

## TEMPOROMANDIBULAR DISORDERS AND OROFACIAL PAIN

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### Summary

Temporomandibular disorders (TMDs) is a collective term for a number of pathologic conditions of the masticatory system. Their symptomatology is diverse, with orofacial pain being one of the most common symptoms which causes a particular discomfort to the patients. Often, TMDs have a very clear etiology, but sometimes it is completely unknown. They are related to different etiologic factors and comorbid conditions, which aggravates precise diagnostics. This pathology requires team work and a multidisciplinary approach, timely detection of causes and a meticulous selection of treatment procedures, particularly for management of orofacial pain, which can be very demanding in terms of differential diagnostics.

There are certain facts which are still unclear; hence notable improvements in approaching this issue are expected. The existing diagnostic classification should be changed and primarily based on etiology instead of symptomatology, which is the current tendency. Also, uniform diagnostic guidelines as well as treatment protocols should be established and that would enhance a multidisciplinary collaboration, which is essential while dealing with this kind of pathology. Special attention should be paid to the development of preventive measures based on scientific evidence that is still neglected.

**Key words:** masticatory system; temporomandibular disorders; orofacial pain; terminology; epidemiology; etiology; symptomatology; diagnostics; treatment.

### INTRODUCTION

Temporomandibular disorders (TMDs) are among the most challenging diseases of modern society, diagnostically, prognostically and in terms of treat-

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ment. Dysfunctions, which have diverse symptomatology, are the result of TMDs. Pain, the most common symptom and certainly the one that causes most discomfort to the patients, often has very clear etiology but sometimes it can be completely unknown. TMDs is a collective term which includes a number of clinical signs and symptoms in the masticatory system, that is, in the temporomandibular joints, the masticatory muscles and the associated structures. TMDs are a synonym for craniomandibular disorders and a subclass of musculoskeletal disorders and, after toothache, they are considered to be the main cause of orofacial pain. TMDs comprise subgroups of correlated disorders of the masticatory system which exhibit a number of shared symptoms. Pain, which is the most common symptom, is usually localized in the masticatory muscles and/or in the preauricular region and it worsens upon chewing or other mandibular activities. Patients with such disorders often manifest limited or asymmetric movements of the mandible and noise in the temporomandibular joint (clicking, crepitations); and often complain of headache as well as pain in the jaw, ears and face. Pain or dysfunctions which are not related to musculoskeletal causes, such as otorhinolaryngologic, neurologic, vascular, neoplasm and inflammatory diseases in the orofacial region, are not considered primary TMDs. Nevertheless, TMDs often coexist with other painful craniofacial and orofacial disorders. It is evident from current clinical practice that the issue of TMDs is partly covered by interest spheres of different health disciplines while the motives and importance of essential communication between experts have not been sufficiently recognized so far [1-3].

## TERMINOLOGY

Over the years, functional disorders of the masticatory system have been described in different terms which resulted in certain misunderstandings and confusion. These disorders, in fact only as a part of today's idea of TMDs, are mentioned as *Costen's syndrome* (J. Costen, 1934), and they referred to symptoms in the region of the ear and temporomandibular joints [4]. Shore (1959) introduced the term *temporomandibular joint dysfunction syndrome* [5]; Ramfjord and Ash (1971) introduced the term *functional temporomandibular joint disturbances* [6]. Some of the terms suggest putative etiologic factors related to the symptoms, such as *occluso-mandibular disturbance* [7], *myoarthropathy of the temporomandibular joint* [8], *temporomandibular pain-dysfunction syndrome* [9] and *myofascial pain dysfunction syndrome* [10]. Since the signs and symptoms are not localized only in the joints or masticatory muscles, some authors considered such terms too nar-

row so they introduced the term *craniomandibular disorders* [11]. Finally, Bell (1982) introduced the term *temporomandibular disorders* which has, since then, become widely used [12]. The respected dental association *American Dental Association* soon accepted this term (1983) and since then temporomandibular disorders have been considered a subclass of musculoskeletal disorders [13].

## EPIDEMIOLOGY

The incidence and prevalence of TMDs in different population groups has been the subject of a large number of epidemiologic studies. The results revealed that about 40-75% of cases in general adult population (non-patients) show at least one sign of articular dysfunction (noise, disturbances of mandibular movements, etc.) and in about 33% of cases of those subjects there is at least one symptom of dysfunction (facial pain, articular pain, etc.) [14,15]. Some signs are relatively prevalent in healthy general population. Namely, noise or asymmetric mouth opening is present in about 50% of individuals [16]. Other symptoms are very rare, such as difficulty in mouth opening which is present in only about 5% of the cases [17]. In general population, articular disorders are present in 19% of individuals, muscular forms of disorders in 23% and the combination of the two in 27% of individuals [18].

TMDs affect all age groups [19]. Signs and symptoms of TMDs have been noted in young individuals and adolescents but the prevalence is lower than in adults [20,21]. Nevertheless, in general population the symptoms are most commonly pronounced between the ages of 17 and 30, while in patients the symptoms are more pronounced between the ages of 20 and 40 [22]. Children and adolescents rarely complain of any symptoms although during their lifetime they exhibit an increase in the number of signs of TMDs. Patients over the age of 60 also rarely complain of the symptoms of TMDs [23,24].

On average, the prevalence of symptoms is evenly distributed between men and women [25,26], although some authors report that the prevalence of TMDs in women is four times higher than in men [27]. When the symptoms are separately and independently evaluated, it has been noted that women more frequently suffer from headaches, clicking in temporomandibular joints, and sensitivity of joints and muscles. Women more frequently (3 to 9 times) ask for medical assistance which is difficult to substantiate by clinical findings since women and men do not differ in sensitivity and reaction to pain [28]. A possible explanation lies in the fact that women are more health conscious and quicker in seeking medical assistance [29].

It is important to mention that there are great differences in results of numerous studies and they cannot be compared because of different approaches, data collection methods, analytical procedures and some other reasons [30]. Yet, some common characteristics of such research have been observed. Thus, the pain in temporomandibular region has been reported in about 10% of cases in population over 18. It is most prevalent in younger and middle aged population and is twice more prevalent in women [20,31].

In spite of the great percentage of signs of TMDs in general population, the prevalence of complaints is very low [32]. Only about 3.6-7% of the population needs treatment [14,15]. Prevalence of these disorders cannot be entirely and correctly evaluated due to a lack of generally accepted classification norms and diagnostic criteria. However, different researchers used a combination of signs and symptoms to indirectly determine the prevalence of TMDs thus reporting that approximately 26-31% of patients with articular changes and about 30-33% of patients with muscular changes need treatment [33].

## ETIOLOGY

It is a general belief that the etiology of TMDs is multicausal although it is still not completely clarified. Also, the role of certain often mentioned etiologic factors has not still been recognized as indisputable. TMDs are often of complex nature and affected by many factors. The role of systemic and local factors is reported in etiology.

Certain factors increase the risk of TMDs and are called *predisposing factors*. Some other factors can cause the onset of a disease and are called *initiating factors*, and those which interfere with recovery or increase the progression of symptomatology are called *perpetuating factors*. A certain etiologic cause, under different circumstances, can play the role of either one or all mentioned factors [2,34].

*Systemic factors* can affect physiological tolerance of the individual and have a predisposing role. Every patient has some unique characteristics which are typical of their body and they are conditioned genetically as well as by gender and diet. Apart from the physical characteristics of the body, systemic factors include a series of acute or chronic diseases and disorders (degenerative, endocrine, infective, metabolic, neoplasm, neurologic, rheumatic and vascular) as well as the overall physical condition of the patient. Even the efficiency of pain modulation system can affect an individual's reaction to a provocation. For example, if the

descending inhibition system inefficiently modulates pain stimulation, the system becomes more vulnerable to new provocations [2,3].

More than a hundred different diseases can affect the musculoskeletal system, many of which affect the temporomandibular joint as well as masticatory muscles and the role of osteoarthritis, osteoarthritis and rheumatoid arthritis should be particularly emphasized. Osteoarthritis of temporomandibular joints is a relatively benign degenerative disease, with or without mild symptoms, and a good prognosis. In osteoarthritis, inflammatory changes follow the degenerative ones. The acute inflammatory form of the disease, with pain and dysfunction, is of a transitory character and the treatment is simple. About 10% of patients with rheumatoid arthritis are affected by serious occlusal disorders and dysfunctions of the masticatory system [35].

On one hand, various circumstances and factors can affect the harmony between the components of the masticatory system thus ensuring functional adaptability and health or, on the other hand, causing dysfunction or pathologic changes. For example, a change in anatomical structure integrity, functional change, excessive biomechanical forces and strain can weaken system adaptability. Additionally, there is a negative impact of some other factors such as genetic and psychosomatic which can contribute to the development of dysfunction and pathologic changes in the masticatory system [36-38].

Among *different etiologic factors*, the following five main factors related to TMDs have been reported in relevant literature: occlusion, trauma, deep pain stimulus, emotional stress and parafunctional activities [2,3].

Thus occlusion (malocclusion), that is the relationship between dental arches in a bite, is considered to have an important role in the development and course of TMDs [5,39,40]. In the past, in dental medicine there was a general belief that occlusal factors are among the most important causes which contribute to the pathological condition of temporomandibular joints and masticatory muscles but there is insufficient evidence to support this claim. Conversely, it has been established that some pathologic changes in temporomandibular joints can cause occlusal disorders, such as occlusal instability or open bite in patients with rheumatoid arthritis [35]. Upon evaluating occlusal factors, both static and dynamic relations between teeth should be taken into consideration. Malocclusion (cross bite, open bite and occlusal interferences) is not an exclusive etiologic factor of TMDs but generally it contributes to them. Neuromuscular imbalance due to malocclusion can cause ischemic circulatory effects which predispose a person for TMDs [41].

Among other important factors in development of TMDs, the one that should be mentioned is *trauma* (microtrauma and macrotrauma) caused by a traffic ac-

cident, sports injury and other casualties, etc. Macrotrauma is often mentioned by patients in medical history while microtrauma usually goes unnoticed so that the patient does not mention it later on, which can be a missing fact in diagnostics. Apart from the above mentioned causes, the most common sources of microtrauma are hypoxic-reperfusion injuries, bruxism and orthopedic instability [2,42].

*Deep pain stimuli* can cause protective co-contraction of masticatory muscles, reduction in mouth opening, but such condition stabilizes when the pain stimulus ceases. The source of deep pain can be toothache, pain originating from the sinus or ear but also the pain originating from remote areas such as the neck. Such conditions should be correctly interpreted in diagnostics and treatment so that the cause is treated rather than the consequence which is often the case in medical practice [2,3].

Some TMDs are related to certain emotional conditions. The elevated level of *emotional stress* can affect muscular function either by increasing muscular activity in physiologic rest position (the so-called protective co-contraction) or by development of bruxism and both can occur simultaneously. The elevated level of emotional stress can activate the sympathetic nervous system and cause muscular pain. Activation of the sympathetic nervous system can also be related to some other psychophysical disorders, which are often related to TMDs [2,3].

*Parafunctional activities* of the masticatory muscles can be responsible for the development of TMDs. Some parafunctional activities such as bruxism are nocturnal while others such as teeth clenching and grinding are diurnal and so are maladaptive parafunctional habits (chewing a pencil or chewing gum, etc). Patients are not aware of most of these activities and a part of treatment procedures relates exactly to raising awareness about such factors and eliminating them. Bruxism can be one of the important etiologic factors in the development of these disorders. However, it should be pointed out that bruxism is a very common phenomenon, therefore, the very presence of wear facets on the teeth or the patient's awareness about bruxist activity are not necessarily indicative for the etiology of TMDs (2,3,43-45). The effect of protective mechanisms should be taken into consideration. Namely, neuromuscular reflexes are present in the course of functional activities, protecting oral structures from damage. However, in the course of parafunctional movements, the protective neuromuscular mechanisms are dampened, which results in reducing the effect on muscular activity. This enables the increase of parafunctional activity and possible reaching of stimulus level, which is sufficient to cause damage to some structures of masticatory system [2,46].

The importance of any of these particular factors significantly varies in different individuals. Occlusion is most commonly reported as a cause because of its unique importance to dental medicine. Nevertheless, a clinician should be aware of the fact that the most important cause of TMDs does not have to be related to occlusal condition. Jumping to such conclusions may lead to failure in treatment. With regard to etiologic diversity, success of TMDs' treatment depends on identification and control of a possible role of a particular cause and is proportionate to the accuracy and completeness of initial testing [2,3].

## **SYMPTOMATOLOGY**

The most common signs and symptoms in patients with TMDs are pain in the temporomandibular joint, pain in muscles, facial pain, headache (tension type), ear pain, pain in the region of the neck (shoulders and back), noise in the joint, uncomfortable or variable occlusion, limited mouth opening (or with disturbances), deviation of the jaw (opening/closing), locked joint (opening/closing), buzzing in ears, impaired hearing (and/or hyperacusis), dizziness, sense of swelling in the face (and/or the mouth) and disturbances of vision [2,3].

In the beginning, the issue of TMDs was focused on mandibular joints, so that later on, in the eighties, many clinicians believed that pathologic changes in temporomandibular joints were the most prevalent cause of signs and symptoms of the TMDs. Today, however, TMDs imply both the disorders of temporomandibular joints and masticatory muscles, which occur isolatedly or very often simultaneously [47]. To be precise, it is difficult to classify TMDs exclusively as a muscular or articular type of disorder. Patients with primary articular disorder are usually affected by muscular type of dysfunction whereas those with primary muscular disorder can also exhibit articular symptoms [48]. In patients with TMDs, muscular disorders are present in about 70% of cases, while the articular disorders, that is, articular disc disorders, as well as disorders due to arthritis, arthralgia and arthrosis were present in about 30% of cases [49].

### **Articular disorders**

Signs and symptoms of temporomandibular joint disorder are related to the change of structural relations and function of osseous articular bodies and the articular disc, which can occur due to any pathologic condition which disturbs normal function of the joint (trauma, inflammation, degenerative disease, tumors, etc.). *Pain in the temporomandibular joint* upon opening and closing of the mouth can occur due to malocclusion, stressful teeth clenching, muscle spasm

and due to intracapsular inflammation caused by trauma. Over 60% of patients with acute dysfunction complain of sensitivity and pain in the joint. *Limited mandibular movements* are most commonly the result of joint trauma, more often as a result of pain than of physical limitation. *Noise in the joint* as an isolated sign is not a reliable indicator of TMDs. It is estimated that about 40% of people have noise without dysfunction of the joint. We can differentiate between clicking and crepitation and the noise can be present in one or in both joints, that is, reciprocal noise. *Change in occlusion*, that is, of contact (bite) between the upper and lower dental arch, or occlusion with strain or discomfort, is a very reliable indicator of TMDs. This condition is often the result of disc dislocation caused by trauma or due to inflammation of retrodiscal tissues. *Symptoms of the ear* such as pain, hearing disturbances or noise (buzzing) in ears, are more rarely reported by patients with TMDs. Causal correlation between TMDs and ear symptoms is unknown [2,35,50].

### **Muscular disorders**

Disorders of the masticatory muscles are a series of different conditions which affect masticatory muscles and their main characteristics are pain and limited mandibular movements. Pain of the masticatory muscles, which occurs as facial pain or headache, is the most prominent chronic pain of the orofacial region. About 5% of the population suffers from such pain, which is sufficiently intense to require treatment. Incidence and intensity of such pain vary. Pain can cease spontaneously, but it often becomes chronic, which can be influenced by psychogenic factors such as depression or multiple painful conditions of patients. Pain in disorders of masticatory muscles is most often of moderate intensity, diffuse, uncomfortable, and exhausting. It can be described as 'persistent deep blunt pain', 'tension' or 'pressure'. In general, the pain occurs gradually and varies in intensity from mild to severe; it can be permanent or occasional; it occurs either spontaneously or upon mandibular movements, or upon palpation. Pain upon palpation of masticatory muscles is a reliable indicator of dysfunction and is rated by different measuring methods (visual-analogue scales, VAS). Some of them are intended for and adapted to children. Apart from pain in muscles, the patient can complain of weakness, tension, cramping as well as of limited mouth opening (less than 40 mm, measured between incisal edges of upper and lower central incisors). It is difficult for the patient to determine the origin of the pain. Frequently, it can only be localized by stimulation upon palpation. The causes of muscular pain can be trauma, strong contraction and strain as well as muscular fatigue. Such conditions result in increased intramuscular pressure, which can



cause local ischemia, increased permeability of cellular membrane and edema. Local conditions, such as inflammation can also act by increasing receptor sensitivity to pain or by lowering their activation threshold [51].

Pain of the masticatory muscles is often transferred to neighboring areas and vice versa, pain from neighboring areas can be reflected into masticatory muscles (disorders of the articular disc, osteoarthritis and rheumatoid arthritis of the mandibular joint, toothache). Patients with myofascial pain (trigger point myalgia) can often have medical history which can be confusing. The patient can complain of heterotopic pain instead of the actual source of pain (that is the trigger points). This may focus on secondary pain treatment which in this case will not be successful. Pain from the temporal muscle often feels like a headache in the forehead or the back of the head whereas the pain from the masseter muscle is reflected into the lower jaw or the posterior teeth; pain from the medial pterygoid muscle is reflected into the facial area in front of the ear and that from the lateral pterygoid muscles into the zygomatic area. Trigger points in the shoulder or in the muscles of the neck can cause co-contractions and disorder in the masticatory muscles. If this persists, local muscular sensitivity and pain in masticatory muscles can develop. This condition will not be resolved by treatment of masticatory muscles but by treatment of trigger points in the muscles of the shoulders and the neck [2,50,51].

## DIAGNOSTICS

### Diagnostic classification of the temporomandibular disorders

A large number of diagnostic criteria have been proposed for the purpose of classification of TMDs, which include a combination of etiologic factors, common signs and symptoms, tissue origin or anatomic region. Therefore, these criteria have certain advantages and disadvantages in diagnostic or differential-diagnostic procedure. In 1951, Weinmann and Sicher wrote probably the very first diagnostic criteria for the classification of TMDs [52]; and among later criteria, diagnostic indexes by Helkimo from 1974 should be pointed out [53]. After Bell presented the classification (1982) which logically categorizes TMDs [12], it was accepted with minor modifications by the *American Dental Association* in 1983 [13]. The so-called *road map*, which helps clinicians in establishing an accurate and well defined diagnosis, was created [2,50]. Recently, the RDC protocol (Research Diagnostic Criteria for Temporomandibular Disorders, 1992) has been more frequently used. Apart from the previously used diagnostic criteria for evaluation of subgroups of TMDs, this protocol includes a new group of diag-

nostic criteria relating to psychogenic factors. Thus, the so called dual diagnostic criteria for the purpose of recognition of not only physical factors (Axis I), but also psychogenic ones (Axis II) which also contribute to suffering, pain and inability of patients with TMDs and orofacial pain, were established [54]. The dual classification was later included into the original Bell's classification of all disorders with orofacial pain [3]. The IHS classification comprising over 230 types of headaches has been revised in recent times. To establish a correct diagnosis based on such a classification implies a good knowledge of all disorders with orofacial pain. However, the IHS classification does not include the dual diagnostic approach [3]. The RDC protocol includes the dual approach and is also more adequate for the evaluation of TMDs. Yet, the RDC protocol encompasses neither all the subgroups of TMDs nor all the circumstances of the orofacial pain development [54].

Therefore, it should be pointed out that, so far, a valid classification has not been made. All existing diagnostic classifications of TMDs have been based on knowledge of signs and symptoms rather than etiology, which is currently still not completely clear.

### **Selective diagnostic procedure (screening evaluation)**

The issue of TMDs and orofacial pain broadens the horizons of dentists because they have to consider much more than only the regions of the mouth, teeth, temporomandibular joints and masticatory muscles. In terms of this, not only it is important to know the role of medical history, clinical examination and relevant testing but also to determine when to have consultations with colleagues or refer the patient to other specialists.

As a rule, patients with TMDs should be first briefly examined, that is, take a selective medical history and perform a selective examination. *A selective medical history* consists of a smaller number of target questions about dental and general health, which can be asked personally or by a medical history questionnaire. Questions are related to the presence and types of signs and symptoms (joints, muscles, teeth, head and neck), their intensity, duration and the course of their development as well as the history of trauma and a possible treatment. *A selective examination* includes teeth, periodontium and other oral structures; regularity of mandibular movements is evaluated; masticatory muscles are palpated; mandibular joints are palpated and auscultated. During the examination, the presence of pain is evaluated as well as the sensitivity of the examined structures, limitations and irregularity of mandibular movements, noise in the joint that is, any deviations from normal anatomy and function. The results of selec-

tive medical history and examination are not always consistent and when the findings are positive and if they are not of dental origin, a complete diagnostic procedure should be performed [2,3].

### **Complete diagnostic procedure (comprehensive evaluation)**

Complete diagnostic procedure begins with a *detailed medical history* according to standardized protocols. It is often the case that an experienced clinician can make a diagnosis based on detailed medical history or the patient will be referred to a target diagnostic examination, that is, a differential diagnostic procedure. During an anamnestic procedure it is important to establish a good relationship with the patients in order to gain their confidence. Patients should be given an opportunity to report and describe in detail all the problems that require medical assistance while the clinician organizes them according to their priority and intensity. Attention should be paid to the site, origin, frequency and duration, intensity, type and concomitant symptoms as well as factors which alleviate, intensify or activate the disturbance or pain. It is also necessary to record possible previous treatment of disturbances due to which the patient requires medical assistance as well as the patient's impressions about the success of the previous treatment. It is necessary to take medical and dental history of previous diseases, physical and emotional traumas and the data about the procedures, administration of drugs, use of alcohol, coffee and narcotics. Some systemic diseases, as well as diseases of connective tissue, autoimmune diseases, fibromyalgia, diabetes, cardiovascular diseases, etc. can have a role in the etiology of TMDs. The data about parafunctional activities like bruxism, clenching and grinding of teeth, and some maladaptive parafunctional activities (nail biting, chewing gum, etc.) have a diagnostic value. Sleep disorders and psychogenic factors such as fear and depression are common findings in patients with chronic pain. With such patients as well as in the case of emotional stress and parafunctional activities, it is recommended to make a psychodiagnostic evaluation [2,3].

*Clinical examination* of patients with TMDs and orofacial pain is considerably more extensive than the usual dental examination of oral structures and this is something that dentists should be well informed about, particularly those specialized in that field. A complete clinical examination begins with checking the vital signs of the patient (blood pressure, pulse, breathing, temperature, body weight), especially in chronic patients and those who use medications. Orofacial pain can be the result of neurological problems so the patients undergo a basic neurological examination, that is, the function of cranial nerves is examined bi-

laterally and the possible motor or sensory dysfunctions are also checked. If the clinician suspects any deviations from normal function of the nerve, the patient is referred to a neurologist. Palpation includes masticatory muscles bilaterally whereby the function is examined as well as their sensitivity and presence of pain. Then, the presence of trigger points is determined as well as the site of the referred pain. The extensive clinical examination also includes the examination and palpation of the neck region which is a common source of referred orofacial pain. Temporal arteries should be palpated in patients with headache, which may cause sensitivity or pain. Mandibular joints are palpated to examine the presence of sensitivity, to determine the type of pain and movements in the joint. Upon mandibular movements, type and time of noise production in the joints can be diagnosed by palpation. Active and passive mandibular movements are examined as well as the possible deviation from normal values, both horizontally and vertically. The patient's evaluation of pain, disturbances and limitations in mandibular movements are recorded. Since symptomatology of TMDs and orofacial pain can be reflected from the surroundings of the masticatory system (ears, nose and throat) and vice versa, it is necessary to examine and palpate these regions and adjacent lymph nodes. In case of any signs of pathological changes or suspicions, the patient should be referred to an otorhinolaryngologist. Depending on what the patient complains of most in medical history, either a brief or a detailed intraoral examination is performed. The examination includes oral mucosa, teeth and periodontium, the relationship of dental arches in a bite and, if necessary, a radiologic examination should be performed, teeth vitality examined or a diagnostic anesthesia for a single or groups of teeth should be given [2,3].

*Psychological evaluation* of patients with orofacial pain and chronic pain in general is important. The influence of psychogenic factors on the course and treatment of the disease was evident in a considerable number of patients with TMDs. By the use of a simple questionnaire, in a relatively easy way, we can learn about the influence of fear of depression on the patient. Also, the patient is asked about the presence of parafunctional movements and maladaptive habits, stressful lifestyle, frequency of seeing the doctor and so on. A psychological evaluation is not necessary in routine treatment of patients with TMDs and orofacial pain. Nevertheless, as soon as the most relevant factors of this kind are recognized, the patient should be referred to a clinical psychologist or a psychiatrist for a specialist examination [55,56].

Additional *diagnostic testing* is rarely performed on most of the patients with TMDs and orofacial pain. Standard diagnostic procedures which include a

complete medical history, clinical examination and psychological evaluation of the patient are sufficient except in the cases when additional information for a conclusive diagnosis or changes in treatment is necessary. Apart from the previously introduced analytical methods of diagnostic casts of a patient's dental arches and instrumental analysis, the advanced electronic procedures such as electrokinetic and axiographic measuring, electromyography, thermography and electrosonography have been developed recently for the purpose of better diagnostics and more efficient selection of TMDs' treatment [3,50].

Diagnostics includes *radiologic imaging techniques*. For imaging of hard tissues, panoramic, transcranial and tomographic techniques are used as well as computer tomography for imaging of soft and hard articular tissues and of the jaw in layers (CT or CAT scan). The CT pneumoarthrography is better for imaging of articular structures but it is an invasive procedure which is used only in selected cases. Magnetic resonance imaging (MRI) shows soft and hard tissues and it is particularly successful in imaging of the articular disc function. It is considered the best imaging diagnostic procedure for TMDs. Arthrography enables investigation of the position and function of some parts of the joint (including articular disc) but it is an aggressive method because of the injecting of the contrast agent into the joint so it is used less often. Panoramic and transcranial radiologic diagnostic procedures belong to the basic tests for patients with TMDs while the CT, MRI and arthrography are not performed routinely but only when the elementary diagnostics is insufficient. Some methods, along with their advantages, also have limitations so that the diagnostic value is obtained only when they are used in combination with high quality anamnestic procedures and clinical examination. Apart from the simpler cases and techniques, the use of imaging implies the interpretation of a specialist radiologist trained in the field of TMDs [2,3,57].

A complete diagnostic procedure can sometimes include *laboratory tests* (serological, hematologic, etc.) and other diagnostic procedures performed either in collaboration with the patient's general practitioner or with specialists [3].

### **Differential diagnostics**

Correct diagnostic procedures can be a very demanding task, considering the complexity of TMDs and orofacial pain etiologic factors. To avoid mistakes, it should be taken into consideration that the multidisciplinary approach is of particular value to such patients regarding both diagnostic procedures and treatment procedures.

In a diagnostic procedure, one should bear in mind the fact that different *comorbidities* are present which may coexist but can also contribute to etiology and symptomatology of TMDs, especially to pain. Different studies report pathological conditions such as chronic pain in different parts of the body, for example, back pain, abdominal pain, chest pain, headache and toothache. It may also be the case that such painful condition preceded the beginning of orofacial pain. The results of studies of women with orofacial pain have shown that they have more health problems than healthy women. Patients with TMDs often have symptoms of fibromyalgia, chronic fatigue syndrome, gastroesophageal reflux, posttraumatic stress disorder syndrome as well as some other pathologic conditions [3].

The prevalence of TMDs has been observed in patients with migraine and headache. Symptoms of migraine are similar to those of TMDs which may result in incorrect diagnoses and confusion. Migraine and TMDs are a frequent cause of headache. They show considerable overlapping of pain distribution as well as gender and age prevalence. An accurate mechanism which connects migraine and TMDs is unknown [2,3,58-61]. Psychogenic factors coexist with symptomatology of TMDs and orofacial pain and therefore such patients more frequently exhibit symptoms of fear, panic behavior, and depression as well as sleep disorders than the healthy individuals [2,3,62,63]. A series of intracranial or extracranial diseases should be recognized in *differential diagnostics* of the orofacial pain. Some of them are very serious. Intraoral pain (teeth, periodontium, oral mucosa, tongue, salivary glands etc.), intracranial pain disorders (neoplasm, aneurysm, hematoma, edema, abscess etc.), primary headaches (migraine, tension-type headache, cluster headache etc.), secondary headaches (posttraumatic headache, temporal arthritis, medication overuse etc.), neuropathic pain disorders (episodic neuralgias, continuous neuropathic pains, sympathetically maintained pain etc.), pain in associated organs and structures (ear, nose, throat, eye, lymph nodes etc.), cervical pain disorders (flexion-extension neck injury, cervical arthritis, cervical disc disorders etc.) and mental disorders (psychogenic painful disorders, somatoform disorders etc) should be mentioned here apart from the TMDs (pain in the joint, muscular pain). TMDs pain disorders come immediately after toothache according to intensity and prevalence. These complex differential diagnostic possibilities are based on the close anatomic relationship between masticatory muscles and temporomandibular joint and the anatomic structures of head and neck as well as on the mechanism of transferred pain into these regions and vice versa. Complex sensory (pain) and motor (co-contraction) network of trigeminal nerve as well as other cranial and cervical nerves, with

participation and modulation of the autonomous nervous system, are the basic transmitters of stimulus [2,3,50,57,61,64-66].

**Table 1.** The International Classification for Headache Disorders according to the IHS (adopted from ref. 3)

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<b>Part 1</b>	<b>PRIMARY HEADACHES</b>
IHS 1	Migraine headache
IHS 2	Tension-type headache
IHS 3	Cluster headache and other trigeminal autonomic cephalalgias
IHS 4	Other primary headaches
<b>Part 2</b>	<b>SECONDARY HEADACHES</b>
IHS 5	Headache attributed to head and/or neck trauma
IHS 6	Headache attributed to cranial or cervical vascular disorders
IHS 7	Headache attributed to nonvascular intracranial disorders
IHS 8	Headache attributed to a substance or its withdrawal
IHS 9	Headache attributed to infection
IHS 10	Headache attributed to disorder of homeostasis
IHS 11	Headache or facial pain attributed to disorders of cranium, neck, eyes, ears, nose, sinuses, teeth, mouth, or other facial or cranial structures
IHS 12	Headache attributed to psychiatric disorder
<b>Part 3</b>	<b>CRANIAL NEURALGIAS, CENTRAL AND PRIMARY FACIAL PAIN, AND OTHER HADACHES</b>
IHS 13	Cranial neuralgias and central causes of facial pain
IHS 14	Other headaches and cranial neuralgias, central or primary facial pain

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TMDs are listed in the diagnostic classification of the International Headache Society (IHS) in the 11<sup>th</sup> category (Part 2), within secondary headaches (Table 1). For the purpose of better understanding of the issue, especially orofacial pain symptomatology, and to stimulate the collaboration between dentists and other medical specialists, the American Academy of Orofacial Pain proposed a supplement to the IHS classification with a more detailed elaboration of the 11<sup>th</sup> category, which also includes the Ninth Revision codes (*ICD-9*) of the International Classification of Diseases (Table 2), [3].

## TREATMENT

The etiology of TMDs has not been completely clarified so far, so there is no consent about treatment procedures. Based on the previous and current knowl-

edge, TMDs cannot be considered a unique pathologic entity but a cluster of conditions with similar, overlapping symptoms. In view of this, the treatment of all the types of TMDs cannot be equal [2,3].

**Table 2.** Recommended modification of diagnostic classification for IHS 11 combined with The International Classification of Disorders, Ninth Revision (ICD-9) codes (adopted from ref. 3)

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**HEADACHE OR FACIAL PAIN ATTRIBUTED TO DISORDERS OF CRANIAL BONES (IHS 11.1)**

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**11.1.1 Congenital and developmental disorders**

- 11.1.1.1 Aplasia (ICD-9 754.0)
- 11.1.1.2 Hypoplasia (ICD-9 526.89)
- 11.1.1.3 Hyperplasia (ICD-9 526.89)
- 11.1.1.4 Dysplasia (ICD-9 526.89)

**11.1.2 Acquired disorders**

- 11.1.2.1 Neoplasia (ICD-9 213.1 - benign; ICD-9 170.1 - malignant)
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**HEADACHE OR FACIAL PAIN ATTRIBUTED TO TEMPOROMANDIBULAR JOINT DISORDERS (IHS 11.7.1)**

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**11.7.1.1 Disc derangement disorders (ICD-9 524.63)**

- 11.7.1.1.1 Disc displacement with reduction (ICD-9 524.63)
- 11.7.1.1.2 Disc displacement without reduction (ICD-9 524.63)

**11.7.1.2 TMJ dislocation (ICD-9 830.0)**

**11.7.1.3 Inflammatory disorders**

- 11.7.1.3.1 Synovitis and capsulitis (ICD-9 524.62 ili 726.90 ili 716.98)
- 11.7.1.3.2 Polyarthritides (ICD-9 714.9)

**11.7.1.4 Non-inflammatory disorders**

- 11.7.1.4.1 Osteoarthritis: Primary (ICD-9 715.18)
- 11.7.1.4.2 Osteoarthritis: Secondary (ICD-9 715.28)

**11.7.1.5 Ankylosis (ICD-9 524.61)**

**11.7.1.6 Fracture (condylar process)(ICD-9 802.2x closed; ICD-9 802.3x open)**

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**HEADACHE OR FACIAL PAIN ATTRIBUTED TO DISORDERS OF MASTICATORY MUSCLES (IHS 11.7.2)**

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- 11.7.2.1 Local myalgia (ICD-9 729.1)
  - 11.7.2.2 Myofascial pain (ICD-9 729.1)
  - 11.7.2.3 Centrally mediated myalgia (ICD-9 729.1)
  - 11.7.2.4 Myospasm (ICD-9 728.85)
  - 11.7.2.5 Myositis (ICD-9 728.81)
  - 11.7.2.6 Myofibrotic contracture (ICD-9 728.9)
  - 11.7.2.7 Masticatory muscle neoplasia (ICD-9-CM 171.0)
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The purpose of treatment as well as the selection and sequence of treatment procedures are similar to treatment of other musculoskeletal disorders. In such patients, pain should be alleviated as well as excessive load of the masticatory system and the function and normal diurnal activity of the masticatory muscles and the temporomandibular joint should be restored. Successful treatment outcome is most quickly attained by a well selected program for the elimination of physical etiologic factors, together with the elimination or the reduction of the effects of perpetuating factors, particularly of those that contribute to such a condition (parafunctional activities, psycho-social conditions, etc.). A large number of patients recover without any treatment or by undergoing minimal, conservative treatment procedures [67]. In muscular types of disorders the treatment is repeated more often than in articular disorders [68]. A relatively small number of cases with TMDs become chronic, and in one third of the cases the symptoms vanish within 8-10 years [69].

Reversible and irreversible therapies are performed in TMDs treatment. The reversible, conservative treatment is performed as initial therapy in almost all the cases of TMDs. The initial therapy includes patient's education, patient's self-treatment, cognitive behavioral intervention and elimination of maladaptive habits, physical therapy, pharmacotherapy and the use of occlusal splints. Irreversible, aggressive, procedures such as extensive occlusal and surgical procedures should be avoided in an early stage of treatment [70,71]. In everyday clinical practice all the above mentioned treatment procedures should be combined depending on the patient's disorder finding. It is important to emphasize the fact that psychogenic factors should be considered in all the patients with TMDs, particularly in those with chronic disorders whose treatment should be multidisciplinary oriented [72,73].

The initial therapy of patients with TMDs should always be non-invasive and reversible. The patient's education aims to eliminate possible parafunctional activities such as teeth clenching and teeth grinding, excessive gum chewing and nail biting, pencil biting, etc. The patient should be informed about stress reduction techniques, and she/he should be also taught how to change her/his lifestyle (behavioral therapy). The use of nonsteroidal anti-inflammatory drugs, antidepressives, muscle relaxants and sedatives is most commonly mentioned in pharmacological therapy primarily for the purpose of pain control and muscle relaxation. Also, a combination of the above mentioned drugs is sometimes used. The exercises for correct body posture, particularly those for the head, neck and shoulders are often introduced, which contributes to both a correct position of the mandible and to the balance of load within the temporomandibular joint.

Rehabilitation and better function and stability of the joint and the masticatory muscles are achieved by joint massage, and by isotonic and isometric exercises. In order to perform such exercises, muscles should be relaxed prior to that and the pain in muscles and joints should be reduced. Apart from using analgesics and myorelaxants, this can be achieved by different types of physical therapy, most commonly by surface cooling, warming (warm compress, infrared light spectrum), ultrasound, electrostimulation (TENS) and some other procedures. Different occlusal splints (stabilization, anterior, etc.) are today used routinely in treatment of TMDs. They are made of acrylic resins and most often positioned on the dental arch of the upper jaw. Their purpose is to temporarily change relationships within the jaw and to eliminate harmful contacts between the teeth if they exist. They reduce parafunctional activities and are successful in alleviating muscular and articular pain. However, a general consent about the type and effect of splints does not exist [2,3,50,74]. After initial therapy, especially in case of acute conditions, the majority of patients feel better and the symptoms of dysfunction disappear. Some authors describe placebo effects and the beneficial effect of good collaboration between doctor and patient on the outcome of treatment [2,3].

Sometimes the conservative initial treatment is not successful. It is mainly due to the following two reasons: incomplete or inaccurate diagnostics and unrecognized or incorrectly determined perpetuating factors. It is important to point out that when multiple perpetuating factors or chronic cases of TMDs are present, then it is very important to take the multidisciplinary approach in treatment. A relatively small number of patients should undergo long-lasting treatment when we deal with unrecognized and neglected clinical cases. Also, the treatment will be prolonged in cases of extensive changes in interrelationships of the jaw due to malpositioned teeth, loss of a part of dental tissue or entire teeth. In addition to the already mentioned reversible procedures, some irreversible procedures, that is, occlusal and surgical procedures by which anatomic structure of certain parts of the masticatory system is permanently changed should be included into the treatment. For example, occlusal therapy implies selective debridement of certain teeth, reconstruction of a part of a tooth or more extensive prosthodontic as well as orthodontic procedures. Imbalanced relationships between single or groups of teeth in static and dynamic relationships are thereby reestablished which results in functional harmony. In this way, better anatomic relationships in the masticatory system are achieved and the function of teeth, masticatory muscles and temporomandibular joint is normalized. Surgical procedures such as arthrocentesis, arthroscopy and arthrotomy (discectomy, condylectomy) are

rarely performed. They are carried out for diagnostic and treatment purposes, some of them bringing relatively good results [2,3,75,76].

There are a growing number of research studies showing that conservative reversible treatment is successful. It should be stressed that the aims of treatment will be best achieved by use of the most adequate combination and arrangement of treatment procedures planned and categorized according to the initial priority list. Treatment plan should be reduced to the necessary measures and should be completely carried out. Yet, there are still clinicians who do not follow current scientific literature thus ignoring the results of numerous studies and scientific evidence and instead they still have certain prejudice and are governed by personal experience and intuition [2,3].

## CONCLUSION

Bearing in mind the complexity of etiology, diagnostics and treatment of temporomandibular disorders, a more intensive interdisciplinary collaboration and discussion, based on scientific evidence, is necessary. Diagnostic classification of TMDs should be changed and primarily based on etiology, rather than on recognition of signs and symptoms, on which the current diagnostic classifications are mainly based. Unique diagnostic guidelines and treatment protocols which will be clear and acceptable to all specialist profiles dealing with TMDs should be established. Studies about preventive measures and etiologic factors of TMDs are insufficient. Although scientists recently significantly contributed to the understanding of TMDs and orofacial pain, there are still some unclear facts; therefore more research resulting in valuable findings is needed.

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## Sažetak

### **Temporomandibularni poremećaji i orofacijalna bol**

Temporomandibularni poremećaji (TMP) skupni je naziv za niz patoloških stanja žvačnog sustava. Šarolike su simptomatologije, a orofacijalna bol jedan je od najčešćih simptoma, te bolesnicima svakako najneugodniji. TMP su često vrlo jasne etiologije, no ponekad posve nepoznate. Povezani su s raznovrsnim etiološkim čimbenicima i komorbidnim stanjima, što otežava preciznu dijagnostiku. Ova patologija zahtijeva timski rad i multidisciplinarni pristup, pravodobno prepoznavanje uzroka i pažljiv odabir terapijskih postupaka, pogotovo pri obradi orofacijalne boli, koja diferencijalno-dijagnostički može biti vrlo zahtjevna.

Još uvijek ima nepoznanica, stoga i prostora za znatna poboljšanja u pristupu ovoj problematici. Postojeću dijagnostičku klasifikaciju treba izmijeniti i prvenstveno temeljiti na etiologiji, a ne na simptomatologiji, što je danas slučaj. Također treba izraditi jedinstvene dijagnostičke smjernice i terapijske protokole, što bi unaprijedilo multidisciplinarnu suradnju, neophodnu u obradi ove vrste patologije. Posebnu brigu valja posvetiti razvoju preventivnih mjera, zasnovanih na znanstvenim dokazima, a one su još uvijek zapostavljene.

**Ključne riječi:** žvačni sustav; temporomandibularni poremećaji; orofacijalna bol; terminologija; epidemiologija; etiologija; simptomatologija; dijagnostika; liječenje.