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TEMPOROMANDIBULAR DISORDERS – PROBLEMS IN DIAGNOSTICS

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Summary

Temporomandibular disorders (TMD) is a group of conditions affecting the temporomandibular joint, masticatory muscles and the adjacent structures, and most clinicians and researchers believe that it is multifactorial etiology. There are multiple risk factors associated with TMD. The etiology of TMD has not been yet completely understood. Likewise with other chronic musculoskeletal pain disorders, TMD seems to be best explained from a biopsychosocial perspective, in which it is viewed as a psychophysiological disorder involving changes in endogenous regulatory pain pathways, resulting in maladaptive emotional, physiological and neuroendocrine responses to physical and psychological stressors. In adolescents with TMD, psychosocial factors such as increased levels of stress, somatic complaints, and emotional problems seem to play a more prominent role than dental factors. Multiple pains in the body and fatigue are significantly more common with TMD group than with the controls. Several studies have categorized TMD into subgroups.

So far, studies which examined psychological differences between subgroups generally pointed to the fact that patients with myogenic diagnoses had more pain and distress than those with joint-related diagnoses. It seems that muscular pain may overshadow joint pain. However, subjects in the myogenous group more often reported parafunction, depression, and worrying. Recent studies suggest that subjects with muscular diagnoses have more severe pain and psychological distress than those with joint diagnoses.

Further studies are needed to clarify the temporal sequence of risk factors, as well as the mechanisms accounting for the association between TMD pain and gender.

***Key words*:** temporomandibular disorders (TMD); temporomandibular joint disorders; masticatory muscles disorders; signs and symptoms; diagnostics of TMD; treatment modalities.

FUNCTIONAL DISORDERS OF MASTICATORY SYSTEM

Masticatory system is a complex functional unit, primary engaged in chewing, swallowing and breathing functions, and some parts are involved in taste recognition and determination of food consistency. Sophisticated functional performances of speech and emotion expressions are specifically human qualities.

Masticatory system is built up of bony mandible and maxillae, temporomandibular joints (TMJ), ligaments, masticatory muscles, perioral muscles, teeth and their supporting tissues, and also nerves and blood vessels for supply (Fig.1).

The complex and specific functions of masticatory muscles and temporomandibular joints are determined with the type and range of possible movements of lower jaw (rotation and translation) and relations between centers of rotation and also with time sequences of three-dimensional movements [1-5] and finally determined with the teeth contacts. Great attention is given to the intracapsular relations, which are tried to be visualized and reproduced by various methods to clarify the manner of functioning and interrelating active and passive components [6,7].

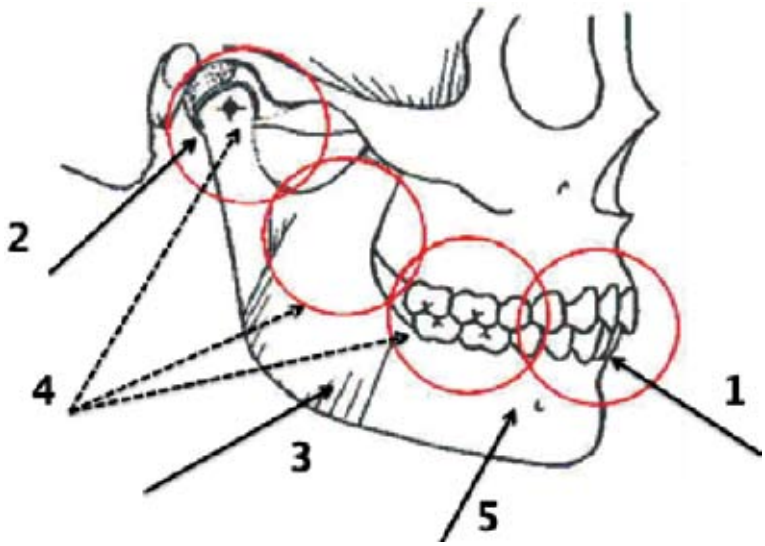


Fig. 1. Masticatory system is complex and sophisticated organ with active and passive components

1. teeth and supporting tissues (PDL-periodontal ligament)
2. temporomandibular joints (TMJ)
3. muscles (masticatory and perioral)
4. nerves and blood vessels
5. bony structures

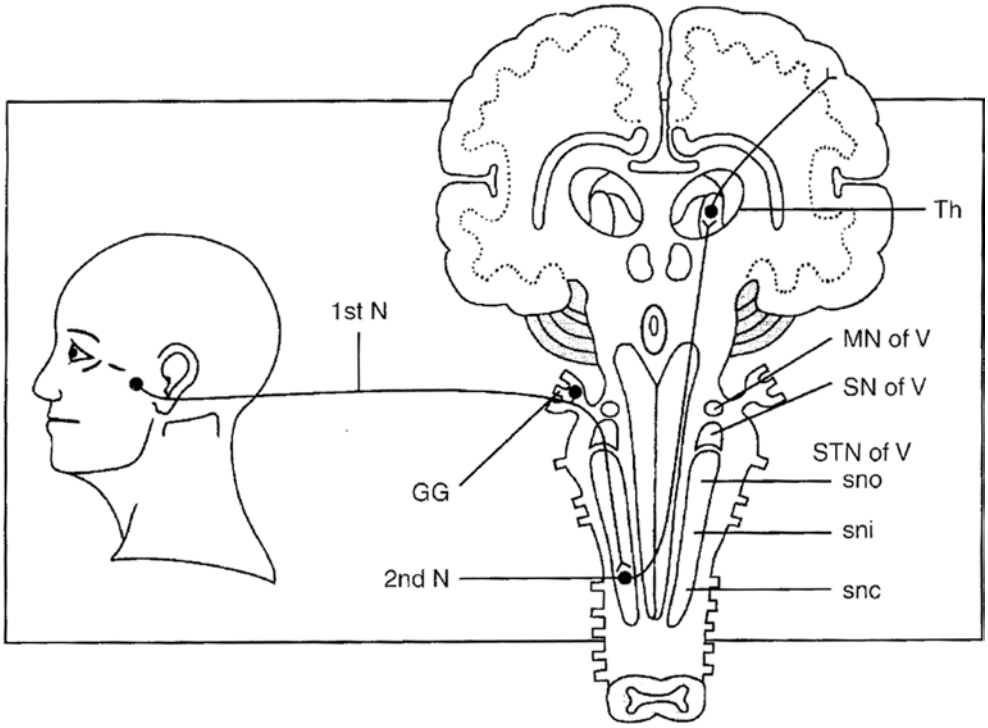


Fig. 2. Graphic depiction of the trigeminal nerve entering the brainstem at the level of the pons. The primary afferent neuron (1s N) enters the brainstem to synapse with a second order neuron (2nd N) in the trigeminal spinal tract nucleus (STN of V). The spinal tract nucleus is divided into three regions: subnucleus oralis (sno), subnucleus interpolaris (sni) and subnucleus caudalis (snc). The trigeminal brainstem complex is also composed of the motor nucleus of V (MN of V) and the main sensory nucleus of V (SN of V). The cell bodies of the trigeminal nerve are located in the gasserian ganglion (GG). Once one second-order neuron receives the input, it is carried on the thalamus (Th) for interpretation (Adopted from ref. 8).

The movements of the lower jaw are regulated and coordinated with the complex neuromuscular mechanisms [8]. Each movement is coordinated so as to obtain maximal function with minimal likelihood for damage of any integrated structure (Fig. 2).

TEMPOROMANDIBULAR DISORDERS (TMD)

Functional disorders of masticatory system are complex and influenced by *multiple factors*. Some factors are *predisposing* and increase the risk for TMD, some are involved in the beginning of TMD and are known as *initiating* factors and

some interfere with the healing or increase the progression of TMD as *perpetual* factors [9,10]. In some cases a single factor can have a role of only one factor or it can play the role of all described factors. The successful treatment of TMD depends on proper identification and control of these factors.

It is often presumed that *occlusion* could have an important role in the beginning and in the course of TMD [11,12]. Recently, the role of occlusal influence has been more observed in order to be objectively evaluated by means of detailed clinical protocols, for each subject, aiming at either confirmation or exclusion of occlusal factors in the induction of TMD.

For evaluation of occlusal factors it is important to take into account static and dynamic relations between teeth. It is assumed that occlusion can initiate TMD most commonly through two mechanisms.

The first mechanism is associated with the acute changes of the occlusal factors that could provoke muscle cocontraction and evoke muscle pain. As this happens, more often new *muscle engrams* are evolved (new schemes of muscle activity) and the patient adapts to changes without concomitant effect.

The second mechanism of occlusal involvement in the TMD occurs through the unstable relationships between upper and lower jaw. Occlusal instability must be significant and the forces must be present. It can be simply described in the following manner: guiding the teeth into the intercuspal position is muscular response, but as the teeth approach the occlusion, the loading of masticatory structures is transmitted to the joints.

Among other significant factors for the TMD there are *trauma* (micro- and macro-trauma), emotional *stress*, origins of *deep pain* as well as *systemic factors*.

Some TMDs are related to certain emotional situations. An increased level of emotional stress can have influence on muscle function through increased muscle activity in resting phase (i.e. protective cocontraction), bruxing activity or both. The increased level of emotional stress can also activate the sympathetic nervous system, which can cause the muscle pain. Activation of sympathetic nervous system can also be connected with some other psychophysical disorders that are often related to TMDs.

Multiple systemic factors can also influence patient's capacity of *physiological tolerance.* Each patient has some individual characteristics, which are unique for his/her constitution. These factors are probably genetically predetermined, as well as by sex and nutrition. Some other situations, like acute or chronic disease and overall physical condition of the patient can have influence on systemic factors. Even the efficacy of the pain modulation system can modify the patient's reactions on provocation. For example, if the efferent inhibitory system ineffectively modulates pain sensation, all system becomes more vulnerable to new provocations.

Concerning the *etiologic variability of TMD*, it is necessary to reveal the main causes which can be connected with this condition. The recognition of the main cause is important for the planning of the accurate and effective therapy.

The review of the scientific literature [11] reveals five major factors connected with TMD: 1) occlusal condition, 2) trauma, 3) emotional stress, 4) origins of deep pain, 5) parafunctions. Most recently the combination of biologic and psychological aspects in etiologic theories about TMD has been termed as biopsychosocial [9,13].

In fact, the importance and role of any of these factors varies from patient to patient. Occlusion is often described first, because it has great importance to dental profession.

The clinician has to be aware that occlusion may not be the most influenced factor for TMD. An automatic performing of such a conclusion could result in a great fault in treatment of TMD.

EPIDEMIOLOGY AND CLASSIFICATION

The prevalence of signs and symptoms of TMD could be best understood by studying some epidemiologic reports. Numerous epidemiologic studies reported the prevalence of temporomandibular disorders in certain populations. It is known that 60-70% of common population today has at least one sign of TMD, and the ratio of women to man is about 4:1 [14]. The ratio of intracapsular, muscular, and both disorders (the combination of intracapsular and muscular) is 19% intracapsular: 23% muscular and 27% combined [15]. All age groups are involved [16] but the most frequent symptoms are developed in the population from 17 to 30 years of age [17]. It is interesting to notice that in population of children and young adolescents there are no serious complaints about any significant symptom, although they showed an increased number of TMD signs during lifetime. Similar findings are found in the patient's group older than 60 years, who also rarely complain about symptoms of TMD [18-20].

Although *malocclusion* is referred as one of the etiologic factors for the TMD clinical findings did not support this interrelationship [21-23]. On the other side, there was a rather high predisposition for TMD evidenced for the anterior cross bite. Extremely deep anterior overbite is considered to be the cause of neuromuscular dysfunction and retroposition of the mandible, which can cause ischemic circulatory effects, with predisposition to development of TMD [24]. Although, in some studies it has been mentioned, that there are significant connections between the TMD and open bite, cross bite and occlusal interferences, malocc-

lusion is considered to be only the contributive factor for TMD and not a single etiologic factor.

Asymmetrical occlusal contacts and *interferences* could, also, be related to functional disorders). These interferences are brought into the correlation with the joint sounds, which aggravate their connection with the dysfunction [25,26].

Bruxism can be one of the significant etiologic factors in the development of TMD, although it is important to say that bruxism is a very common phenomenon so that the presence of bruxing facets or the information about the bruxing activity is not necessarily indicative for TMD etiology. All possible factors which will determine the most probable cause of TMD need to be investigated [27]. Neuromuscular reflexes are involved during the functional activities in protection of oral structures (components) from damages. During parafunctional activities, however, it seems that neuromuscular protective mechanisms are suppressed and therefore not fully capable of protecting masticatory components, especially masticatory muscles from high level of their activity. This can lead to an increased parafunctional activity, almost to the level of damages to some structures [27-29].

HISTORICAL REVIEW OF TMD

The evolution of etiologic concepts in the field of TMDs has been thoroughly discussed in the dental literature [9,13,30,31]. It is known that in early 1934 James Costen, an otolaryngologist, observed a group of symptoms in the ear and in the temporomandibular joint region in patients with reduced vertical dimension of occlusion. He described these findings as a syndrome [32]. Although there had been some papers in dental literature before that time, J.B. Costen was the first who pointed out the role of TMJ as a separate source of facial pain [33]. He also described about 11 other symptoms (most of which could not be anatomically connect with the TMJ). The main importance was to lay the foundation for two propositions that have dominated the field for years:

1. These so called TMJ problems were the result of *structural malalignments* between the mandible and the cranium;
2. Only *dentists* could take care of TMJ problems because of the structural corrections that would be required.

After the 1970s, advances in imaging techniques that included tomography, arthrography, computed tomography (CT), and, later, magnetic resonance imaging (MRI) resulted in improved visualization of intracapsular structures. These imaging techniques and increasing experience in clinical management, provided information for more specific diagnoses.

Since 1990s, TMD are not considered to be a single entities but a group of several diseases of varying etiology and pathology. However, the controversy about different etiologic theories of TMD still exists because of limited knowledge regarding the etiology and natural history of the course of TMD.

The American Academy of Orofacial Pain (AAOP) defined temporomandibular disorders (TMD) as *"a collective term embracing a number of clinical problems that involve the masticatory musculature, the temporomandibular joint (TMJ) and associated structures, or both"* [10]. These disorders have been principally characterized by:

1) pain in the temporomandibular region or in the muscles of mastication;
2) limitations or deviations in mandibular range of motion;
3) TMJ sounds during jaw function.

The American Dental Association (ADA), made up three categories of symptoms and signs according to the affected structures: the muscles, temporomandibular joints and the dentition. TMD are considered to be a subclassification of musculoskeletal disorders and typically run a recurrent or chronic course, with a substantial fluctuation of signs and symptoms over time .

The research diagnostic criteria for TMD (RDC/TMD), developed by Dworkin and LeResche [34,35] has been still widely used. This is a *dual axis system* for classifying TMD patients and subjects. It provides specifications for conducting a standardized clinical examination and for establishing a dual diagnosis that recognizes not only the physical conditions (axis I), including muscle disorders, disc displacements and other types of joint conditions that may contribute to the pain disorder, but also the psychosocial issues (axis II) that contribute to the suffering, pain behaviour, and disability associated with the patient's pain experience. Three main diagnostic subgroups of TMD can be distinguished: muscle disorders (group I); disc displacement (group II); and arthralgia, arthritis, and arthrosis (group III).

Although the myogeneous and the arthrogeneous disorders have some common clinical findings, there are certain characteristics in anamnestic and clinical examination, which help to differentiate them.

After the ADA (*American Dental Association*) had accepted the categorisation of TMD, a road–map was created to help clinicians in obtaining the proper and correct diagnosis [10], (Table 1).

SIGNS AND SYMPTOMS OF TMD

The most common signs and symptoms in the patients with temporomandibular disorders and their diagnostic significance are presented in a Table 2.

Table 1. Classification system established by AAOP and IHS, with code numbers (Adopted from ref. 10).

10-1 Classification System Used for Diagnosing Temporomandibular Disorders

I. Masticatory muscle disorders
  1. Protective co-contraction (11.8.4)*
  2. Local muscle soreness (11.8.4)
  3. Myofascial pain (11.8.1)
  4. Myospasm (11.8.3)
  5. Centrally mediated myalgia (11.8.2)

II: Temporomandibular joint disorders
  1. Derangement of the condyle-disc complex
    a. Disc displacements (11.7.2.1)
    b. Disc dislocation with reduction (11.7.2.1)
    c Disc dislocation without reduction (11.7.2.2)
  2. Structural incompatibility of the articular surfaces
    a. Deviation in form (11.7.1)
      i. Disc
      ii. Condyle
      iii. Fossa
    b. Adhesions (11.7.7.1)
      i. Disc to condyle
      ii. Disc to fossa
    c. Subluxation (hypermobility) (11.7.3)
    d. Spontaneous dislocation (11.7.3)
  3. Inflammatory disorders of the TMJ
    a. Synovitis/capsulitis (11.7.4.1)
    b. Retrodiscitis (11.7.4.1)
    c. Arthritides (11.7.6)
      i. Osteoarthritis (11.7.5)
      ii. Osteoarthrosis (11.7.59)
      iii. Polyarthritides (11.7.4.2)
    d. Inflammatory disorders of asociated structures
      i. Temporal tendonitis
      ii. Stylomandibular ligament inflammation

III. Chronic mandibular hypomobility
  1. Ankylosis (11.7.6)
    a. Fibrous (11.7.6.1)
    b. Bony (11.7.6.2)
  2. Muscle contracture (11.8.5)
    a. Myostatic
    b. Myofibrotic
  3. Coronoid impedance

IV. Growth disorders
  1. Congenital and developmental bone disorders
    a. Agenesis (11.7.1.1)
    b. Hypoplasia (11.7.1.2)
    c. Hyperplasia (11.7.1.3)
    d. Neoplasia (11.7.1.4)
  2. Congenital and developmental muscle disorders
    a. Hypotrophy
    b. Hypertrophy (11.8.6)
    c. Neoplasia (11.8.7)

Table 2. The most common signs and symptoms of TMD.

Facial pain	Limited opening or inability to continuously open the mouth
Pain in temporomandibular joint (TMJ)	Deviation or deflexion of mandible at opening
Neck and shoulder pain and/or back pain	Locking the joint at opening or closing
Joint pain, or facial pain during mouth opening or closing, jawing or chewing	Ear noise, tinnitus, pain in the ear, loss of hearing and/or hyperacoustics
Joint sounds	Vertigo
Headache	Swelling on one side of the face or mouth
Occlusion that is unpleasant or constantly changes	Disturbance of vision

Temporomandibural joint's pain

Pain normally appears as the result of exaggerated stimulation of the neuromuscular system. The overstimulation can be caused by different reasons: malocclusion, stressed teeth clenching, muscular spasm and intracapsular inflammation caused by joint injury.

Limitation of jaw movements

Muscular cocontraction usually appears as the result of joint injury. It is an immediate effect of physical damage and pain caused by movement. The patients with whiplash injury have higher incidence of cocontraction. Limited movements are more the result of pain than of physical restriction.

Trauma to the TMJ can occur during orotracheal intubation. Anterior dislocation of the mandible has been noted and disc displacement without reduction associated with limited opening has also been reported in a small number of patients [36]. These conditions were noted after emergence from anesthesia in patients who reportedly had no prior history of TMDs. TMJ dislocation has also been noted following endoscopy.

Temporomandibular joint's sounds

Although joint sounds (especially clicking) are commonly found among patients with either TMJ or masticatory muscle pain they may also be present without associated pain and therefore they are not pathognomonic for either kind of disorder. Joint sound alone is not an indication of TMD, although it could be possible that TMD is present. It was estimated that 40% of population have joint sounds without TMJ dysfunction. The main diagnostic role of TMJ sound is connected with other symptoms to determine the nature of the disorder. The quality of sound is *clicking* sound and *crepitation***.** Sound can be a single or reciprocate, and can appear in only one ear or in both ears. Although the presence or absence of joint sounds, whether clicking or crepitation, should be noted and recorded as part of the diagnostic protocol, they have no diagnostic validity in terms of specifically identifying or differentiating one type of pain problem from another.

Pain and sensitivity

Most researchers in the TMD field have observed that the primary symptom that determines the treatment seeking behavior is the facial and head pain experienced by these patients [37,38]. Because it is well known that both acute and chronic pain have psychological associations, a responsible clinician must take that fact into account while treating all patients with TMDs.

Over 60% of patients with acute dysfunction complain (at light touch) about painful sensations and pain in TMJ. Pain at muscle palpation is certain sign of dysfunction. For the evaluation of pain there are certain measuring instruments, such as VAS (visually analogue scale) and VNS (visually numerical scale). Some

2.0 Bol - ako ne osjećate nikavu bol u području glave i lica preskočite na 3.0

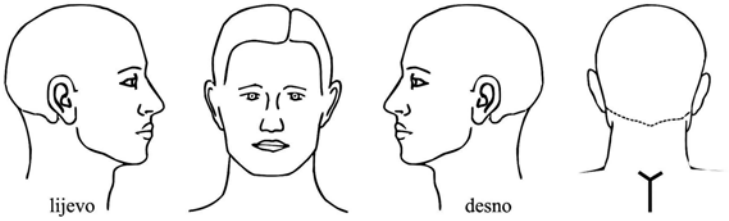
2.1 Na skali ispod povucite okomitu crtu na mjestu koje označava jačinu Vaše boli

bez boli 0 1 2 3 4 5 6 7 8 9 10 najjača bol

2.3 Stavite križić ispred pojmova koji opisuju Vašu bol

- ☐ pulsirajuća
- ☐ glodajuća
- ☐ lagana
- ☐ strašna
- ☐ probadajuća
- ☐ pečenje
- ☐ potmula
- ☐ okrutno-kažnjavajuća
- ☐ oštra
- ☐ parajuća
- ☐ umarajuća-iscrpljujuća
- ☐ bolesnička
- ☐ grčevita
- ☐ teška

2.4 Ocrtajte na shemama područja na kojima se bol javlja



2.5 Stavite križić u kućicu ispred izraza koji opisuje trajanje Vaše boli

- ☐ manje od 1 minute
- ☐ od 1 do 10 minuta
- ☐ manje od 1 sata
- ☐ od 1 do 5 sati
- ☐ od 6 do 12 sati
- ☐ od 13 do 24 sata
- ☐ nekoliko dana
- ☐ nikad ne prestaje

2.6 Stvite križić kod uzroka koji pojačavaju ili provociraju bol

- ☐ žvakanje
- ☐ govor
- ☐ zijevanje
- ☐ pjevanje
- ☐ jako otvaranje usta
- ☐ manjak sna - nesanica
- ☐ sviranje muzičkog instrumenta
- ☐ vožnja u auta duže vrijeme
- ☐ neka određena hrana
- ☐ vruća ili hladna pića
- ☐ mlaka ili hladna voda
- ☐ emocionalni stres/ nervoza
- ☐ dugotrajno sjedenje
- ☐ vježbanje
- ☐ ostalo */upišite na crtu/*

_____

_____

_____

2

2.7 Stavite križić pored čimbenika koji umanju ili Vas u potpunosti oslobađaju boli

☐ vježbanje	☐ masaža bolnog područja	☐ topli oblozi
☐ toplina	☐ određen položaj doljnje čeljusti	☐ hladni oblozi
☐ san	☐ micanje donje čeljusti	☐ lijekovi protiv bolova
☐ vrijeme	☐ relaksacija - odmor	☐ ništa ne pomaže

☐ drugo */upišite na crtu/* _____

2.8 Da li Vas boli zub ili nešto drugo u usnoj šupljini - ako da zaokružite to područje na slici desno

☐ da
☐ ne

3.0 Glavobolja - ako nemate glavobolja ili ih imate vrlo vrlo rijetko preskočite na 4.0

3.1 Koliko su otprilike bolne vaše glavobolje (na skali stavite okomitu crtu na mjestu koje otprilike odgovara intenztetu bola)

bez boli 0 1 2 3 4 5 6 7 8 9 10 najjača bol

3.2 Stavite križić ako tvrdnja s lijeve strane odgovara istini.

Imam glavobolje najmanje jednom tjedno	☐
Moje glavobolje se razlikuju po vrsti boli - nisu uvijek jednake	☐
Budim se ujutro sa glavoboljom	☐
Glavobolja imam kasnije tijekom dana	☐
Glavobolje me bude dok spavam	☐
Uz glavobolju ide i osjećaj mučnine i nagon za povraćanjem	☐
Uz glavobolje se javljaju i poremećaji vida *(kakve vrste su ti poremećaji - upišite na crtu ispod)*	☐

_____

_____

3.2 Stavite križić pored čimbenika koji Vas oslobađa glavobolje

Odmor	☐
San	☐
Vježbanje	☐
Ništa, nema pomoći	☐
Lijekovi *(navedite koji na crtu ispod)*	☐

_____
_____
_____

3

Fig. 3. Gnathologic Questionaire, School of Dental Medicine, University of Zagreb.

of them are adapted for children [39]. One of the most popular evaluations of pain is Mc Gill Pain Questionnaire (MPQ) which contains 78 words (pain descriptors) which can assess sensory and affective pain qualities [40]. Most Clinics or Dental Schools use adapted Questionnaires for the follow up of TMD. One of them is Gnathology Questionnaire at the School of Dental Medicine University of Zagreb, which is designed for clinical and research studies and is partly based on TMD/RDC protocol (Fig. 3).

Occlusal changes

Changes in occlusion (the way the teeth fit together in closure) could be a valuable indicator of TMD, often because of disc dislocation, mainly caused by trauma (blow or car accident), or intracapsular inflammatory process (retrodiscitys, rheumatoid arthritis, capsulitis). If the patient cannot put teeth together during closure, TMD is suspected. It is strongly recommended that, unless there are specific and justifiable indications to the opposite, treatment be based on the use of conservative and *reversible treatment* modalities.

Headache

Temporomandibular disorders (TMD) and cervical pain disorders (CPD) include musculoskeletal complaints that have been associated with symptoms similar to those of tension-type headaches, migraines, and combinations of these two entities. Headaches are more connected with myogenous than arthrogenous origin of TMD, however they can be related to many systemic disorders [41-43]. Tension-type headache, including pain generating from the masticatory musculature, can be episodic as well as chronic and may be indistinguishable clinically and therapeutically from migraine. It is also known that TMD and headaches are highly prevalent among the general population and can co-exist. Unfortunately there are minimal epidemiological data regarding the relation between TMD and headache.

Ear symptoms

Some TMD patients complain of a sensation of fullness in the ear or ear stuffiness. Ear pain can actually be TMJ pain perceived more posteriorly, Only one thin area of the temporal bone separates the TMJ from the external auditory meatus and middle ear. Patients suffering from TMD have also reported tinnitus (i.e., ear ringing) and vertigo (i.e., dizziness). Some patients complain of altered hearing as a result of protective cocontraction of the tensor tympani. Pain, loss of hearing, tinnitus are all symptoms that could be connected with TMD [9,44].

MUSCULAR DISORDERS (Myogenous component)

Patients suffering from myogenous pain will often have certain anamnestic data, which could raise some confusion. The main complaints could be a heterotopic pain, and not the real origin of pain (i.e. trigger-points). The therapy can be recommended for the treatment of secondary pain instead of the origin of pain, and the result can be ineffective. The clinician should distinguish the *site of pain* from the *origin of pain* and direct the therapy toward it.

Trigger-points can be present in their active or latent stages. When active, they can cause centrally excitatory effects, and patient could suffer from tension-type headache [45,46]. When trigger-points are in their latent stage headache is not reported. Because transferred pain is in relation with the true origin of pain, palpation on the active trigger-point (local provocation) can increase the level of pain on the remote site. In latent stage the trigger-point is no more sensitive on palpation and therefore is not the origin of the secondary pain. Different inputs could activate trigger-points, like forced use and overwork of muscles, emotional stress, even the infection of the upper respiratory tract.

Trigger-points in shoulder or in neck muscles can provoke cocontraction in masticatory muscles. If this continues a local muscle hypersensitivity could be developed in masticatory muscles. Therapy of masticatory muscles will be unsuccessful, as the main cause are trigger-points in neck muscles, spine and shoulders. The proper therapy of trigger-points will also cure the disorder of the masticatory muscles.

TEMPOROMANDIBULAR JOINT DISORDERS (Arthrogenous components)

Disorders of temporomandibular joint (TMJ) have symptoms and signs related to the disturbed function of condyle-disc complex. Symptoms are connected with mandibular movements as clicking and locking in the joint. Usually, they are constant, repeatable and sometimes progressive. Disorders of TMJ can be classified into three main groups: 1) disorders of condyle-disc complex, 2) structural incompatibilities of joint surfaces, 3) inflammatory disorders.

Disorders of the condyle-disc complex fall in two subgroups: 1) disc dislocation with reduction, 2) disc dislocation without reduction.

Disc dislocation can be caused by elongation of disc and capsular ligaments together with the changes of discus articularis. This can often be the result of micro or macro-trauma. Patients are usually certain about macrotrauma and report it in the medical history, but the cause of microtrauma is more difficult to be recognized. Some causes of microtrauma can be bruxism and orthopedic in-

stability. Joint loading and orthopedic instability can be the predisposing factors for some condyle-disc displacements.

Structural incompatibilities of joint surfaces are often the result of some disorders in function that is trauma, pathologic processes, or sometimes too wide mouth opening. These disorders are characterized by dysfunctional pattern of jaw movements which are repeatable and difficult to avoid.

TMJ osteoarthritis refers to an inflammatory condition affecting an articulation that results in erosion and destruction of articular cartilage and degeneration of subchondral bone. TMJ overloading, consisting of either repetitive or extreme mechanical loads, results in pathologic state if the intrinsic healing or adaptive capacity of the joint is exceeded. Systemic factors (e.g. immune dysfunction) can also contribute to TMJ osteoarthritis, or a variety of other distinct forms of arthritis of TMJ (e.g. rheumatoid arthritis) that share common pathogenetic mechanisms (e.g. molecular events mediated by interleukin 1ß or tumor necrosis factor α), [47]. The impact of these systemic factors is presumably either amplification of molecular events generated by mechanical loading or the enhancement of susceptibility to injury.

TMJ osteoarthritis is typically a slowly progressive, asymmetric disease resulting in the destruction of articular tissues. Some degenerative conditions, such as idiopathic condylar resorption, progress very rapidly in relatively young individuals (juvenile rheumatoid arthritis) and can represent either a distinct pathologic entity or osteoarthritis in a highly susceptible individual. Clinically, individuals suffering from TMJ osteoarthritis experience pain of variable intensity, restricted jaw movement and joint sounds (crepitation).

DIAGNOSTIC METHODS (The role of technology)

Barney Jankelson said *"If it is measured it is a fact otherwise it is an opinion* [48,49]. There are significant problems in TMD diagnostics, because recent classifications are mostly based on the signs and symptoms and not on etiology. The traditional approach to diagnosis of temporomandibular disorders (TMDs) has been based on the medical model of listening patient's main complaints, recording subjective histories and obtaining physical findings from direct examination.

The most common complaint of TMD patients is the pain of musculoskeletal origin, which can be localized or diffused and is usually exacerbated by jaw function [50,51]. Since masticatory system is situated in the head, the distinction between the *TMD pain* and other types of *craniofacial pain* conditions can be quite

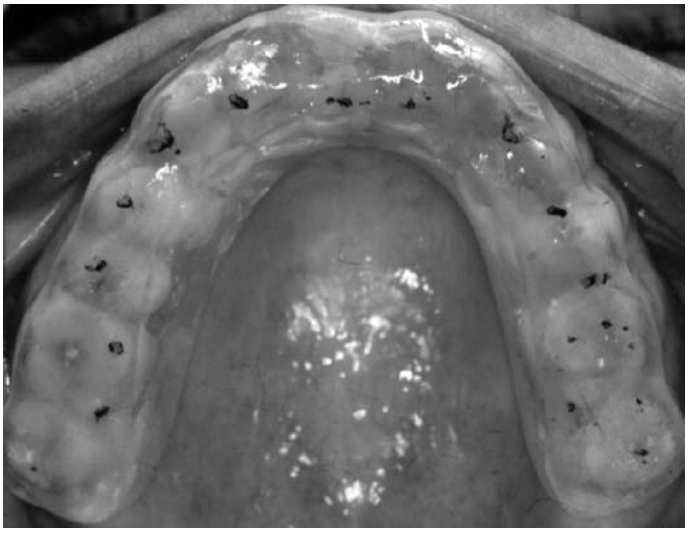


Fig. 4. Occlusal appliance. After the polymerization of acrylic occlusal surface precise adjustments are needed in the mouth.

demanding. International Headache Society in 2004 revised diagnostic criteria for labeling more than 150 types of craniofacial pain disorder, and there are several overlapping characteristics. It is not surprising that many clinicians have problems in differential diagnosis and they would like to have proven technologic assessment procedures which could help them to discriminate among various factors. Most commonly used parameters in dentistry are the amplitudes of jaw movements, examination of dental occlusion, palpation of TMJs and masticatory muscles and registration of the joint sounds. Also, there are information about pain, injuries, oral habits and previous dental procedures.

The most widely used technology to evaluate TMD patients is imaging, such as standard radiographic imaging technique (orthopantomographic radiograph), or a more detailed ones, such as computerized tomography (CT, CT Scan), arthrography, scintigraphy, and magnetic resonance imaging (MRI), [52]. Magnetic resonance imaging is becoming a gold standard for evaluating the soft tissue of the TMJ, especially disc position.

For dynamic recordings of the active components of masticatory system other technologies, such as computerized techniques of surface electromyography, gnathosonic recordings (jaw or occlusal sounds), axiography (Cadiax, Arcus Digma) are used. Electromyography can provide an insight into the muscle activity comparing simultaneous activity on both sides (usually m. masseter and m.

temporalis) for some standard recording phases: resting muscle levels, maximal voluntary clench, swallow, chewing patterns an so on [53-55]. For analysis of dental occlusion and occlusion on implants the recordings using 3-D sensors (T-Scan) in combination with other described methods are used [56].

It is important to take the interdisciplinary approach in treating patients with diffuse complaints because pain-related emotional and behavioral factors can represent the major burden. Psychological and psychosocial assessment is strongly advocated as an essential component of evaluating the patient with TMD. The scientific and clinical rationale for conducting a psychological and psychosocial assessment of TMD patients rests on four premises:

1. Many of TMDs result in chronic pain;
2. Chronic pain is associated with psychological and psychosocial disturbance;
3. Increased levels of psychological and psychosocial impairment are often associated with poor treatment outcomes;
4. A multidimensional understanding of chronic pain improves the diagnosis and treatment.

THERAPEUTIC MODALITIES

Pain and dysfunction are the most frequent reasons for coming into the dental office and could be very dramatic for the TMD patient asking for help. *Initial therapy* should always be noninvasive and reversible. *Pharmacologic therapy* primary is directed to pain relive and antiinflammatory effect. In patients with more chronic TMDs antidepresive drugs are prescribed. In their report, AAOP members (*American Academy of Orofacial Pain*) who treated TMD patients prescribed about 68% NSAID (nonsteroid antiinflammatory drugs), 51% antidepresive drugs, 49% myorelaxants, and 31% sedatives [57].

Also some other modalities should be used, especially the *education* of patients in order to eliminate the stress (behavioral therapy), decrease loading of TMJ and avoid teeth clenching and grinding.

The use of methods of *physical therapy* for the treatment of painful TMDs can be very effective in reducing pain and other symptoms associated with these conditions. Empirically, it is known that most patients who undertake these procedures will report their improvement in both their signs and symptoms, and many of these therapies are widely used to treat musculoskeletal conditions elsewhere in the body. Ultrasound is often used in conjunction with

stretching and other exercise therapies, to treat chronic pain caused by TMDs. Application of heat and cold is often prescribed, but data on the effectiveness of these therapies are also limited. Acupuncture is believed to reduce pain by stimulating the release of endogenous opiates (endorphins). The efficacy of low-level laser therapy for treating musculoskeletal pain seemed to be greater in conjunction with exercise therapy [58]. Good results are achieved by using TENS (transcutaneous electrical nerve stimulation). Frequencies in the 100 Hz range are often used at low intensity, with the intention of producing pain-free paresthesia. It has been suggested that TENS is most useful in cases of acute and neurologic pain.

Occlusal appliances are often recommended as initial phase of therapy in the treatment of TMD patients. Occlusal appliances have several uses, one of which is to temporarily provide a more *orthopedically stable position*. They can also be used to introduce an optimum occlusal condition that reorganizes the neuromuscular reflex activity; this in turns reduces abnormal muscle activity, while encouraging more normal muscle function. [59,60]. Oral appliances also protect the teeth and supportive structures from abnormal forces that may create breakdown or tooth wear (bruxism). The occlusal appliance should be individually made from hard acrylic, preferably by the use of articulator (Fig. 4).

After the initial therapy, most patients show improvement and cessation of the symptoms of dysfunction, while a smaller number of patients should receive different kind of therapy, multidisciplinary planned and conducted over longer period.

CONCLUSIONS

TMD is a group of conditions affecting the temporomandibular joint, masticatory muscles and adjacent structures, and most clinicians and researchers agree that it is of multifactorial etiology.

There is no common opinion about the most acceptable diagnostic procedures and most effective treatment modalities, but it is generally accepted that more chronic the disorder, the greater the involvement of psychogenic factors. Also, the need for multidisciplinary approach is more mandatory.

The clinicians need to know that occlusion need not to be the most influencing factor for TMD. Therefore is important for achieving a musculoskeletal stable position in the joint (orthopedically stable occlusion) which prevents from damaging effect of microtrauma, and contribute to the health of the masticatory system.

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Sažetak

Temporomandibularni poremećaji – problemi u dijagnostici

Temporomandibularnim poremećajem (TMP) uglavnom su zahvaćeni temporomandibularni zglobovi (TMZ) i žvačni mišići s okolnim strukturama. Smatra se da su uzročnici mnogobrojni te neki izravno utječu na pojavu i razvoj TMP-a, dok se drugi pojavljuju kao čimbenici koji mogu doprinijeti nastanku bolesti. Kao i ostali kronični mišićno-koštani bolni poremećaji, i TMP bi se mogao opisati kao psihofizički poremećaj s promjenama u endogenim regulacijskim putovima boli i posljedično otežanom prilagodbom na emocionalne, fiziološke i neuroendokrine odgovore na fizičke i psihičke stresore. Čini se da kod adolescenata s TMP-om važniju ulogu imaju psihosocijalni čimbenici, kao što su povećana razina stresa, somatske tegobe i emocionalni problem, nego sami dentalni čimbenici. U pacijenata s TMP-om znatno je prisutnija pojava multiplih boli u tijelu i općenito umora nego u kontrolnih ispitanika.

Postoje različite klasifikacije TMP-a; neki ih dijele u podgrupe. Pacijenti s mišićnim dijagnozama imaju izraženije pritužbe na bol i distres nego oni koji imaju poremećaje vezane uz zglob. Čini se da mišićna bol može zasjeniti zglobnu, a pacijenti iz miogene skupine više se žale na parafunkcije, depresiju i zabrinutost. Smatra se da pacijenti s mišićnim dijagnozama imaju više bolnih simptoma od onih sa zglobnim dijagnozama.

Bit će potrebna daljnja istraživanja kako bi se razjasnila uloga i utjecaj čimbenika rizika i mehanizama koji su odgovorni za povezanost TMP-a i boli te utjecaj spola.

Ključne riječi: temporomandibularni poremećaji (TMP); znakovi i simptomi; poremećaji mastikatornih mišića; poremećaji temporomandibularnog zgloba (TMZ); dijagnostika TMP-a.

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