

TEMPOROMANDIBULAR DISORDERS AND OCCLUSION

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SUMMARY – Occlusion has an important place within the multifactorial concept of the temporomandibular disorder (TMD) etiopathogenesis as well as in every form of dental treatment. The modern concept of treatment of these disorders differentiates initial and definitive forms of treatment. The aim of this paper is to analyze recent viewpoints on the role of occlusion in the etiopathogenesis and treatment of TMDs. Masticatory muscles and temporomandibular joints are directly connected with occlusal relations and TMDs are traditionally linked with occlusal disorders. The initial occlusal treatment can be applied to all TMD patients, regardless of their having intact teeth with respect to physiological occlusal relations and in patients in need of orthodontic or prosthodontic treatment or an oral surgical procedure. On managing TMD patients, there are doubts about the indications for definitive treatment and whether there has been a possibility of treating a painful TMD by reversible treatment modalities, that is, by initial treatment. Other types of orofacial pain such as trigeminal neuralgia can be comorbid with TMDs but also result in unnecessary procedures on the teeth and prosthodontic work if they are not recognized. Although dental profession mainly recognizes the importance of occlusal treatment of TMD problems, their relationship is controversial because it is not strictly demonstrated in numerous scientific studies. Occlusion is not the dominant cause of TMD problems.

Key words: *Dental occlusion; Temporomandibular disorders; Splint; Prosthodontic treatment; Orofacial pain*

Introduction

Musculoskeletal disorders in the area of stomatognathic system comprise the articular and/or muscular component of temporomandibular disorders (TMDs). The masticatory muscles (myogenic subgroup) and/or articular component (disc displacement (DD) and degenerative bone changes or osteoarthritis (OA)) are the most common cause of orofacial somatic nonodontogenic pain^{1,2}. There are numerous factors related

to TMDs, however, without confirmed causal relationship. The aim of this paper is to review recent concepts on the role of occlusion in the etiopathogenesis and treatment of TMDs.

A number of described theories have been systematically grouped based on a single factor. The theory of mechanical displacement is based on otorhinolaryngology (Costen's syndrome). Loss of teeth in the supporting zone causes condylar movement with respect to the cranium, which leads to orofacial pain. Clinical significance of otologic symptoms in the clinical picture of TMDs is undeniable due to embryonic and topographic reasons. However, even clearly pronounced TMD symptoms can be confused with otologic pathology in the course of diagnosis³.

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According to the neuromuscular theory, parafunction (bruxism) is a result of occlusal interferences, which cause muscular spasm and muscular hyperactivity. A trigger point which causes pain and muscle spasm upon stimulation can be identified. Any other occlusal interference should be excluded. The psychological theory considers TMD a psychosomatic disorder. Psychological disorders (anxiety, depression) initiate muscle hyperactivity (parafunctions), which leads to occlusal disorders. According to the psychophysiological theory, the main cause is muscle spasm, which is a result of muscle fatigue, excessive muscle flexion or extension. In this way, parafunction and occlusal disorders occur. Each theory is controversial in its application because they are mutually exclusive with regard to the etiology explained by them^{4,5}.

The American Academy of Orofacial Pain defined the following factors: traumatic, anatomical, pathophysiological and psychosocial⁶. In other words, the multifactorial etiology includes a large number of factors, which can have different relative significance in individual cases.

The biomedical approach to TMD diagnosis and treatment stresses the importance of development of chronic pain, which is a common feature of other musculoskeletal disorders of the human body⁷. However, TMD symptoms are not easily recognized in a clinical picture, that is, they are not pathognomonic with other pathological conditions in the region of the face and mandible: traumas, tumors, rheumatic diseases, muscle and temporomandibular joint (TMJ) pain after extraction, etc.⁸.

Occlusion was considered as a possible etiopathogenic factor of TMD but their relationship is complex and still remains partially unexplained. Occlusal treatment is important not only to patients but also to dentists – nearly half of the interviewed Swedish dentists consider that the replacement of molars is necessary due to the development of TMD and compromising of masticatory function⁹.

The Epidemiology of Temporomandibular Disorders

Although there are some methodological discrepancies that can hinder direct comparison of epidemiological results of TMD, it is certain that tem-

poromandibular pain has a low prevalence, mostly less than 10% of the general population, and most often only 5%¹⁰. Another issue in the TMD epidemiology is dependence on the patient age and gender. Manfredini *et al.*¹¹ differentiated two age peaks (two peaks of greatest incidence) in TMD patients (30-35 and 50-55 years) with the female:male ratio 5:1, which partly coincides with previous knowledge that the greatest prevalence is in women of reproductive age (that is age 18-45)^{10,12,13}. In the elderly population, there is a discrepancy of the high incidence (70%) of OA signs accompanied by the low incidence of clinical signs of TMD¹⁴. Female predominance in TMD patients is explained by the effects of female hormones, biological and physiological differences, behavioral characteristics, and genetic factors¹⁵.

The occurrence of TMD signs and symptoms was followed during 20 years, with the first examination at the age of three. It was determined that TMD symptoms had a higher incidence on later examinations (incidence 5%-9%), while at the youngest age, there was almost none. However, the need for treatment was 1%-2%¹⁶.

Magnetic resonance imaging (MRI) diagnostics of a 12-year-old female patient with clinical signs and symptoms of clicking in both TMJs was performed as part of the pre-orthodontic treatment. The MRI finding confirmed bilateral DD. The MRI follow-up finding remained unchanged after treatment of unilateral cross bite¹⁷.

Occlusion and Temporomandibular Disorders

The importance of occlusion in the etiopathogenesis has been redefined by refuting the mechanistic concept, which has been present since the beginning of scientific research of TMD. Loss of teeth and/or disorders of occlusion are certainly illnesses by nature but any type of irreversible occlusal treatment cannot be associated with causal treatment of TMD^{18,19}.

In an epidemiological study, a low incidence of certain variables of malocclusion was found (unilateral open bite, negative overjet and unilateral cross-bite in men, and edge-to-edge bite in women) with signs or symptoms of TMD. In both genders, anatomically correct occlusion was not significantly associated with TMD compared with malocclusions. By including

static and dynamic factors of occlusion, a significant correlation with TMD incidence was statistically determined but with a low correlation coefficient²⁰.

Anterior open bite, deep overjet 6 mm or more, unilateral cross-bite and difference between centric relation and maximal intercuspitation amounting to more than 2 mm with more than six posterior teeth to be replaced can be considered increased risk factors for TMD²¹. Conversely, Rammelsberg²² offered a review of the etiopathogenic model of DD development wherein high abrasion and insufficient restorative procedure on posterior teeth are risk factors causing occlusal instability.

In a population of children, Pereira *et al.*²³ did not find any correlation between malocclusion and TMD but they identified bruxism and posterior cross bite as risk factors for TMD. Tecco *et al.*²⁴ and Tecco and Festa²⁵ found a correlation between TMD with painful symptoms in children (5-15 years of age) and unilateral cross bite, but not with TMJ sounds. Myofascial pain was more prevalent in females. In their study, Badel *et al.*²⁶ found a significantly higher prevalence of hyperbalance and interference contacts in asymptomatic patients compared to TMD patients. No difference was found between Angle's classes in patients with DD and asymptomatic individuals. There was a statistically significant difference in teeth contact between the maximal intercuspitation and centric position in patients and asymptomatic subjects.

The importance of occlusal interferences was perceived differently regarding the etiopathogenesis of TMDs. Le Bell *et al.*²⁷ found that artificial interferences did not stimulate development of dysfunctional symptoms in healthy subjects, instead they adapted successfully to them. In patients whose medical histories show TMD interferences stimulate the recurrence of stronger symptoms.

Hypervigilance

Reflex response to peripheral stimulus, that is, occlusal interference *via* periodontal receptors, can be modulated in the central nervous system in such a way that the stimulus causing normal opening in that case causes mouth closing. The hypothalamus and the limbic system mediate tonus increase in affective conditions and under stress, whereas the reflex response to

occlusal stimulus depends on the current state of agitation of those centers. In patients, even the slightest interference can produce the state of high stimulation and muscle hyperactivity, which can cause TMD at a lower level of adaptation. In other individuals with low level of activity of those centers, an increase of muscle tonus due to occlusal interference does not occur. Only in cases of hypervigilance, the occlusal changes will lead to TMD, due to increased awareness of one's own body and intensified activity of emotional motor system such as stress, pain or psychosocially caused parafunction. Hypervigilance is a changed form of observation wherein the harmful nociceptive stimuli are intensified^{13,28,29}.

Malocclusions, as well as different occlusal variations are secondary to TMD etiopathogenesis. Orthopedic instability only worsens the symptoms which develop due to some other reason. Contrary to such a viewpoint, wherein occlusal pathology is seen only as a secondary factor of etiopathogenesis³⁰, continuing reviews of the subject can be found in the literature, but based only on morphological variables of occlusion related to TMD³¹.

Trigeminal Neuralgia

Neuropathic trigeminal pain is a significant form of other orofacial pains manifested with various symptoms as an extremely disabling illness. Trigeminal neuralgia commonly afflicts the second or third division and therefore a primarily dental component can be expected when the strong and sudden neuralgic pain appears in both jaws. The nature of the initial complaint can be difficult to distinguish – occlusion and occlusal contacts, prosthetic works or individual teeth can have a false-positive finding because some patients have extremely focal sites of neuralgic pain^{32,33}.

Trigeminal neuralgia can have comorbidity with TMDs, wherein the strong, paroxysmal attacks create difficulties in making the correct diagnosis. Dental and medical clinicians should recognize symptoms of neuropathic trigeminal pain, especially within the general group of patients with orofacial non-dental pains, since the share of patients with trigeminal neuralgia can be 11.2%³⁴.

Regarding the prevailing view of occlusion as an etiologic factor of TMDs, the discrepancy between

unrecognized strong neuralgic pain and the mild clinical picture of the teeth and TMJs can lead to wrong treatment, unnecessary endodontic procedures, as well as tooth extractions or removal of correct prosthodontic appliances³⁵.

Discussion

Taking into account the great number of static and dynamic occlusal variables, it is difficult to comprehend the overall correlation with the development of TMDs due to the often non-standardized studies based on occlusal analysis. According to John *et al.*³⁶ 'complex interaction' is the only but scientifically non-defined link between occlusion and TMDs. Occlusion ensures orthopedic stability of TMJ, whereas occlusal stability is ensured by mutually antagonistic contacts in the position of maximal intercuspitation. When the relationship between the two factors is compromised, it could lead to an overload of articular structures and consequently pose a risk of TMD development. The changes in occlusal relations are pronounced in the etiopathogenesis, causing co-contraction of antagonist muscles the purpose of which is to protect the agonists and remove pain. The influence of possible adverse chronic effects can be avoided by the adaptation of muscular activity³⁷.

There is a dichotomy between scientific and clinical concepts of occlusion, which can be explained by the concept of integrated neurobiological system³⁸. Occlusion is a basic component of dental restorative procedures, which changes or supplements the compromised or lost occlusal relations in each segment of planning the procedure. The pathogenetic and therapeutic effects of myofascial pain can be explained only as a mutual relationship between occlusion and neuromusculature. The results of La Bell *et al.*²⁷ are explained by the neurobiological hypothesis based on the differentiated activity of the part of the muscle in which increased tension and pain can occur. The changes in occlusal relations cause mild unloading in painful muscles or within the structures of TMJ, which means that different condyle positions during treatment can have the same effect. However, the mutual relationship between occlusal interferences and microtrauma has not been completely explained¹⁹.

Generally, in TMD treatment the principle of palliative medicine is preferred, which means treatment,

control and alleviating temporomandibular pain. In its essence, palliative medicine comprises symptomatic methods of treatment, which in musculoskeletal pain does not necessarily mean poor outcome of treatment. However, the principle of noninvasive and reversible methods of treatment is preferred before definitive complex prosthodontic treatment in patients with TMDs³⁹. These methods encompass occlusal splints and physical therapy, which are mostly used by dentists as well as cognitive-behavioral methods, acupuncture and psychological therapy in cases of chronic pain⁴⁰.

By recognizing the signs and symptoms of TMDs and by choosing initial methods of treatment as the methods of choice, the excessive use of diagnostics (for example, MRI) as well partial or complete over-treatment modalities are avoided^{41,42}. It has become the dominant radiologic technique in the diagnostics of TMDs enabling imaging of cartilaginous articular surfaces and it can successfully show the position of the articular disc⁴³. Therefore, MRI has become the gold standard of diagnostics which is used simultaneously with clinical diagnosis and as a means of evaluation of validity of other clinical diagnostic methods^{12,44}. Excessive, unnecessary and incorrect treatment methods in TMDs patients can have legal repercussions⁴⁵.

Complex prosthodontically rehabilitated patients are satisfied irrespective of the occlusion of their removable or fixed dentures – chewing efficiency appears to be more important to the patients¹⁹. The patient has an input in the planning of own treatment and the dentist should consider the patient's wishes, and the current trend is to collaborate with other dental and medical specialists, which is a multidisciplinary approach regarding TMD problems. Cuspid guidance in prosthodontic treatment is more functional and more acceptable than balanced or group function⁴⁶.

In conclusion, permanent occlusal treatment is acceptable in functionally uncompromised patients, which opposes the traditional opinion that there is a more or less direct causal relationship between TMDs and occlusion. However, occlusion has not been determined as the dominant cause of TMD problems. Temporary and reversible treatments by occlusal splints are the primary means of TMD treatment, whereas prosthodontic and orthodontic treatment should be carried out in patients who are without functional disorders of the stomatognathic system.

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Sažetak

TEMPOROMANDIBULARNI POREMEĆAJI I OKLUZIJA

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Okluzija ima istaknuto mjesto unutar multifaktorijskog koncepta etiopatogeneze temporomandibularnih poremećaja kao i svakog oblika stomatološkog liječenja. Suvremena koncepcija liječenja tih poremećaja razlikuje inicijalne od definitivnih oblika terapije. Svrha rada je dati pregled suvremenog shvaćanja uloge okluzije u etiopatogenezi i liječenju temporomandibularnih poremećaja. Žvačni mišići i temporomandibularni zglobovi su izravno povezani s okluzijskim odnosima pa su temporomandibularni poremećaji tradicionalno povezani s okluzijskim poremećajima. Inicijalna okluzijska terapija može biti provedena kod svih pacijenata s temporomandibularnim poremećajima bez obzira na to imaju li intaktne zube u okviru fizioloških okluzijskih odnosa, pacijenata kojima je potrebna ortodontska, protetska terapija ili operacijski oralno kirurški zahvat. U liječenju pacijenata s temporomandibularnim poremećajima postoji nedoumica je li postojala indikacija za definitivnu terapiju, ako se bolni temporomandibularni poremećaj mogao izliječiti oblicima reverzibilne terapije, odnosno inicijalnom terapijom. Druge vrste orofacijalnih bolova, npr. trigeminalna neuralgija, mogu biti u komorbiditetu s temporomandibularnim poremećajima, ali i kao neprepoznata bolest imati za posljedicu nepotrebne intervencije na zubima i protetskim radovima. Iako u struci postoji prevladavajuće shvaćanje važnosti okluzijske terapije temporomandibularnih poremećaja, taj međuodnos je kontroverzan, jer to nije strogo dokazano u brojnim znanstvenim istraživanjima. Okluzija se nije pokazala dominantnim uzročnikom temporomandibularnih poremećaja.

Ključne riječi: Dentalna okluzija; Temporomandibularni poremećaji; Udlaga; Protetsko liječenje; Orofacijalna bol