

## CONSERVATIVE TREATMENT OF TEMPOROMANDIBULAR DISORDER USING PHYSICAL THERAPY

Raluca Dragomir<sup>1</sup>, Ana-Maria Andreea Simionescu<sup>1\*</sup>(correspondent author), Sorin Nicolae Peiu<sup>2</sup>, Andrada Raluca Doscas<sup>1</sup>, Bogdan Radu Dragomir<sup>3</sup>, Irina Zetu<sup>3</sup>, Victor Vlad Costan<sup>1</sup>

### Review Article

[\\*andreea.simionescu@yahoo.com](mailto:andreea.simionescu@yahoo.com)

1 "Gr. T. Popa" U.M.Ph. - Iași, Romania, Faculty of Dentistry, Oral and Maxillo-Facial Surgery Department

2 "Gr. T. Popa" U.M.Ph. - Iași, Romania, Faculty of Medicine, Vascular Surgery Department

3 "Gr. T. Popa" U.M.Ph. - Iași, Romania, Faculty of Dentistry, Orthodontic Department

### ABSTRACT

Temporomandibular disorders (TMDs) refer to a number of disease entities responsible for impaired function of temporomandibular system. They represent a various group of musculoskeletal and neuromuscular disorders involving temporomandibular joint (TMJ) and surrounding tissues. Common symptoms include pain and jaw dysfunction. Excluding the possibility of headache or sinus pathology, the diagnostic hypothesis is oriented towards TMDs, especially if the pain associates joints noises and limitation in jaw movements. Up to 70% of the general population experience at least one sign of TMDs, but few seek treatment. The etiology of TMDs is not known, but is generally agreed that a variety of conditions may influence the functionality of masticatory system, including biological, psychological, social and cognitive factors. First-line treatment involves noninvasive therapies, including physical therapy, pharmacotherapy, occlusal devices and most patients show improvement. This article reviews the clinical features of TMDs and the possibilities of treatment, focusing on physical therapy.

Key words: temporomandibular disorder, conservative treatments, physical therapy.

### INTRODUCTION

The practitioners in oral health field, dentists, orthodontist, oral and maxillofacial surgeons are aware that temporomandibular disorders (TMDs) are still a controversial topic and all the assumptions regarding the etiology and the treatment principles are constantly the subject of debates and generate various opinions. There is no formally endorsed specialty group or guidelines of care for TMDs management, as a result the clinical approach of these pathologies varies according to the professional background of the practitioners<sup>1</sup>. For a proper treatment of TMDs, practitioners must have a good understanding of their clinical presentation, etiology, evolution, complications and associated risks. The absence of unanimously

accepted practice guidelines may expose TMD patients to either conservative and simple procedures or to invasive and irreversible treatments, both for the same clinical presentation. None of the different therapeutic approaches for TMD has demonstrated scientific superiority, consequently practitioners must be guided by the particularity of each case, following the clinical and biological logic<sup>2</sup>. Considering these circumstances and for ethical reason, it is recommended to start the treatment with conservative methods when the etiology is uncertain and the risks of invasive treatment are considerable<sup>3</sup>.

### DEFINITION

Temporomandibular disorder (TMD)

refers to a collective term used to describe a number of pathologies affecting the temporomandibular joints and all associated structures, which have common symptoms such as pain, joint noises, and restricted jaw function. The American Association for Dental Research define TMD as a “group of musculoskeletal and neuromuscular conditions that involve the temporomandibular joints (TMJs), the masticatory muscles and all associated tissues”<sup>4</sup>. This condition has been described since the 1934, when James Bray Costen reported a detailed approach of temporomandibular joint pathology, its relationship with masticatory muscles, teeth and jaws, and introduced the treatment of this disease, which is still known as “Costen’s syndrome”. Since then, these conditions have been given various names: temporomandibular joint pain-dysfunction syndrome, functional disorder of the masticatory system, mandibular dysfunction, myofascial pain dysfunction, oromandibular dysfunction or<sup>5</sup> craniomandibular dysfunction. According to Kirveskary, TMD represent a cluster of dysfunctional conditions affecting the masticatory muscles and/or the TMJ. They represent an important cause of nondental pain in orofacial territory and are considered a subclass of musculoskeletal disorders<sup>6</sup>.

### EPYDEMOIOLOGY

The literature provide a great variability in the prevalence of TMDs symptoms and signs, from 6% to 93%, for self-reported symptoms and from 0% to 93% for clinically assessed conditions, mainly as a result of different conceptualization and other methodological factors, but about one-third of these persons are seeking treatment<sup>5,7,8,9</sup>. TMDs may occur at any age, but the incidence peaks from 20 to 40 years, primarily in women<sup>10,11</sup>. According to Al-Jundi et al., although women are the majority of patients in clinical treatment centers, the differences

between genders are smaller in general population than in clinical trials<sup>12</sup>.

### ETIOLOGY

The etiology of TMDs is not known with certainty, but is agreed that multiple factors and conditions may reduce the adaptive capacity of masticatory system and conduct to TMDs<sup>4</sup>. Most authors support a multidimensional model of TMD’s etiology including structural, functional, psychosocial and neuroendocrine components that can be classified as “pre-disposing”, “triggering” and “perpetuating” factors of this disease. “Pre-disposing” factors include alteration in occlusion, hyperlaxity, parafunctional habits (chewing gum, nail biting, the habit of forced mandibular movements of lateralization or protrusion without occlusal contact), bruxism and psychological factors (stress, anxiety, depression). “Triggering” factors involve stress or emotional shock supporting parafunctions, rapid occlusal changes following orthodontic or prosthetic treatments, behavioral changes in parafunctional habits, acute trauma. “Perpetuating” factors are represented by secondary tooth migrations, alveolar remodeling, hypersensitivity to pain, emotional lability<sup>13</sup>. The involvement of genetic factors is not well proven. According to Michalovicz and al., following a study conducted to a group of 494 monozygotic and dizygotic twins, the genetic factors and the family environment have no significant influence upon the prevalence of TMD’s clinical presentation<sup>14</sup>.

### CLINICAL FEATURES

There are three major features of TMDs: orofacial pain, articular sounds and anomalies of mandibular movement and function. Pain is the most common symptom and the most difficult problem to evaluate<sup>15</sup>. Anomalies of mandibular movement refer to a restriction of movement of the mandible or inability to perform mandibular translation

and rotary movement. Articular sounds are represented by clicking and crepitation and the clinical relevance is insignificant in the absence of pain. Pain occurs in various aspects, either spontaneously or triggered by mastication or palpation. The site of pain can be easily specified, as a localized pain or referred to a distant region. The pain may be acute which occurs before initiating of jaw movements, suggesting an articular malfunction or associated with fatigue when mobilizing the mandible, localized in the masseter muscle and surrounding areas, suggesting a muscular malfunction. The pain is frequently associated with the surrounding tissues and muscles more than the TMJ itself. Some non-specific symptoms, such as headaches, tinnitus, earaches, shoulder pain, ocular disturbance, cephalic discomfort, and neurovegetative manifestation of edema, rhinorrhea and excessive lacrimation are also reported<sup>13</sup>.

#### CLASSIFICATION

Considering the diversity of opinions regarding diagnostic criteria and etiology, the classification of TMDs remains a challenge. There is an agreement on the existence of two major categories depending on the affected structures, respectively intra-articular (within the joint) or extra-articular (involving the surrounding musculature)<sup>16</sup>. The first category refers to muscle pathology, including hyperactivity, spasm, trismus, inflammation, trauma, atrophy and hypertrophy, myofascial pain and fibromyalgia. The second category includes a great variety of arthrogenic disorders: disc displacement, dislocation and subluxation, hypomobility of the disc, arthritis, infections, capsulitis and synovitis, ankylosis, metabolic diseases affecting bone structures, condylar hyperplasia, hypoplasia or aplasia, fractures and neoplasms<sup>4</sup>. The most common cause of TMDs are in the first category, accounting for at least 50% of

cases<sup>17</sup>. From the second category, the most frequent is articular disc displacement involving the condyle-disc relationship.

#### DIAGNOSTIC

The diagnostic algorithm of TMD is largely based on history and physical examination findings and must take into account the multifactorial etiology of this disease. The main symptoms may include orofacial pain, often in the preauricular, masseter, or temple region, articular sounds, restricted mouth opening or a combination of these. Another source of orofacial pain should be suspected if pain is not affected by jaw

movement<sup>15</sup>. A large retrospective study, conducted over 25 years, reported that the most common clinical presentations of TMDs were facial pain (96%), ear discomfort (82%), headache (79%), and jaw discomfort or dysfunction (75%)<sup>18</sup>. Physical examination results that support the diagnosis of TMD may include abnormal or restricted mandibular movement, tenderness of masticatory, neck or shoulder muscles, joint sounds, signs of bruxism. Myofascial pain frequently presents with cyclic and diffuse pain which is often more intense in the morning and associates a history of stress and sleeping difficulties<sup>15</sup>.

The role of occlusion as an etiologic factor of TMDs is also a controversial topic. Some authors found a strong correlation between symptoms and signs of TMDs and malocclusion<sup>19</sup>,

others reports a partial association<sup>20</sup> and there are also results that attribute to occlusion a secondary role in the

etiology of these diseases<sup>21</sup>. Although some authors argue that masticatory system is capable to adapt to occlusal discrepancies, within tolerable limits, without causing specific clinical manifestation of TMDs, the tolerance limit of each patient cannot be predicted<sup>22</sup>. Articular sounds as clicking,

crepitus, or locking of the TMJ may inform about joint pathology. A single click produced at the opening of the mouth may be representative for an anterior disk displacement. Crepitus or grating sounds reflects damage to joint surfaces, which often occurs in osteoarthritis<sup>23</sup>. Tenderness to TMJ palpation inform about an intra-articular pathology, while tenderness of the surrounding muscles may distinguish myalgia, myofascial trigger points, or referred pain syndrome<sup>16</sup>.

Imaging can assist in the diagnosis of TMD especially to exclude the hypothesis of other pathologies that may mimic TMDs clinical presentation. The most accessible investigation are plain radiography of the TMJ (transcranial and transmaxillary views) or panoramic radiography providing useful information regarding degenerative or traumatic pathology of bone structures. Additional information of subtle bony morphology can be obtained using computed tomography. The optimal modality for joint evaluation is magnetic resonance imaging, indicated for cases with persistent signs and symptoms, refractory to conservative treatments.

### TREATMENT

The peculiarity of TMD is represented by the multifactorial etiology and the involvement of multiple factors in the maintenance of symptoms. The main objectives of treatment are to reduce or eliminate pain or articular sounds and to restore the functionality of mandible. As this pathology frequently associates psychogenic diseases, it is necessary from the beginning of the treatment to establish the organic or psychogenic origin. Treatment options include both conservative methods and surgical methods. The effectiveness of a particular method of treatment has not been unanimously accepted, so the option for a particular approach is dictated by the doctor's experience and the particularity of the case,

however, non-surgical treatment remains the most effective approach over 80% of patients<sup>15</sup>.

Regardless of the therapeutic approach, **patient education and self-care** is an important component of treatment. A daily self-care routine should aim the following: avoiding exposure to stressful and anxious situation, an adequate program of rest and relaxation, habit awareness and the motivation to change them, limitation of mandibular movements, a home exercise program<sup>15</sup>. Patients should be advised toward an increased awareness of all the mandibular movements, to carefully plan meals, avoiding hard foods that require a significant chewing force or extreme movements of the mandible and also acknowledging different vicious patterns, as laterality of chewing or grinding of teeth, trying to eliminate the habit<sup>25</sup>. Patients with hypermobility may require education to avoid wide mouth opening. A useful technique is to explain patients not to lower their mandible further than the position that allow the tip of the tongue to maintain contact with the hard palate just posterior to the upper incisors<sup>24</sup>. In some patients, the deconditioning of harmful habits is difficult, and their persistence maintains or exacerbate the symptoms. These cases may benefit from **behavioral therapy** procedures, using relaxation therapy, counseling on lifestyle and hypnosis.

### PSYISICAL THERAPY

**Physical Therapy**, also known as **kinesitherapy**, **kinesitherapy**, **kinesiology**, **physiotherapy**, **physical exercise**, the therapeutic treatment of disease by passive and active muscular movements, address muscle reeducation, being the first line treatment in patients with severely asymmetries and symptoms and the only proper approach of treatment<sup>26</sup>. Successful results in muscle restoration are also noticed

after trauma and injuries. Adequate training is necessary as the exercises must be performed moderately, with a well-dosed intensity and adjusted during the treatment, in such condition ensuring a success rate of 70%. This treatment aims to avoid stress related pain from the masticatory muscles and reduce this symptoms using therapeutic exercises, self-massage and relaxation. These exercises also target the posture of head, neck, shoulders, mandible and tongue, opening movement of the mandible, focusing on translation and rotation, progressive relaxation of masticatory muscles, education on avoiding excessive mouth opening and vicious habits, restoration of joint mobility<sup>29,30,34</sup>. Exercises aimed at muscle reeducation and restoring symmetry between the left and right sides and it is recommended to be performed in front of the mirror opening the mouth in a straight line, in sets of 15 to 20 repetitions, 2 to 3 times a day, providing significant improvement after 6 weeks<sup>27</sup>. Limited mobility, deviation of the mandible and pain in masticatory muscles could be improved by using a combination of alternative activation and relaxation exercises. One exercise recommends placing the tongue in contact with the anterior part of the palate and followed by light force to the tip of the tongue so it doesn't touch the teeth, having the patient maintain this position as long as possible (3 times over a period of 4 weeks, 10 minutes each time)<sup>28</sup>. Joint hyperlaxity, associating mandible deviation during opening has a lower benefit from physical therapy. The exercises aim opening the mouth while the tip of the tongue is placed in the anterior palate, in front of a mirror, along the straight line, 15 to 20 repetitions, 2 to 3 times a day<sup>27</sup>. **Manual therapy** aims to alleviate the signs and symptoms of TDM addressing the "trigger points" by using **joint and soft tissues mobilization and muscle energy technique**. The **joint mobilization** method involves

successive traction or sliding movements at a slow speed and increasing amplitude, in various amount of mouth opening. The movements are performed perpendicularly or parallel to the plain of targeted articulation, repeated 8 to 10 times in 3 sets. Traction follows three successive effects: relaxation, tension and stretching, increasing mobility in the joint area. This method is successfully used in disc displacement pathologies<sup>33</sup>. **Soft tissue mobilization** especially addresses to myogenous forms of TMD. It is based on finger(s) pressure to contact a myofascial trigger point or the general masticatory muscles bellies, using multiple methods, as friction massage or tissues techniques, resulting in an increase of tissues strength and myofascial pain alleviation<sup>24</sup>. **The muscle energy technique** is indicated in cases of limitation of mandibular movements that are caused by soft tissues disorders. The exercises take place in three successive stages that are repeated up to the limit of individual tolerance. Initially, the patients perform as much movement as the affected tissues allow, then they perform a slight tightening of the muscles, against the resistance created by the therapist for about 10 seconds and finally they relax their muscles<sup>35</sup>. These procedures are frequently associated with **massage therapy**. The main massage technique used in TMD's therapy are: *kneading/effleurage*, performed by soothing and circular movements, aiming to increase blood flow and warming up the muscles, *friction*, which uses pressure of fingertips in trigger points, working toward local tissues remodeling and *stretching* ("petrissage"), conducted by rolling the muscles, intending to alleviate the pain and to increase the range of movement<sup>36</sup>.

The presence of malocclusions, the association of somatic symptoms or the severe damage of joint components may benefit from additional treatment modalities such as **oral**

**splints therapy, pharmacotherapy, minimally invasive and surgical procedures.** Oral splints therapy use different types of artificial occlusal surfaces for therapy of various conditions affecting the relationships between jaws. These are removable devices, fitting over the dental arches are mainly used for occlusal stabilization or for the prevention of teeth wearing<sup>31</sup>. They are effective in reducing symptoms and muscular activity, but the effect is insufficiently strong to treat sleep bruxism<sup>32</sup>. **Drug treatment** represent a complementary therapy rather than an independently one, prescribed for patients with TMD who associate a range of somatic symptoms as chronic pain, inflammatory diseases, neuropathies, myalgias and sleep disorders<sup>25</sup>. The mainly medications are myorelaxants, nonsteroidal anti-inflammatory drugs, analgesics, benzodiazepines and corticosteroids<sup>25</sup>. Botulinum toxin injections have shown successful results in various conditions of TMD such as bruxism, trismus, masseter and temporalis hypertrophy, headaches by decreasing the intensity,

frequency, and duration of painful episodes<sup>37</sup>. **Surgical procedures** mainly use *the arthrocentesis*, indicated in inflammatory pathologies, *the intr-articular injections of platelet-rich plasma (PRP)*, especially in chronic pain associated with important articulation dysfunction and the *implants* that replace the severely damaged joint.

### CONCLUSIONS

Temporomandibular disorders represent a heterogeneous musculoskeletal and neuromuscular diseases that affect the stomatognathic system, presenting a multifactorial etiology, insufficiently elucidated, whose diagnostic and classification criteria are still a controversial topic. Consequently, multiple therapeutic approaches have been developed, without resulting in the elaboration of a unanimously accepted practice guideline. Considering these premises and for ethical reason, it is recommended to start the treatment with conservative methods because of their low risk of side effects. Physical therapy holds a central place among conservative treatment methods, offering a wide range of procedures, with a high success rate in treating various conditions of temporomandibular diseases.

### REFERENCES

1. Reid KI, Greene CS. Diagnosis and treatment of temporomandibular disorders: an ethical analysis of current practices. *J Oral Rehabil.* 2013 Jul;40(7):546-61.
2. Ash MM. Paradigmatic shifts in occlusion and temporomandibular disorders. *J Oral Rehabil* 2001; 28:1-13.
3. Stohler CS, Zarb GA. On the management of temporomandibular disorders: a plea for a low-tech, high-prudence therapeutic approach. *J Orofac Pain.* 1999;13:255–261.
4. Neville BW., Damm DD., Allen CM., Chi AC.- *Oral and Maxillofacial Pathology*, Fourth Edition, Elsevier, 2016: 813-814.
5. Roda RP, Bagan JV, Díaz Fernández JM, [HYPERLINK "https://pubmed.ncbi.nlm.nih.gov/?term=Hern%C3%A1ndez+Baz%C3%A1n+S"](https://pubmed.ncbi.nlm.nih.gov/?term=Hern%C3%A1ndez+Baz%C3%A1n+S) [HYPERLINK "https://pubmed.ncbi.nlm.nih.gov/?term=Hern%C3%A1ndez+Baz%C3%A1n+S&cauthor\\_id=17664915"&](https://pubmed.ncbi.nlm.nih.gov/?term=Hern%C3%A1ndez+Baz%C3%A1n+S&cauthor_id=17664915) [HYPERLINK "https://pubmed.ncbi.nlm.nih.gov/?term=Hern%C3%A1ndez+Baz%C3%A1n+S&cauthor\\_id=17664915"&](https://pubmed.ncbi.nlm.nih.gov/?term=Hern%C3%A1ndez+Baz%C3%A1n+S&cauthor_id=17664915) [HYPERLINK "https://pubmed.ncbi.nlm.nih.gov/?term=Hern%C3%A1ndez+Baz%C3%A1n+S&cauthor\\_id=17664915"](https://pubmed.ncbi.nlm.nih.gov/?term=Hern%C3%A1ndez+Baz%C3%A1n+S&cauthor_id=17664915) [HYPERLINK "https://pubmed.ncbi.nlm.nih.gov/?term=Hern%C3%A1ndez+Baz%C3%A1n+S&cauthor\\_id=17664915"](https://pubmed.ncbi.nlm.nih.gov/?term=Hern%C3%A1ndez+Baz%C3%A1n+S&cauthor_id=17664915) Bazán SH, Soriano YJ. Review of temporomandibular joint pathology. Part I: classification, epidemiology and risk factors. *Med Oral Patol Oral Cir Bucal.* 2007 Aug 1;12(4):E292-8.

6. Kirveskari P, Jämsä T, Alanen P. Occlusal adjustment and the incidence of demand for temporomandibular disorder treatment. *J Prosthet Dent* 1998; 79: 433-8.
7. Salonen L, Hellden L. Prevalence of signs and symptoms of dysfunction in the masticatory system: an epidemiological study in an adult Swedish population. *J Craniomandibular Disord Facial Oral Pain* 1990; 4:241-50.
8. Hannson T, Milner M. A study of occurrence of symptoms of disease of the temporomandibular joint, masticatory musculature, and related structures. *J Oral Rehabil* 1975; 2:313-24.
9. Pullinger A, Seligman DA, Solberg W. Temporomandibular joint disorders. Part 1: Functional status, dentomorphologic features and sex differences in a non patient population. *J Prosthet Dent* 1988; 59:228-35.
10. Pow EH, Leung KC, McMillan AS. Prevalence of symptoms associated with temporomandibular disorders in Hong Kong Chinese. *J Orofac Pain*.2001;15(3):228-34.
11. Gesch D, Bernhardt O, Alte D, Schwahn C, Kocher T, John U, Hensel E. Prevalence of signs and symptoms of temporomandibular disorders in an urban and rural German population: results of a population-based Study of Health in Pomerania. *Quintessence Int.* 2004 Feb;35(2):143-50.
12. Al- Jundi MA, John MT, Setz JM, Szentpétery A, Kuss O. Meta-analysis of treatment need for temporomandibular disorders in adult nonpatients. *J Orofac Pain*.2008;22(2):97-107.  
HYPERLINK "<https://pubmed.ncbi.nlm.nih.gov/?term=Al-Jundi+MA>" HYPERLINK "[https://pubmed.ncbi.nlm.nih.gov/?term=Al-Jundi+MA&cauthor\\_id=18548838](https://pubmed.ncbi.nlm.nih.gov/?term=Al-Jundi+MA&cauthor_id=18548838)"& HYPERLINK "[https://pubmed.ncbi.nlm.nih.gov/?term=Al-Jundi+MA&cauthor\\_id=18548838](https://pubmed.ncbi.nlm.nih.gov/?term=Al-Jundi+MA&cauthor_id=18548838)"cauthor\_id=18548838" HYPERLINK "[https://pubmed.ncbi.nlm.nih.gov/?term=Al-Jundi+MA&cauthor\\_id=18548838](https://pubmed.ncbi.nlm.nih.gov/?term=Al-Jundi+MA&cauthor_id=18548838)" Jundi MA, John MT, Setz JM, Szentpétery A, Kuss O. Meta-analysis of treatment need for temporomandibular disorders in adult nonpatients. *J Orofac Pain*.2008;22(2):97-107. HYPERLINK "<https://pubmed.ncbi.nlm.nih.gov/?term=Szentp%C3%A9tery+A>" HYPERLINK "[https://pubmed.ncbi.nlm.nih.gov/?term=Szentp%C3%A9tery+A&cauthor\\_id=18548838](https://pubmed.ncbi.nlm.nih.gov/?term=Szentp%C3%A9tery+A&cauthor_id=18548838)"& HYPERLINK "[https://pubmed.ncbi.nlm.nih.gov/?term=Szentp%C3%A9tery+A&cauthor\\_id=18548838](https://pubmed.ncbi.nlm.nih.gov/?term=Szentp%C3%A9tery+A&cauthor_id=18548838)"cauthor\_id=18548838" HYPERLINK "[https://pubmed.ncbi.nlm.nih.gov/?term=Szentp%C3%A9tery+A&cauthor\\_id=18548838](https://pubmed.ncbi.nlm.nih.gov/?term=Szentp%C3%A9tery+A&cauthor_id=18548838)" Szentpétery A, Kuss O. Meta-analysis of treatment need for temporomandibular disorders in adult nonpatients. *J Orofac Pain*.2008;22(2):97-107.
13. Laplace O, Ehrmann E, Pedeutour P, Duminil G. TMD clinical diagnostic classification (Temporo Mandibular Disorders). *J Dentofacial Anom Orthod* 2012;15:202.
14. Michalowicz BS, Pihlstrom BL, Hodges JS, Bouchard TJ Jr. No heritability of temporomandibular joint signs and symptoms. *J Dent Res*. 2000;79:1573-8.
15. Duinkerke AS, Lutejin F, Bouman TK, de Jong HP. Relations between TMJ pain dysfunction syndrome (PDS) and some biographical variables. *Community Dent Oral Epidemiol* 1985;13:185-9.
16. Okeson JP. Joint intracapsular disorders: diagnostic and nonsurgical management considerations. *Dent Clin North Am*. 2007; 51(1): 85-103.
17. Reiter S, Goldsmith C, Emodi-Perlman A, et al. Masticatory muscle disorders diagnostic criteria: the American Academy of Orofacial Pain versus the research diagnostic criteria/temporomandibular disorders. *J Oral Rehabil*. 2012; 39(12): 941-947.
18. Cooper BC, Kleinberg I. Examination of a large patient population for the presence of symptoms and signs of temporomandibular disorders. *Cranio*. 2007; 25(2): 114-126.
19. Dworkin SF, LeResche LR, DeRouen T, Von Korff M. Assessing clinical signs of tempormandibular disorders: reliability of clinical examiners. *J Prosthet Dent* 1990; 63:574-79.
20. Keith DA. Differential diagnosis of facial pain and headache. *Oral Maxillofac Surg Clin North Am*. 1989; 1:7-12.
21. Helms CA, Morrish RB, Kircos LT, Katzberg RW, Dlwick MF. Computed tomography of the meniscus of the tempormandibular joint. Preliminary observation. *Radiology* 1982; 145:719-22.
22. Gray HS. Occlusal adjustment: principles and practice. *New Zealand Dent J*. 1994; 90: 13-9.
23. Okeson JP, de Leeuw R. Differential diagnosis of temporomandibular disorders and other orofacial

- pain disorders. *Dent Clin North Am.* 2011; 55(1): 105-120.
24. Shaffer SM, Brismée JM, Sizer PS, Courtney CA. Temporomandibular disorders. Part 2: conservative management. *J Man* HYPERLINK  
"<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4062348/>" HYPERLINK  
"<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4062348/>" Manip HYPERLINK  
"<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4062348/>" HYPERLINK  
"<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4062348/>" HYPERLINK  
"<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4062348/>" Ther. 2014 Feb; 22(1): 13–23.
25. Freesmeyer WB, Fussnegger MR, Ahlers MO. Diagnostic and therapeutic-restorative procedures for masticatory dysfunctions. *GMS Curr Top Otorhinolaryngol Head Neck Surg.* 2005; 4:1–29.
26. Robson FC . The clinical evaluation of posture: relationship of the jaw and posture. *Cranio.* 2001; 19:144
27. Kijak E, Lietz-Kijak E, Śliwiński Z, Frączak B. Muscle activity in the course of rehabilitation of masticatory motor system functional disorders. *Postepy Hig Med Dosw.* 2013; 67:507–516.
28. Bae Y, Park Y . The Effect of Relaxation Exercises for the Masticator Muscles on Temporomandibular Joint Dysfunction (TMD). *J Phys Ther Sci.* 2013; 25:583–586
29. van Grootel RJ, Buchner R, Wismeijer D, van der Glas HW. Towards an optimal therapy strategy for myogenous TMD, physiotherapy compared with occlusal splint therapy in an RCT with therapy- and-patient-specific treatment durations. *BMC Musculoskelet Disord.* 2017 Feb 10;18(1):76.
30. Armijo-Olivo S, Pitance L, Singh V, Neto F, Thie N, Michelotti A. Effectiveness of Manual Therapy and Therapeutic Exercise for Temporomandibular Disorders: Systematic Review and Meta-Analysis. *Phys Ther.* 2016 Jan;96(1):9-25
31. Hamata MM, Zuim PRJ, Garcia AR (2009) Comparative evaluation of the efficacy of occlusal splints fabricated in centric relation or maximum intercuspitation in centric relation or maximum intercuspitation in temporomandibular disorders patients. *J Appl Sci* 17:32–38
32. Harada T, Ichiki R, Tsukiyama Y, Koyano K. The effect of oral splint devices on sleep bruxism: a 6-week observation with an ambulatory electromyographic recording device. *J Oral Rehabil.* 2006;33:482–8.
33. Yabe T, Tsuda T, Hirose S, Ozawa T, Kawai K (2014) Treatment of the acute temporomandibular joint dislocation using manipulation technique for disk displacement. *J Craniofac Surg* 25:596–597
34. Magnusson T, Syre'n M. Therapeutic jaw exercises and interocclusal appliance therapy. A comparison between two common treatments of temporomandibular disorders. *Swed Dent J.* 1999;23:27–37.
35. Kraus S. Temporomandibular disorders, head and orofacial pain: cervical spine considerations. *Dent Clin North Am.* 2007;51:161–93.
36. Gerwin RD. Classification, epidemiology, and natural history of myofascial pain syndrome. *Curr Pain Headache Rep.* 2001;5:412–20.
37. Mor N, Tang C, Blitzer A. Temporomandibular Myofacial Pain Treated with Botulinum Toxin Injection. *Toxins* HYPERLINK "<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4549724/>" (Basel). 2015 Aug; 7(8): 2791–2800.