

RECENT TRENDS IN DIAGNOSIS AND MANAGEMENT OF TEMPOROMANDIBULAR JOINT DISORDERS

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ABSTRACT

Diagnosis and treatment of temporomandibular disorders (TMDs) have been within the domain of dentistry for many decades. However, the field of TMDs and other causes of orofacial pain is undergoing a radical change, primarily because of an explosion of knowledge about pain management in general. As a result, etiological theories about TMDs are evolving toward a biopsychosocial medical model from the traditional dental framework. Conservative and reversible management approaches (especially of chronic pain conditions) are becoming the norm rather than the exception in treating TMD patients, and already certain biological and psychosocial factors are known to affect the outcomes. Current research in this field is focused on genetic and environmental susceptibility factors as well as individual adaptive potentials. To continue as the main providers of care for TMD patients, dentists will need to recognize and appreciate these important changes.

INTRODUCTION

Temporomandibular disorders (TMDs) are defined by the American Academy of Orofacial Pain as “a collective term that embraces a number of clinical problems that involve the masticatory muscles, the TMJ [temporomandibular joint], and the associated structures.” [1]. Pain and dysfunctional symptoms or signs such as limitations in opening, asymmetric jaw movements and TMJ sounds are the most common findings. The concept of TMDs as part of the constellation of musculoskeletal disorders, rather than some special kind of dental condition, is relatively recent. In 1918, Prentiss [2] initiated interest in the dental community when he suggested that the development of “TMJ problems” was due to the following process: “When the teeth are extracted, the condyle is pulled upward by the powerful musculature and pressure on the meniscus results in atrophy.”

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This was soon followed by several articles from other dentists, who emphasized missing teeth and lost vertical dimension leading to displacement of the mandible as the cause of the signs and symptoms displayed by patients with TMD [3,4,5].

It was not until 1934 that dentists were given ownership of this problem, when J.B.Costen, an otolaryngologist, pronounced that the TMJ was a separate source of facial pain and several other associated symptoms, due to nerve impingement from overclosure of bites, lack of molar support and malocclusion [6]. Over the next 5 years, he followed up with 11 more articles emphasizing these structural concepts as the etiology for TMDs and urging dentists to take responsibility for managing them. It was subsequently shown that Costen's explanation of the anatomic relations between the TMJ and ear and sinus structures was incorrect [7,8]. However, terms such as overclosed vertical dimension, condylar malposition, trapped mandibles, occlusal disharmony and neuromuscular imbalance developed from the initial conceptual framework, and treatments to correct these



problems became the basis for a variety of invasive and irreversible dental therapies, including bite-opening, occlusal adjustments, major restorative dentistry, orthodontics and even surgeries. Whatever one may think of these concepts and interventions, it is clear that they were the basis for a mechanical, dentistry-oriented etiological viewpoint and that the related therapies were seen as being anti-etiological. In fact, the word *definitive* was often used to describe the *curative* value of these approaches to TMD treatment.

Over the next 7 decades, the field of TMDs experienced many taxonomic and conceptual changes. Various labels, such as TMJ syndrome, TMJ pain-dysfunction syndrome and myofascial pain-dysfunction syndrome, were applied to TMDs. Fortunately, single-disease concepts have been discarded because of their simplicity and naïveté, and the early dental mechanical theories of misaligned jaws or faulty occlusal relations have largely been discredited [9]. Today, TMDs are being studied and treated from a medical perspective that involves orthopedic principles, combined with a biopsychosocial understanding of how chronic pain disorders affect those who have them.

Treatment of any condition involves an accurate diagnosis which in turn entails finding the exact etiology. Unfortunately for many of the chronic pain disorders including TMD's, the search for exact cause or the initiating process and thereby the sequence of progression has been difficult, due to the nature of the disease. This article is an attempt to make a general practitioner understand the various proposed concepts, the controversies and the present consensus.

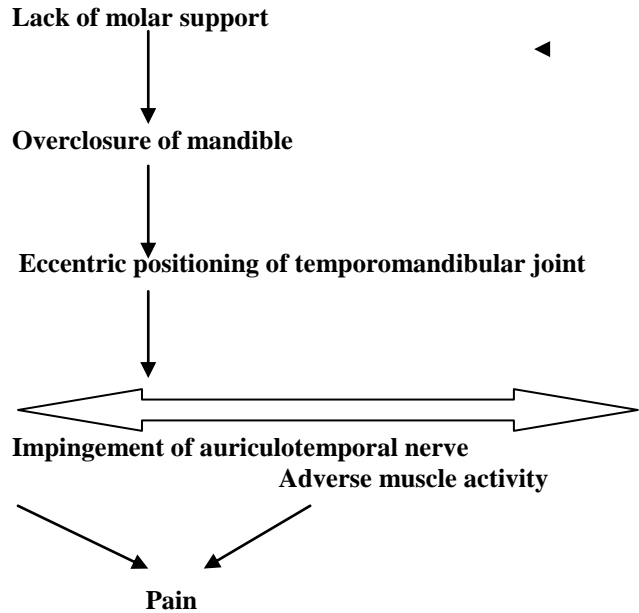
Etiological concepts

The causes of temporomandibular disorders are complex and multifactorial. There are numerous factors that can contribute to temporomandibular disorders. Factors that can increase the risk of temporomandibular disorders are called '*Predisposing Factors*' and those causing the onset of temporomandibular disorders are called '*Initiating factors*' and factors that interfere with healing and enhance the progression of temporomandibular disorders are called '*Perpetuating factors*'

The etiological concepts in its earlier days of inception were purely mechanistic; attributing the various signs and symptoms to derangement of a particular anatomical region (temporomandibular joint, muscles of mastication or the occlusion). The earlier theories were based on a biomedical model comprising

- 1) The mechanical displacement theory
- 2) The trauma theory
- 3) The biomedical theory
- 4) The osteo-arthritis theory
- 5) The muscle theory

The mechanical displacement theory hypothesized that the lack of molar support or functional occlusal prematurities caused a direct eccentric positioning of the condyle in the glenoid fossa, leading to pain, dysfunction and ear symptoms. The faulty condylar position led directly to adverse muscle activity. This theory gained momentum after Costen published his article focusing on occlusion as the most important causative factor for TMD. He proposed that due to the absence of molar support, the powerful elevating muscles of the mandible could press the condyles upward and backward causing damage to nerves and vessels including chorda tympani [10].



Mechanical Displacement Theory.

The trauma theory proposed by Zarb and Speck¹¹ considered micro-/macrotrauma as a principal factor that initiated pathologic processes and dysfunction in different parts of the stomatognathic system thus leading to the symptoms of TMD. According to this theory any trauma which can cause structural alteration to the joint or the muscles is considered Macrotrauma. Microtrauma refers to any small force that is repeatedly applied to the joint structures over a long period of time. Consequently, even though the etiological premise of this theory was related to trauma, it was actually an earlier multidimensional etiological model. However, no critical appraisal for the multitude of factors involved was given in the causation of TMD.

The biomedical theory by Reade also supported the role of trauma in the initiation of the disorder. Once initiated, the condition will either resolve or in presence of certain factors like disrupted occlusion, parafunctional habits (particularly bruxism) and occupational activities, will progress further. Apart from factors causing increase or



adverse functional loading, psychological elements were recognized as important maintaining influences. According to Reade (1984) “this theory would explain why similar occlusal interferences do not cause similar symptoms in different individuals and why all individuals with stress do not develop TMD” [12].

The osteoarthritic theory by Stegenga proposed osteoarthritis as the causative factor for TMD.¹³ According to this theory muscular symptoms and internal derangement were secondary to joint pathology. Pathological changes in the TMJ could be induced by absolute or relative overloading. Absolute overloading of the joint can occur at the time of trauma. Relative overloading could happen if the adaptive capacity of the joint structures is reduced by inflammation and ageing. This theory can explain some subcategories of TMD, but lacks in its ability to explain all the other disorders under the TMD's.

The muscle theory supported by Travell and Rinzler, suggested that the primary etiologic factor was in the masticatory muscles themselves. It suggests that myalgia of masticatory muscles can refer pain to TMJ. The myalgia in the facial region is caused by chronic myospasm which is secondary to parafunctional habits. This theory placed the temporomandibular pain in the context of a wider general muscle disorder and denied any influence of the occlusion [14].

The neuromuscular theory supported by Ramjford proposed that the occlusal interferences were the causative factor for the disorder. He noted that regional pain associated with bruxism and myalgia was completely eliminated in subjects after occlusal equilibration. This theory proposed that the occlusal interferences caused an altered proprioceptive feedback, leading to incoordination and spasm of some of the masticatory muscles [15]. Slowly the idea of TMD's occurring outside the realm of physical factors started percolating through. Perhaps the very first attempt in this direction was made by Schwartz.

The psychophysiological theory by Schwartz and Laskin, suggested that the psychological factors are more important than the occlusal disturbances in initiating and perpetuating TMD. Spasm of the masticatory muscles, caused by overextension, overcontraction or muscle fatigue due to parafunctions was used by patients as a means to relieve stress. According to this theory it is the interaction between physiological predisposition, and psychological stress which causes TMD. The effect on the individual depended on their ability to cope with stress [11,12,13].

The psychological theory proposed that emotional disturbances initiating centrally, induced muscular hyperactivity which led to parafunctional habits and so

indirectly to occlusal abnormalities. It emphasizes emotional factors, particularly stress, whereby tense individuals clench their teeth creating a state of muscle contractility that leads to pain. In TMD patient the behavioural aspect of the patient needs to be studied. Several authors have confirmed the role of psychological factors in TMD [16,17,18]. Various researchers have talked about the influence of personality [19], mental attitude [20] and behavioral pattern [21] of the patient on TMD. Scientific literature confirms at least the following psychological and psychosocial dimensions as important in the assessment and management of TMD: affective disturbance (depression and/or anxiety), somatization and psychosocial dysfunction. There is now general agreement that all patients with TMD should be screened for psychological and psychosocial dysfunction[22]. Gradually, concepts based on a single factor lost their scientific and clinical credibility. As it became more and more apparent that the etiology was multifactorial and that none of these theories in isolation could explain the etiologic mechanisms in TMD patients. The theories advanced from a pure mechanistic view, and expanded to a wider arena inclusive of psychological and behavioral factors.

The Multifactorial Concept

The TMJ and the stomatognathic system in general are affected by a large variety of pathological conditions with different prognosis. They often overlap with respect to their signs and symptoms thus making the differential diagnosis in the individual patient difficult resulting in diagnostic errors. It is now generally accepted that the etiology is multifactorial for TMD even though finding the primary etiologic factor can be difficult for the individual patient [23,24]. It is likely that the etiology will be different in young and in older patients. With increasing age, there is an increased risk of age-related joint changes and systemic conditions affecting the TMJ. Ageing the reparative capacity of the articular cartilage is significantly reduced. Also TMDs have been reported to be more common in females than males, with the highest prevalence among women of reproductive age.

All the factors influencing the disorder have been categorized by Bell into the predisposing, initiating and perpetuating factors [25]. The predisposing factors are generally subdivided into systemic, psychologic (personality, behavior) and structural (all types of occlusal discrepancies, improper dental treatment, joint laxity) factors. The initiating factors are trauma, micro and macro, adverse or overloading of joint structures, parafunctional habits. The perpetuating or sustaining factors include mechanical and muscular stress, behavioral, social and emotional difficulties (Figure 1). The multifactorial theory was unable to explain the exact role the various factors played and could not differentiate whether the proposed factor were predisposing, activating or perpetuating in nature. This theory then gave way to the present biopsychosocial model of TMD.



Factors involved in Temporomandibular disorders

1. Occlusal factors and anatomic predisposing factors

The etiologic role of occlusal factors is probably the most discussed and controversial one. Occlusal factors should, like all other factors, be considered as a contributing factor amongst the many causes and not as the single causative factor [26,27]. The degree of occlusal disharmonies does not seem to be a good predictor for the severity of the dysfunction. Unstable occlusal conditions can be considered as a predisposing factor. Dolico-facial are likely to have an overload in the joints because a steep articular eminence has been reported to predispose for intracapsular derangement [28].

Condylar position within the glenoid fossa also has been studied. Weinberg had showed a correlation between condylar position in the fossa and TMJ dysfunction. Anterior condylar displacement can affect the musculature by inducing over functional response in the proprioceptive system. Posterior condylar displacement usually results in an intrajoint response consisting of a disk derangement, reciprocal clicking, possible anterior disc dislocation, possible pathologic swallowing pattern and noxious stimulation to the proprioceptive system [29].

2. Role of parafunctional habits

Parafunctional habits such as grinding, clenching, nail and cheek biting are often mentioned as important co-factors in the etiology of TMD and can be classified under the group of neuromuscular factors [30]. According to the psychophysiologic concept, vulnerable patients respond to stress with higher levels of masticatory muscle tension and show less habituation to stress. The concept that this hyperactivity of the masticatory muscles during nocturnal bruxism is correlated to TMD is reinforced because of the connection with bruxism and other psychophysiologic events of sleep [31,32].

3. Trauma

The trauma itself is, in most patients, an initiating etiologic factor. The anatomical asymmetry, which can be the sequel of a trauma, is most likely a sustaining factor because it leads to an asymmetric loading of the joints and thereby asymmetric contraction of the masticatory muscles. It is usually subdivided into microtrauma and macrotrauma [33,34].

Macrotrauma

Trauma is categorized as macrotrauma when any sudden force to the joint results in structural alterations. Macrotrauma can be further subdivided into two types; direct and indirect trauma.

Direct trauma to the mandible, such as a blow to the chin, can instantly create an intracapsular disorder. If such trauma occurs when the teeth are apart (open mouth trauma) the condyle can get suddenly displaced within the fossa and the sudden movement of the condyle is resisted

by the ligaments, which then get elongated due to the high force, thereby altering the normal condyle-disc mechanics. Macrotrauma can also occur when the teeth are together in intercuspation (closed mouth trauma) and in such a scenario the intercuspation of the teeth maintains the jaw position, resisting joint displacement. Direct trauma may also be iatrogenically induced when the jaw is overextended, causing ligament elongation. Individuals are more at risk for this type of injury if they have been sedated, altering the normal joint stabilization by the supporting muscles. A few common examples of iatrogenic trauma are intubation procedures during general anesthesia, third molar extraction procedures, and a long dental appointment. Extended wide opening of the mouth such as during yawning, eating foods like burgers, sandwiches, etc has the potential of elongating the discal ligaments too.

Indirect trauma refers to injury that may occur to the TMJ secondary to a sudden force that does not directly impact or contact the mandible. The most common type is associated with cervical flexion-extension (whiplash) injuries seen in road traffic high speed accident [35].

Microtrauma- Microtrauma refers to any small force that is repeatedly applied to the joint structures over a long period of time. Microtrauma can result from joint loading associated with muscular hyperactivity such as bruxism or clenching. This may be especially true if the bruxing activity is intermittent and the tissues have not had an opportunity to adapt. Another type of microtrauma results from mandibular orthopaedic instability when the stable intercuspal position of the teeth is not in harmony with the musculoskeletally stable position of the condyles. When this condition exists, it results in microtrauma to the joint. A common occlusal condition known to provide this environment is the skeletal class II deep-bite, which may be further aggravated with a division 2 anterior relationships [36].

4. Psychological and behavioral factors

It has now been established that psychological and behavioral aspects are strongly related to TMD not only as initiating but also as predisposing and perpetuating factor. Patients with higher anxiety levels have more excitable muscles than those with lower anxiety scores. These patients have higher rates of depression, somatization and health care utilization [37,38].

The biopsychosocial Model

The biopsychosocial model attempts to integrate both the physical disorder factors, i.e., biological factors as well as the illness impact factors, i.e., psychological and social factors. In 1992, Dworkin and his colleagues reviewed epidemiologic and relevant clinical studies in TMD and presented a comprehensive biopsychosocial model of chronic pain development and experience that was especially applicable to TMD research and an



understanding of TMD pain. It integrated dynamic and multilevel (physiologic, psychological and social) factors at different stages in the development of pain and pain dysfunction thus reflecting for the first time comprehensive biopsychosocial perspective (multidimensional aspects) of TMD. More specifically, this model showed the dynamic nature of intrinsic intrapersonal factors (such as nociception, pain perception, pain appraisal) and extrinsic interpersonal factors (behaviour responses to pain, social roles for the person in pain within the context of the family, the health care delivery system, the workplace, and the social welfare system) in chronic pain, including TMD. The model

showed how these factors could be intensified or minimized and how augmentation of pain perception, appraisal and pain behaviours can lead to chronic TMD pain dysfunction [39]. One of the most widely studied instruments in this orientation is the RDC/TMD, which conceptualizes TMD according to a two-axis system, one for the physical disorder factors (Axis I) (Figure 2) and the other for the psychosocial illness impact factors (Axis II). (Figure 3). The RDC/TMD has been accepted in the scientific community worldwide, including the establishment of an international consortium of RDC/TMDbased researchers [40].

Table 1. Common signs and symptoms of Temporomandibular Disorders

• Pain or tenderness in the Temporomandibular joint, muscles of mastication, facial areas, ear region, shoulder and neck
• A clicking, popping or grating sound when opening or closing the mouth or while chewing
• Catching or locking of the joint with deviations or deflections of the mandible on opening or closing the mouth
• Limitations in opening or closing the mouth
• Difficulty or discomfort while chewing
• Sensation of an uncomfortable bite

Figure 1. Model describing the multi factorial concept.



Figure 2. Biobehavioral Model of Pain [40]

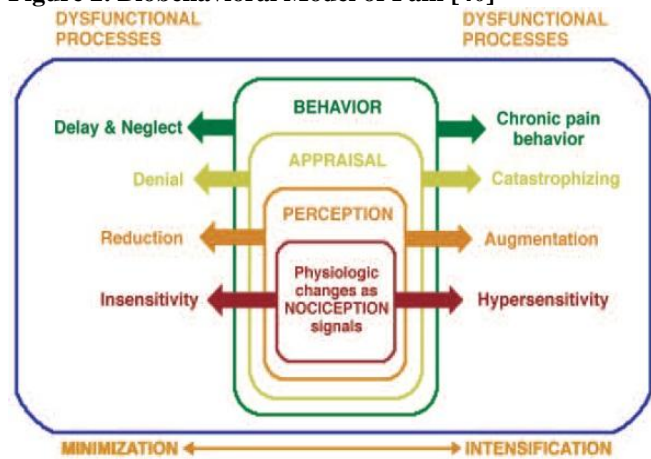


Figure 3. Biophysical Model Domains for Treatment Interventions



CONCLUSIONS

The field of TMDs is undergoing a major transformation as a result of research findings about pain in general, as well as specific advances within the field. As

a result, TMDs are currently recognized as a subset of musculoskeletal pain conditions, and this requires a medical perspective to understand and manage TMD patients. For the dental profession, the implications of this



information are profound and serious in most TMD cases, but especially in chronic conditions. Essentially, it means that dentists should try to avoid invasive, irreversible and aggressive treatments that are intended to “cure” these problems. Instead, more reversible and conservative medically based management strategies are recommended

to reduce pain and improve function, an approach that has been shown to be successful for most TMD patients. Currently the biopsychosocial model is the most accepted theory. The search for the etiology of the temporomandibular disorders is by no means over.

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