antioxidants, which limit the damage cause by free radicals in both joints and muscles. Certain vitamin deficiencies have been linked to enhanced inflammatory process activities and free radical formation, including magnesium and B vitamins.[40]

Historically, TM disorders have been on stage for confusion and disagreement about what constitutes proper diagnosis, treatment and management. The literature has demonstrated that most of the management and treatment of TM disorders has been based on belief systems and testimonials. Why so much controversy? The controversy may exists because of the limited knowledge regarding the etiology and the natural history of the course of TMD. Probably the difficulty is in establishing clinically, a significant direct cause/effect relationship because of the many variables involved that probably are too difficult, if not impossible, to exclude.

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Many early theories emphasized dental morphological factors of malocclusion, occlusal disharmony, and bad mandibular alignment as being primarily responsible for the development of TMD symptoms. Based on the definition, evaluation and analysis of occlusion are important aspects in the diagnosis and treatment of TMD. The question is, Is occlusion the most important factor? Little evidence is available to strongly implicate occlusion in the etiology of TMD.[43–46]

Several studies have demonstrated that the presence of predisposing factors such as structural, metabolic, and/or psychological conditions could be sufficient to increase the risk of developing TMD related problems if they are affecting the masticatory system in a negative way. It has been reported than an extreme anterior open bite, overjet greater than 6 to 7 mm, discrepancy between the retruded contact position and the intercuspal position greater than 4 mm, five or more missing posterior teeth, and unilateral maxillary posterior lingual crossbite in children may be associated with TMD.[41–46]

Some contributing etiologic factors are only risk factors, others are causal in nature, and others result from, or are purely coincidental to the problem. These factors are classified as predisposing, initiating (precipitating), and perpetuating (factors that interfere with the healing or enhance the progression) of a disease process.[47] The contribution of specific occlusal factors to the multifactorial etiology of TMD have been demonstrated in studies to be only 10 to 25%.[48] Associated existing factors should be considered and not assume a direct cause effect due to their presence. The dentist must consider each of these potential contributing factors on a case-specific basis.

The role of various types of trauma in the etiology of TMD has been debated for many years. Trauma is described as any force applied to the mastication structures that exceeds that of normal

functional loading. Factors such as intensity and duration must be considered. Most trauma can be divided into three types: direct trauma (the result of a sudden and usually isolated blow to the structures), indirect (sudden blow without direct contact), micro-trauma (the result of prolonged, repeated forces over time due to parafunctional habits or adverse loading through postural imbalances).

Forces leading to structural failure, loss of function may follow. Stretching, twisting, or compressing forces during eating, yawning, yelling, or prolonged mouth opening have also been reported to trigger or aggravate TMD.[49,50] The results of several studies indicate that the majority of TMD patients experience a more gradual and mostly unperceived onset of their symptoms, likely related to micro-trauma or a repetitive stress response. Micro traumatic factors include bruxing, clenching, postural dysfunction, and any other habitual repetitive behaviors. Experimentally induced parafunction has shown to cause pain similar to that reported by those with TMD.[53, 54]

The importance of sleep has been underestimated by the majority of the population, 63% of American adults do not obtain the recommended amount of daily sleep. Sleep is a basic human need, and must be considered as important as diet and exercise. Getting the right amount of sleep is vital, but just as important is the quality of our sleep. Sleep disturbances have been reported in many epidemiological studies in persons experiencing not only acute but also chronic pain. It is estimated than one in seven Americans suffers from some kind of sleep disturbance. Studies have shown that disturbed sleep has significant physiological effects and a number of psychological relationships have been demonstrated.[53–56]

Sleep bruxism is reported by 8% of the adult population and is mainly associated with rhythmic masticatory muscle activity, characterized by repetitive muscle contractions primarily during the REM stage of sleep. The reduction in the inhibitory controls while sleeping makes forces during nocturnal bruxism 3 to 4 times greater than during waking hours, forces that potentially exceed the normal capacity of the system.[55] Sleep bruxism may eventually lead to many signs and symptoms of dysfunction, including pain, and/or structural changes in the masticatory system.

It has been demonstrated that the metabolic activity of the brain significantly decreases after 24 hours of sustained wakefulness. A number of sleep dependent activities have been recognized, leading us to a better understanding of how sleep deprivation or interruption may result in a decrease in body temperature, a decrease in immune system function (T-cells and lymphocyte function), a decrease in the release of growth hormone (necessary for repair and regeneration of damaged tissues) and a reduction in serotonin (neurotransmitters involved in pain modulation and mood) in the central nervous system. A thorough sleep history must be obtain in all orofacial pain patients due to the significant implications of disrupted sleep and nocturnal bruxism.

Acceleration-deceleration injury (whiplash) with no direct blow to the face can cause symptoms consistent with TMD. However, a direct causal relationship between jaw symptoms and indirect trauma has yet to be established.[57,58,59] Studies have failed to demonstrate a jaw movement to cause mandibular strain in a flexion-extension type of injury.

The TMD examination requires a comprehensive approach understanding all potential factors. The physical examination should consist of a review of systems including not only a patient's actual chief concern(s), but also the chronological history, history of present illness(es), medical history, dental history, and personal history (social, family), general inspection of the head, neck and cervical spine, neurovascular evaluation, comprehensive orthopedic evaluation of the TM joints, evaluation and palpation of the masticatory and cervical muscles, gross screening of the cranial nerves, and intraoral evaluation of hard and soft tissues including occlusal analysis.

Basic assessment of all TMD patients should include behavioral and psychological screening by the dentist during the history taking process. The history should include questions to evaluate behavioral, social, emotional, and cognitive factors that may initiate, sustain or result from the patient's condition. Consideration to relevant factors such as oral habits, signs of depression, anxiety, stressful life events, lifestyle, secondary gain, and overuse of health care should also be given. Imaging of the TM joint and orofacial structures may be necessary to rule out structural disorders, and must be prescribed primarily when the clinical examination suggests some form of disorder.[60]

Heretofore clinical practice in the area of TMD has been based on anecdotal reporting. Individual and group interpretation of the limited scientific evidence has led to a marked variation in the philosophy of practice in this complex area. Empiricism and rationalism has at times resulted in disregard for the valid scientific evidence-base that does exist. With the recent explosion of knowledge regarding pain mechanisms and pathways, the effect of pain on quality of life, and an enhanced appreciation for the multifactorial nature of TMD, today's dentist can better apply science to the art of practicing evidence-based dentistry. Evidence-based dentistry is the conscientious, explicit and judicious use of current best evidence in making decisions about the care of each patient. "The purpose of using the evidence-based approach is to close the gap between what is known and what is practiced and to improve patient care based upon informed decision making".[61] Albert Einstein said, "Science without religion is lame, religion without science is blind". DT

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