CLINICAL ASPECTS OF TEMPOROMANDI-BLUAR JOINT DISORDERS – LITERATURE REVIEW

Anna Sójka
Yasmin Abu-Fillat
Wiesław Hędzelek
Department of Prosthodontics, Poznan University of Medical Sciences, Poland

KLINICZNE ASPEKTY ZABURZEŃ STAWÓW SKRONIOWO-ŻUCHWOWYCH – PRZEGLĄD PIŚMIENNICTWA

Anna Sójka
Yasmin Abu-Fillat
Wiesław Hędzelek
Katedra i Klinika Protetyki Stomatologicznej, Uniwersytet Medyczny im. Karola Marcinkowskiego w Poznaniu, Polska

SUMMARY
Introduction
The aetiology of temporomandibular disorders (TMD) is multifactorial and not fully understood. In the therapy of TMD is recommended a multidisciplinary approach: counseling, exercises, occlusal splint therapy, massage, manual therapy, prosthodontic treatment and physiotherapy. The need of early and rapid recognition of TMD resulted in many schemes of research for detection of symptoms. Objective signs of TMD may be evaluated using the Helkimo Clinical Dysfunction Index Di and subjective symptoms with the Gsellmann's Occlusal Index, Helkimo Anamnestic Index Ai and Fonseca's anamnestic index FAI. Currently the most recommended among diagnostic classifications are The Research Diagnostic Criteria for TMD (RDC/TMD).

Aim
The aim of the study is to present different clinical aspects of TMD based on the literature review with particular emphasis on diagnostics.

Material and methods
Literature review has been performed with the use of PubMed database while the Polish literature has been reviewed manually. Following key words were used: TMD, RDC/

STRESZCZENIE
Wprowadzenie
Etiologia zaburzeń w stawach skroniowo--żuchwowych jest wieloczynnikowa i nie w pełni poznana. W leczeniu zaburzeń skroniowo-żuchwowych zalecane jest podejście multydyscyplinarne: poradnictwo, ćwiczenia, terapia szynami okluzyjnymi, masaże, terapia manualna, leczenie protetyczne i fizjoterapia. Potrzeba wczesnej i szybkiej diagnostyki dysfunkcji skroniowo-żuchwowych zaowocowała wieloma schematami badań. Obiektywne oznaki dysfunkcji skroniowo-żuchwowych mogą być ocenione za pomocą Clinical Dysfunction Index Helkimo (Di), subiektywne za pomocą Occlusal Index Gsellmann'a, Anamnestic Index Helkimo (Ai) oraz Fonseca's anamnestic index (FAI). Obecnie najbardziej zalecaną klasyfikacją diagnostyczną jest The Research Diagnostic Criteria dla zaburzeń stawów skroniowo-żuchwowych (RDC/TMD).

Cel
Celem pracy jest zaprezentowanie różnych aspektów klinicznych zaburzeń stawów skroniowo-żuchwowych na podstawie przeglądu piśmiennictwa ze szczególnym uwzględnieniem diagnostyki.

Materiał i metody
Dokonano przeglądu piśmiennictwa dostępnego w bazach PubMed oraz ręcznego przeglądu piśmiennictwa polskiego. Wpisywane hasła to: TMD, RDC/TMD, Helkimo

TMD, Helkimo Indexes. Among more than six hundred articles found, twenty five of them were chosen as suitable to the topic of this publication.

Results
The literature search has been mostly limited to the years 2005–2016. The literature review has been performed using Mesh Terms. Overall 624 articles resulted in twenty five included publications: original articles and review papers which presented etiology, symptoms, diagnostic methods and treatment of TMD.

Conclusions
Research Diagnostic Criteria for TMD (RDC/TMD) is considered as a golden standard among diagnostic classification tools. TMD treatment is complex and long-lasting and it depends on the diagnosis made. Depending on the cause of the disease, treatment may include: prosthetic treatment, usage of occlusal splints, masticatory muscles therapy and other physiotherapeutic methods.

indeks. Spośród ponad sześciuset znalezionych artykułów wybrano dwadzieścia pięć, które najlepiej odpowiadały tematyce niniejszej publikacji.

Wyniki
Przegląd literatury został zawężony głównie do lat 2005–2016. Przegląd piśmiennictwa został wykonany przy użyciu terminów MeSH. Z 624 artykułów, w publikacji zawarto dwadzieścia pięć: prace oryginalne i przeglądowe prezentujące etiologię, symptomy, metody diagnostyczne oraz leczenie stawów skroniowo-żuchwowych.

Wnioski
Klasyfikacja RDC/TMD jest uważana za złoty standard wśród dostępnych metod diagnostycznych. Leczenie zaburzeń stawów skroniowo-żuchwowych jest złożone, długotrwałe i jest uzależnione od postawionej diagnozy. W zależności od przyczyny schorzenia, leczenie może obejmować: leczenie protetyczne, zastosowanie szyn okluzyjnych, terapię mięśniową oraz metody fizykoterapeutyczne.

Introduction
Temporomandibular disorder (TMD) is an issue which increasingly attracts attention of dentists and affects people of all ages. Despite increased awareness, treatment is not easy and there is no clear standard in the therapy.

The aetiology of temporomandibular disorders is multifactorial and not fully understood. Chisnoiu *et al.* (2015), based on the literature review, grouped factors which can contribute to TMD into three categories: predisposing factors which increase the risk of TMD forming, initiating factors

that trigger the disease: trauma and factors that hinder the healing process and lead to exacerbations: behavioral, social, emotional and cognitive factors. An important factor in the formation of TMD is psychosocial stress (Ungari *et al.* 2012). Other causes are: genetic predispositions, anxiety, depression, occlusal factors: midline shift, large overjet and deep overbite. A high prevalence of condylar bony changes occurs in joints of patients with bruxing behaviour. Symptoms that may indicate the presence of TMD are, among others: pain,

psychological discomfort, and limitation of mandibular movements. Muscle and/ or joint pain, joint sounds and masticatory dysfunction are called the "classical triad" of TMD (Almăşan *et al.* 2013, Chisnoiu *et al.* 2015). Joint sounds are clinically described as clicking, popping and crepitus (Guler *et al.* 2014).

Frequency of TMD is greater in females than in males. In adults, age-specific prevalence displays an inverted U relationship, being greatest among people in their 40s, and lower in both younger and older age groups (Maxiner *et al.* 2011).

Due to the complexity of the problem and the difficulty of therapy it is important to find reliable ways of early diagnosis. It is essential to use a standardized examination method of TMD to enable comparison of outcomes between different studies.

Aim

The aim of the study is to present different clinical aspects of TMD based on the literature review with particular emphasis on diagnostics.

Material and methods

Literature review has been performed with the use of PubMed database while the Polish literature has been reviewed manually. The following key words were used: TMD, RDC/TMD, Helkimo Indexes. Among more than six hundred articles found, twenty five of them were chosen as suitable to the topic of this publication.

Results

The literature search has been mostly limited to the years 2005–2016. The literature review has been performed using Mesh Terms. Overall 624 articles resulted in twenty five included publications: original articles and review papers which presented etiology, symptoms, diagnostic methods and treatment of TMD.

Discussion

Symptoms of TMD are well known and usually easily recognized by dentists. However, in the literature the significance of these signs is not emphasized and there is no reliable tool to predict which symptoms would exacerbate and would thus require an implementation of early treatment.

The Research Diagnostic Criteria for TMD (RDC/TMD) are considered a golden standard among diagnostic classification tools which can help dentists making a proper diagnosis. They not only provide detailed instructions but also give diagnostic algorithms. RDC/TMD, introduced in 1992, consists of two components: axis I – (clinical and radiographic assessment) and axis II – evaluates psychological status and pain-related disability (Dworkin *et al.* 1992, Ahmad *et al.* 2009, Hasanain *et al.* 2009).

In RDC/TMD axis I diagnoses there are 3 diagnostic groups that includes 8 subdiagnoses (Table 1): muscle disorders (group I, with possible subgroups Ia: myofascial pain and Ib: myofascial pain with limited opening), disc displacement (group II, with subgroups IIa: disc displacement with reduction, IIb: disc displacement without reduction with limited mouth opening, and IIc: disc displacement without reduction, without limited opening), or arthralgia, osteoarthritis, and osteoarthrosis (group III, with subgroups IIIa: arthralgia – pain and tenderness in the joint capsule and/ or the synovial lining of the temporomandibular joint (TMJ), IIIb: osteoarthritis – pain and tenderness in the joint capsule and/or the synovial lining of the TMJ and coarse crepitus in the TMJ, and IIIc: osteoarthrosis – coarse crepitus in the TMJ and/or tomograms showing pathology in the TMJ). In order to diagnose a muscle related TMD, the pain must be present in the jaw, temples, face, pre-auricular area, or the inner ear at rest or during activities. Tenderness/palpation must be present in at least three out of 20 palpation sites, with at least one tender site situated ipsilaterally to

the complaint of pain. The examination included measurement of the range of mandibular movements, assessment of pain in joints and muscles in motion, and palpation of clicks or crepitus during mandibular movements.

Classification on RDC/TMD axis II involved pain-related impairment (Graded Chronic Pain Severity, from 0 – no TMD pain in the prior 6 months, to IV – high disability, severely limiting), depression, and somatization levels (normal, moderate, severe) (Dworkin *et al.* 1992, Loster *et al.* 2015). The use of axis II of the RDC/TMD as a TMD assessment tool allows the diagnosis of psychosocial conditions in individuals (Rodrigues *et al.* 2012).

Di I (1–4 points), Di II (5–9 points) and Di III (10–25 points). Clinical examination includes the range of mandibular movements, assessment of TMJ function, recording of pain during movements and during palpation of TMJ and masticatory muscles (Uhac *et al.* 2003). The Helkimo index allows to classify patients into the groups: without TMD, with mild TMD and with moderate to severe TMD (Lauriti *et al.* 2014).

In the initial diagnosis which can indicate a group of patients requiring more detailed study Fonseca's anamnestic index (FAI) may be used to classify TMD as no, light, moderate or severe dysfunction. FAI is based on 10 questions with "yes/no/sometimes" answers (Fonesca 1994; Habib *et al.* 2015).

Table 1. Categories of the clinical conditions present in TMD, according to the axis I RDC/TMD based on Dworkin *et al.* (1992).

Main groups	Diagnoses
I. Myofascial pain	Ia. Myofascial pain Ib. Myofascial pain with limited opening
II. Disc displacements	IIa. Disc displacement with reduction IIb. Disc displacement without reduction, with limited opening IIc. Disc displacement without reduction, without limited opening
III. Arthralgia, Osteoarthritis, Osteoarthrosis	IIIa. Arthralgia IIIb. Osteoarthritis of the temporomandibular joint IIIc. Osteoarthrosis of the temporomandibular joint

Objective signs of TMD may be evaluated using the Helkimo Clinical Dysfunction Index Di (Helkimo 1974) and subjective symptoms with the Gsellmann's Occlusal Index OI (Gsellmann *et al.* 1998), Helkimo Anamnestic Index Ai (Helkimo 1974) and Fonseca's anamnestic index FAI (Fonseca 1994). The Helkimo Ai is based on a questionnaire in which the subjects answer "yes/no" questions. According to obtained results, patients are classified to the following groups: Ai 0, I, II. Helkimo Clinical Dysfunction Index (Di) is calculated on the five symptoms scored: 0 – without symptoms, 1 – mild symptoms and 5 – severe symptoms. The sum of these points determines the allocation to the group Di 0 (0 point),

To diagnose TMD panoramic radiography and Cone beam computed tomography (CBCT) can be used. However, TMJ image in panoramic X-ray is always distorted. Panoramic radiograph is used for initial evaluation of TMJ disorders, only. Ladeira *et al.*, basing on their research, object using panoramic radiography to diagnose morphological changes in TMJ because of a large number of imperceptible pathological changes. What is more, distortions present on the image may result in false positive diagnosis. CBCT is a golden standard as a tool to diagnose morphological changes in TMJ. It should only be used if there are clinical signs and symptoms of join disorders (Ladeira *et al.* 2015).

Electromyographic examination of masticatory muscles is also a valuable diagnostic method which indicates differences in muscle tension of both sides (Pihut *et al.* 2007). Another diagnostic tool is ultrasonography which has become one of the most recommended methods due to its non-invasiveness, inexpensiveness, and an ability to evaluate the integrity and correlation of the hard and soft tissues of the TMJ through static and dynamic assessments. It has acceptable sensitivity in the diagnosis of disc derangement and joint effusion. In contrast to MRI, it can be used in patients with pacemakers and metallic implants and in claustrophobic patients (Kundu *et al.* 2013).

The prevalence of TMD in adolescents found in the literature vary from 46% to 74.1%. The study conducted by Lauriti *et al.* on the sample of 81 adolescents aged 14 to 18 years showed 74.1% of them with TMD symptoms. The prevalence of TMD was greater among females – and amounted to 87.2%, while 54.8% of men presented mild TMD. Among females 46.2% presented with mild TMD, 35.9% with moderate and 5.1% with severe TMD. The cited study found significant correlations between electromyographic activity of the masseter and temporal muscles in the resting position and TMD, no correlations were found between the presence of TMD with the number of occlusal contacts (Lauriti *et al.* 2014). Differences in the results may be caused by criteria used in the study and data collection method as part of them is immeasurable and subjective. Helkimo index and Craniomandibular indexes are regarded as more objective to show the of significance of the disease than others (de Sena *et al.* 2013). In the study involving 400 male university students in Riyadh (aged 21.9 +/− 1.79), which used Fonseca's anamnestic index (FAI) to classify TMD, 46.8% of participants presented disorders such as light dysfunction (36.1%), moderate dysfunction (9.6%) and severe dysfunction (1.1%)

(Habib *et al.* 2015). Female individuals are at increased risk of stomatognathic disorders. The most common among TMD are muscle disorders (Salameh *et al.* 2015). An interesting study confirming the influence of stress on the occurrence and severity of TMD was conducted by Uhac *et al.* on 100 male patients aged 25–50 years with post-traumatic stress disorder (PTSD). 18% were classified as Ai 0, while in the control group of healthy patients 76% presented Ai 0. 8% of patients with PTSD presented mild symptoms (Ai I) and 74% severe symptoms (Ai II). In the group of PTSD free patients 22% were classified to Ai I and only 2% to Ai II. The most frequent symptom in both groups were sounds in TMJ (60% and 12% in PTSD free patients), than fatigue in the area of the jaw (56% and 6% in PTSD free patients), stiffness of the jaws (56% and 2% in PTSD free patients), locking of the jaw, pain on the face, pain after mastication, difficulties in opening the mouth wide (40% and 0–4% in PTSD free patients). Disturbance of the noradrenergic system, hypothalamic–pituitary–adrenal axis, mechanism of endogenic opiates and disturbance in the level of serotonin can influence the dysfunction by inducing muscular hyperfunction and altered pain perception (Uhac *et al.* 2003). Research conducted by Loster *et al.* among 260 Polish young adults also showed higher prevalence of TMJ symptoms in females. Muscle disorders were the most frequent. In axis I of RDC/TMD 26.5% (69 individuals) of 260 patients received one or more diagnoses on one or both sides. Diagnoses were mainly from the first diagnostic subgroups of each group, i.e. Ia: myofascial pain in 52 (20%); IIa: disc displacement with reduction in 24 (9.2%); and IIIa: arthralgia in 11 (4.2%) cases of 260 participants. Only in one case the diagnosis was IIIc (osteoarthrosis) on both sides (Loster *et al.* 2015). Treatment of TMD is long-term and complex. Depending on the aetiology, implemented treatment should be causal. TMD

pain management requires implementing various methods. The first level of treatment includes: counseling, exercises, occlusal splint therapy, massage, manual therapy. These treatment options are at low risk of side effects. In cases of severe acute or chronic pain resulting from serious disorders, inflammation and/or degeneration pharmacotherapy, minimally invasive and invasive procedures should be included (Wieckiewicz *et al.* 2015). The intramuscular injections of botulinum toxin type A (BTXA) may be used in the treatment of masseter muscle pain in patients with TMD and tension-type headache. As BTXA causes bone loss which can lead to fractures, the dose should be as small as possible and it should not constitute the first step of treatment (Kun-Darbois *et al.* 2015). Physiotherapeutic interventions are also used in treatment of TMJ dysfunctions. Ionophoresis is an introduction of drugs (prone to dissociation in water) through the undamaged skin with the use of galvanic current. Ionopheresis is used in post-traumatic states (sprain, scarring, adhesions), overload states, chronic inflammation, acute or chronic pain, lockjaw. Another treatment option is an ultrasounds therapy which is characterized by three mechanisms of action i.e. thermal mechanism (thermotherapy), mechanical ("micro massage"), physicochemical (the change of pH). Other methods include the use of infrared, visible and ultraviolet light (Sollux lamp), criotherapy, biostimulation lasers and massage of masticatory muscles (Wałach *et al.* 2006).

Common treatment method in excessive increase of masticatory muscles tension and their functional asymmetry is application of occlusal splints such as relaxation splint (Michigan), repositioning and the NTI device. A study conducted on 30 individuals showed that application of occlusal splints leads to a drop in electric potentials of muscles. Michigan splint was the most effective in masticatory muscles relaxation (Pihut *et al.* 2007).

To sum up, temporomandibular disorders make a complex and difficult issue. The need of early and quick recognition of TMD resulted in many schemes of diagnostic research. Standardization of diagnostic tools helps in fast, correct and comparable diagnostics as well as enable monitoring of medical treatment.

Conclusions:
1. Research Diagnostic Criteria for TMD (RDC/TMD) are considered as a golden standard among diagnostic classification tools.
2. TMD treatment is causal, complex and long-lasting. It may include the prosthetic treatment, usage of occlusal splints, masticatory muscles relaxation therapy and other physiotherapeutic methods.

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Author responsible for correspondence:
Anna Sójka
Department of Prosthodontics
Poznan University of Medical Sciences

Bukowska 70
60-812 Poznan, Poland
anna.sojka23@gmail.com

Autor odpowiedzialny za korespondencję:
Anna Sójka
Katedra Protetyki Stomatologicznej
Uniwersytet Medyczny im. Karola Marcin-
kowskiego w Poznaniu
ul. Bukowska 70
60-812 Poznań, Polska
anna.sojka23@gmail.com