The Changing Field of Temporomandibular Disorders: What Dentists Need to Know

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SOMMAIRE

Le diagnostic et le traitement des problèmes temporo-mandibulaires (PTM) relèvent du domaine de la dentisterie depuis de nombreuses décennies. Le domaine des PTM et des autres causes de la douleur bucco-faciale subit toutefois des changements fondamentaux, qui s’expliquent principalement par l’explosion du savoir sur le traitement de la douleur en général. On constate ainsi que les théories étiologiques sur les PTM évoluent en faveur d’un modèle médical biopsychosocial qui s’éloigne du cadre dentaire classique. Les méthodes prudentes et réversibles de prise en charge (en particulier de la douleur chronique) sont en voie de devenir la norme plutôt que l’exception dans le traitement des patients atteints de PTM, et on sait déjà que certains facteurs biologiques et psychosociaux influencent l’issue du traitement. Les recherches actuelles dans ce domaine sont axées sur la génétique et les facteurs de sensibilité environnementale, ainsi que sur la capacité d’adaptation de la personne. Si les dentistes veulent demeurer les principaux fournisseurs de soins auprès des patients atteints de PTM, ils devront reconnaître ces importants changements et en tenir compte.
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

The aim of this paper is to make dentists aware of the significant conceptual and practical changes that have already occurred or are in the process of emerging in the field of TMDs, so that they can continue to play an important role in the management of these disorders.

Etiology of TMDs

Greene defined etiology as the following: “We want to know why a particular patient began to have both the biology and the perception of his/her pain (in the absence of frank trauma).” It is within the context of this definition that the etiology of TMDs is discussed here.

In addition to the early views described above, various disciplines of dentistry and other areas of health care have proposed theories about the etiology of TMDs. As a result, the field of orthodontics developed its own version of structural disharmony concepts and corrective treatments within an orthodontic framework. Another structural concept of TMD etiology, proposed by some physical therapists, chiropractors and dentists, is based on the notion that “bad” craniocevical relations may be causing TMDs. Although this idea has enjoyed some popularity in the past (and is still popular in some regions of the world), several studies have demonstrated that there are no consistent postural findings that differentiate TMD patients from other people.

Although many patients complain of concomitant cervical pain and TMDs, this should be understood as comorbidity resulting from functional rather than structural relations. In addition, this common clinical finding may be a result of heterotopic (referred) pain in these areas, due to the neuroanatomic and neurophysiologic convergence of cervical and cranial sensory nerves in the brainstem nuclei.

The theories of TMD etiology that have made the largest impact are related to various types of occlusal imperfection. Occlusion is a very important subject within the profession of dentistry, especially as it pertains to orthodontics, restorative dentistry and prosthodontics; however, its relevance to the etiology of TMDs is questionable, especially in chronic conditions. In a review of 57 epidemiological studies of the relation between occlusion and TMDs, Okeson found that 35 suggested a relation compared with 22 studies that suggested no relation. The “positive” occlusal findings in the 35 studies varied so widely that no consistent feature could be identified. The occlusal disharmonies cited in these studies were also prevalent among many symptom-free people.

McNamara and others reviewed the role of morphologic and functional occlusal factors with respect to development of TMDs and found only a weak relation between them. Koh and Robinson systematically reviewed the literature pertaining to occlusal adjustments for treating and preventing TMD. After reviewing specific outcome measures, they concluded that there was no evidence for the use of occlusal adjustment procedures for either the treatment or prevention of TMD.
In addition to structure, other etiological factors\textsuperscript{24-25} have been proposed and discussed as a result of large studies of patient populations. For example, trauma at both the macro and micro levels has been noted in the history of certain TMD patients, with a rather clear relation to onset of symptoms in many cases.\textsuperscript{13} A psychophysiological theory of the etiology of TMDs was developed in the 1950s and 1960s, with particular emphasis on the category of myofascial pain and dysfunction.\textsuperscript{26-28} Even though Laskin’s classic article about the etiology of myofascial pain and dysfunction\textsuperscript{26} served as the basis for much of this work, eventually his psychophysiological theory proved to be incomplete as an explanation for the development of myofascial pain. Today, the importance of psychological factors in the onset, progression, treatment and persistence of various TMDs is well recognized as foundational knowledge in this field. However, the reasons why some patients exhibit TMD symptoms while others do not remains unexplained by the psychophysiological theory of etiology.

Currently the most popular theories regarding TMD etiology are based on the biopsychosocial model, which involves a combination of biological, psychological and social factors.\textsuperscript{10,29} These 3 words provide an excellent descriptor of the world that most patients with pain (and especially patients with chronic pain) are living with on a daily basis. They have a biological problem (i.e., activation of pain pathways, with or without a demonstrable pathologic condition) that may have psychological antecedents as well as behavioural consequences. This situation exists in a social framework that includes interpersonal relationships with friends, families and health care providers, which almost always produces major negative experiences for the patients as well as for their immediate families. Unlike the mechanistic dental theories of etiology, the biopsychosocial model encourages a rehabilitation–management approach rather than providing the unrealistic expectation of a permanent cure (which is even less likely in chronic conditions). Unfortunately, due to the limitations of current physical diagnostic procedures for assessing pain conditions, as well as the crude psychometric tools that are currently available, the biopsychosocial model lacks the ability to assess all of these variables at the individual patient level and, therefore, is useful only at the group level.

Dentists should appreciate and recognize that the inability to identify precise etiologies or the lack of a perfect theoretical model does not prevent the rendering of reasonable and effective treatment. It is acceptable, as occurs daily in the medical profession, to provide a presumptive diagnosis that is probably correct, then to deliver reversible, conservative, noninvasive and empirically validated targeted treatments (Table 1). For example, a painful TMJ that began to cause pain without any specific initiating event or cause can still be successfully treated using medications, appliances or physical therapy in various combinations. By following these foundational concepts, dentists can take a “low-tech and high-prudence” therapeutic approach to TMD patient care.\textsuperscript{30}

### Future Directions in the Field of TMDs

The changes taking place in the field of TMDs are not driven purely by dental research, but are coming more from progress in the larger field of pain management. Multiple research projects around the world involving basic and clinical sciences as well as translational activities (the merging of basic and clinical activities) are greatly influencing our understanding of pain. TMDs are currently being investigated in terms of orthopedic principles, neurophysiological aspects of pain, neuroanatomic regions of pain processing, molecular and cellular pathophysiology of muscle and joints.

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**Table 1** Relations among diagnosis, etiology and treatment in TMDs

<table>
<thead>
<tr>
<th>Standard</th>
<th>Diagnosis</th>
<th>Etiology</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ideal</td>
<td>Correct</td>
<td>Specific</td>
<td>Anti-etiologic</td>
</tr>
<tr>
<td></td>
<td>Measurable</td>
<td>Measurable</td>
<td>Definitive/curative</td>
</tr>
<tr>
<td></td>
<td>Demonstrable</td>
<td>Treatable</td>
<td>Successful</td>
</tr>
<tr>
<td>Acceptable</td>
<td>Presumptive</td>
<td>Unclear</td>
<td>Validated response</td>
</tr>
<tr>
<td></td>
<td>Probably correct</td>
<td>Complex</td>
<td>Matched to diagnosis</td>
</tr>
<tr>
<td></td>
<td>Universal labels</td>
<td>Reversible</td>
<td>Conservative</td>
</tr>
<tr>
<td>Wrong/bad</td>
<td>Personal label</td>
<td>Experience based</td>
<td>Prolonged use of an oral appliance</td>
</tr>
<tr>
<td></td>
<td>Technologic diagnosis</td>
<td>Morphofunctional analysis</td>
<td>Bite-changing procedures</td>
</tr>
<tr>
<td></td>
<td>Possibly correct</td>
<td>Mechanistic</td>
<td>Jaw-repositioning procedures</td>
</tr>
<tr>
<td>Fringe</td>
<td>Misdiagnosis of pain</td>
<td>Guru/cult concepts</td>
<td>Whole-body procedures</td>
</tr>
<tr>
<td></td>
<td>Neglect pathology</td>
<td>Quackery concepts</td>
<td>Unorthodox treatments</td>
</tr>
<tr>
<td></td>
<td>Neglect chronicity</td>
<td>Specialty bias</td>
<td>Extreme dental intervention</td>
</tr>
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Adapted with permission from Greene.\textsuperscript{11}
and behavioural aspects of chronic pain. From these domains, 3 main areas of investigation have emerged.

Genetics

Human genetic studies are providing us with a better understanding of inherent susceptibility to pain, variability in pain perception and responses and the factors that predict risk of chronicification of pain. Some investigators have looked at catechol-O-methyltransferase (COMT), an enzyme that is responsible for metabolizing catecholamine and is involved in pain perception, cognitive function and mood. Studies have reported that carriers of the low-pain haplotype on the gene that codes for COMT appear to have 2.3 times less risk of developing myogenous TMD. In another study, people who have genetic coding for certain levels of adrenergic receptor expression were shown to be about 10 times less likely to develop TMDs. Numerous other genes code for the neurotransmitters and neuromodulators that influence pain sensitivity. The implications of these findings for the management of patients with pain may ultimately be to tailor treatment approaches to the individual or provide pharmaceutical agents targeted at specific receptors.

Pathophysiology

A plethora of information is erupting regarding the molecular chemistry and cellular biology of various types of pain. Understanding of the pathophysiology of conditions that affect the TMJ has been greatly enhanced by these discoveries. For example, inflammation in the synovial tissues of the TMJ is the main determinant of whether the joint becomes painful. Complex cellular processes such as activation of T cells, macrophages and plasma cells with the expression of a multitude of inflammatory mediators, such as prostaglandins, serotonin, proinflammatory cytokines and their antagonists, drive the inflammatory cascade. It appears that both the absolute levels of this inflammatory “soup” and the balance between pro- and anti-inflammatory substances are important in the pain process and the propensity for chronicification. In addition, neurochemicals from sympathetic efferents (neuropeptide Y, norepinephrine and others) and neuroendocrine peptides (substance P, calcitonin gene-related peptides and others) are involved by having bidirectional communication with the immune system and, thus, contributing to TMJ pain.

Currently, the pathophysiology of muscle pain is not as well understood. Numerous mechanisms have been considered as sources of muscle pain, yet the literature has not provided definitive answers. Localized factors, such as microtrauma, local ischemia or hypoperfusion can produce structural or functional consequences, because of the release of endogenous algesic substances (glutamate, histamine and others) from tissue cells and afferent nerve fibres leading to excitation or sensitization of muscle nociceptors. Central processes involving neuroendocrine factors (endogenous and exogenous hormones) as well as neurophysiological mechanisms (peripheral and central sensitization) also play a role in the pathophysiology of muscular pain. Combinations of local and central factors must also be considered.

As more research is undertaken and new information emerges, dentists should be aware of it and recognize that treatments directed at the underlying pathophysiology of both arthrogenous and myogenous painful conditions will invariably result in a more precise and targeted medical approach to treatment.

Predictive Factors

Predicting responses to therapeutic interventions in pain patients (including those with TMDs) by identifying certain physical and psychological factors is currently being done with some success. A major focus of current research is trying to prevent acute pain conditions from developing into chronic ones. This requires good early intervention and treatment strategies as well as better predictors of who is most likely to develop such problems. The discovery of more predictors should enhance the ability of dentists to develop appropriate treatment plans tailored to the individual patient.

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.

In the future, treatment modalities directed at the pathophysiological processes of joint and muscle pain as well as the psychosocial aspects of chronic pain will need to be tailored to each patient’s individual problems. For now, the cautious approach recommended by Stohler and Zarb (low-tech and high-prudence) must be understood and followed so that dentists can continue to serve as the primary providers of care for TMD patients. If not, then it seems inevitable, as scientific discovery continues and provides us with a deeper understanding of these patients, that “ownership” of this group of disorders will be lost to other medically oriented health practitioners.
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