

## Treatment modalities for TMJ disorders: A literature review

\*Sherifa H. Jaaidah<sup>a</sup>, Zeinab M. Al towati<sup>b</sup>

<sup>a</sup>Departement of oral and maxillofacial surgery, school of dentistry/ Sebha University, Libya

<sup>b</sup>Departement of orthodontic, school of dentistry/ Sebha University, Libya

\*Corresponding author: [she.jaaidah@sebhau.edu.ly](mailto:she.jaaidah@sebhau.edu.ly)

**Abstract** Most patients complaining from temporomandibular disorders (TMD) have relatively mild or periodic symptoms which may improve on their own within weeks or months with simple home therapy. However, many therapies have been advocated for treating TMD, ranging from simple, non-invasive remedies to surgeries that involve replacement of the joint. While no specific treatment has been proven to be effective, many health professionals have found that they are able to help patients improve TMD symptoms. Professional treatment should be augmented with a home care program, in which patients are taught about their disorder and how to manage their symptoms. The practitioner managing the patients' condition should decide which therapies are most cost-effective, conservative, reversible and evidence-based, and which have greatest potential to provide the patient with long term symptoms relief.

**Keywords:** TMD, temporomandibular disorders, myofascial pain, internal derangement, disc dislocation, masticatory muscle disorders.

### الطرق العلاجية لمتلازمة المفصل الصدغي الفكي

\*شريفة حامد جعيدة<sup>1</sup> و زينب مسعود التواتي<sup>2</sup>

<sup>1</sup>قسم جراحة الفم والوجه والفكين-كلية طب الاسنان-جامعة سبها، ليبيا

<sup>2</sup>قسم التقويم-كلية طب الاسنان-جامعة سبها، ليبيا

\*للمراسلة: [she.jaaidah@sebhau.edu.ly](mailto:she.jaaidah@sebhau.edu.ly)

**المخلص** معظم المرضى الذين يعانون من متلازمة المفصل الصدغي لديهم أعراض خفيفة ودورية نسبياً، والتي غالباً ما تتحسن من تلقاء نفسها باستخدام علاجات بسيطة في المنزل. على كل حال، طورت العديد من الاستجابات لعلاج متلازمة المفصل الصدغي والتي تتراوح من علاجات بسيطة إلى جراحات تتطلب استبدال المفصل بالكامل. لم تثبت فعالية طريقة معينة في علاج المتلازمة دون غيرها، ولكن أي طرق مهنية للعلاج يجب أن يتبعها برنامج عناية منزلي مكثف والذي يشمل تثقيف المريض وتوعيته بخصوص المتلازمة وكيفية السيطرة عليها. الطبيب المسئول عن الحالة يجب عليه أن يقرر أي طريقة علاج هي الأكثر فاعلية، الأقل تكلفة للمريض، تعتمد على الدليل العلمي وتقضي على وجود الأعراض لأطول فترة زمنية ممكنة.

**الكلمات المفتاحية:** متلازمة المفصل الصدغي، آلام الوجه والعضلات، اضطرابات القرص الصدغي، متلازمة عضلات المضغ.

### Introduction

Temporomandibular disorders are musculoskeletal disorders in the masticatory system whereby signs such as jaw joint noise, tenderness of the muscles and joints, and limitation and deviation in the range of motion of the mandible are seen; the most common symptoms include jaw pain, facial pain, headache, and joint noises.

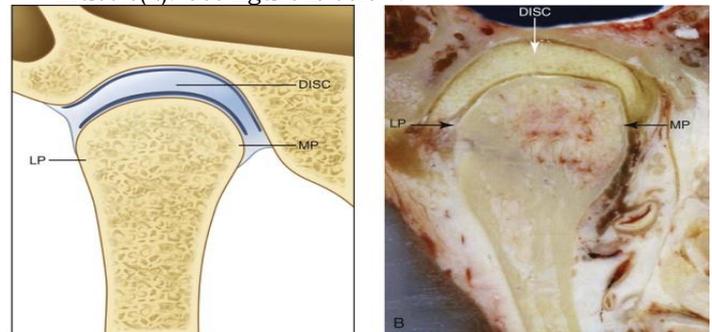
“Temporomandibular disorder” (TMD) is a broad and nonspecific term incorporating multifaceted, physiological, anatomical and sometimes psychological comorbid conditions unique to each patient. TMD is not a single disease; therefore, no testing device or procedure can exclusively diagnose a temporomandibular disorder<sup>(1)</sup>.

### Anatomy of temporomandibular joint

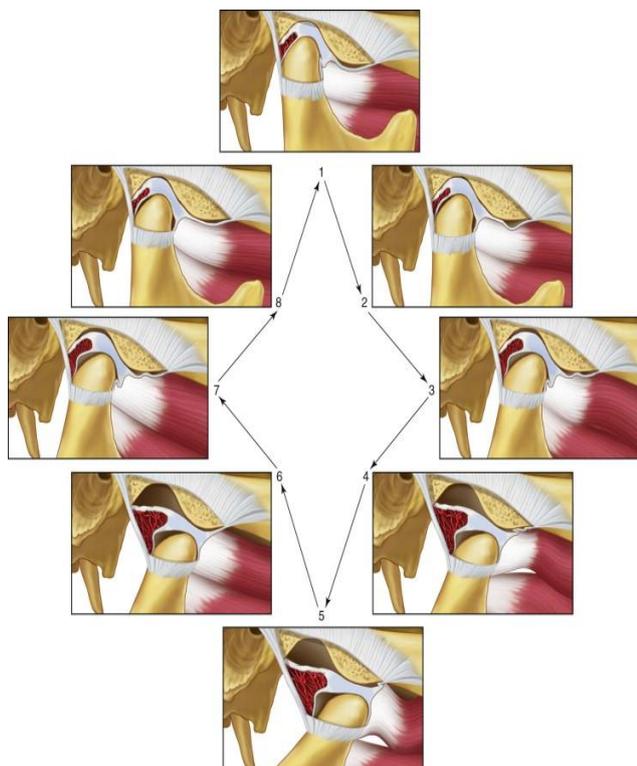
The craniomandibular articulation is made up by the mandibular condyle below and the temporal bone above. An avascular fibrous disc divides the articular space of TMJ inside the glenoid fossa into upper and lower quadrants, (figure 1). The disc condyle complex and the mandibular fossa are enclosed within the temporomandibular ligament. The disc is firmly attached to the medial and the lateral poles of the condyle and moves in tandem

with the mandible. The mandible undergoes two basic movements; rotary or hinge movement and translatory or sliding movement.

The normal mouth opening is from 40 to 55mm, and it is caused by combined action of lateral pterygoid, geniohyoid, mylohyoid, and digastric muscles and the relaxation of masticator elevator muscle<sup>(2)</sup>. See figure 2 below.



**Fig.1** A- anterior cross-sectional view of TMJ, B- cadaver specimen<sup>(3)</sup>.



**Fig 2.** Shows the normal functional movement of TMJ(3).

#### **Epidemiology of TMDs**

TMDs are broad group of clinical problems which involve masticatory system, the TMJ, the surrounding soft and bony tissues and the combination of these problems.

The TMDs symptoms include reduced range of mandibular motion, pain in masticatory muscles, pain in TMJ, associated joint noise (clicking and crepitus) with function, generalized myofascial pain, and functional limitation and deviation of the mouth opening(4).

The prevalence of TMDs related-orofacial pain is about 12% of population, while the prevalence of TMDs signs is around 60% (5). The peak occurrence of TMDs is between the second and the fourth decade of life, and it is more common in females than males. The reason behind this sex distribution is not clearly understood, but some has suggested hormonal influence (4).

#### **Etiology of TMJ disorders**

The etiology of TMJ disorders still not clear, but is likely to be multifactorial. These factors include; abnormal occlusion, parafunctional habits, anxiety, stress, and abnormalities of the articulating disc. Recently, many of theories about the development of TMJ disorders have been questioned. Dental occlusion abnormalities and the parafunctional

habits may equally present in patients with or without TMDs. There is a strong evidence support anxiety, stress and emotional disturbance as exacerbating factors in TMDs, especially patients with chronic pain (6).

#### **History and clinical examination**

Full and thorough history is taken with detailed history of the current complain, as the history may be the most important part of the evaluation. The clinical examinations include; inspection of the face for asymmetry followed by bilateral palpation and auscultation of both TMJs during closing and opening movements to detect any pain, tenderness, any limitation or deviation of mouth opening, and joint sound (clicking and crepitus). Although joint sounds are of little clinical significance of they are not associated with pain or joint dysfunction.

The range of mandibular motions is measured, and this includes the maximum comfortable opening, maximum unassisted opening regardless of pain, and the assisted opening with slight gentle stretching. The lateral and protrusive movements are also measured. Next, examination of masticatory muscle is carried out by bimanual palpation of masseters, temporalis, and medial pterygoid muscles. Lateral pterygoid is excluded due to its anatomical position. This muscle can be checked by resistance to lateral movements of the mandible (7).

#### **Differential diagnosis of TMDs**

American Academy of Orofacial Pain and international Consortium for RDC/TMD-based Research (Research Diagnostic Criteria for Temporomandibular Disorders) have developed diagnostic classification systems for TMDs. These systems are substantially similar but are not identical. The RDC/TMD classification system is shown in the table 1 below, and an abbreviated version of American Academy of Orofacial pain is shown in table 2 below.

TMJ disorders are divided into two main groups based on the anatomic origin of the problem: articular disorders and masticatory muscle disorders. Articular disorders include the articular surface, intra-articular disk, or articulating bones. Masticatory muscle disorders are problems within the muscles surrounding the TMJ (6).

Disc displacement problems (internal derangement) with or without reduction is one of the most common TMDs, it is illustrated down in the figure 3 and 4. In addition, myofascial pain and osteoarthritis, and subluxation are considered to be quite common in patients with TMDs.

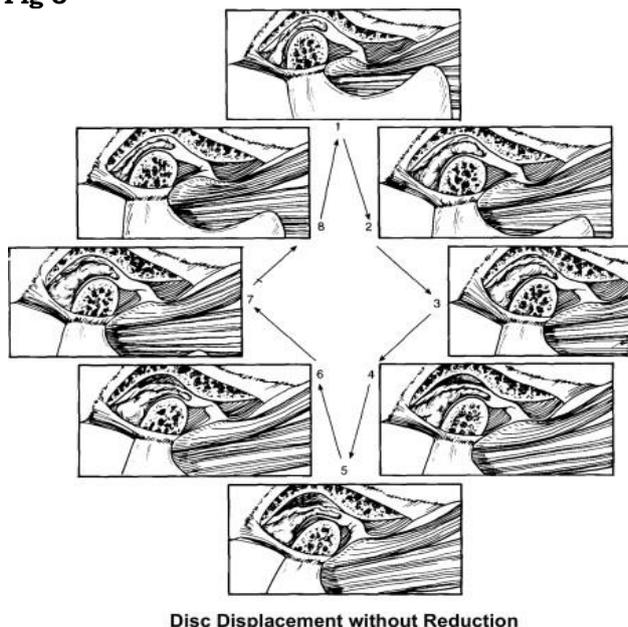
**Table1. Expanded Taxonomy for Temporomandibular Disorders (DRC/TMDs) (8,9)**

Temporomandibular joint Disorders		
Joint pain	A- Arthralgia B- Arthritis	
Joint disorders	A- Disc disorders	1- Disc displacement with reduction 2- Disc displacement with reduction with intermittent Locking
		3 -Disc displacement without reduction with limited Opening 4- Disc displacement without reduction without limited Opening
	B- Hypomobility disorders other than disc disorders	1- Adhesions/Adherence 2- Ankylosis: a. Fibrous b. Osseous
	C- Hypermobility disorders	1- Dislocations a. Subluxation b. Luxation
Joint diseases	A- Degenerative joint disease	1- Osteoarthritis 2- Osteoarthritis
	B- Systemic arthritides C- Condylitis/Idiopathic condylar resorption D- Osteochondritis dissecans E- Osteonecrosis F- Neoplasm G- Synovial Chondromatosis	
Fractures		
Congenital/developmental disorders	A- Aplasia B- Hypoplasia C- Hyperplasia	
II . MASTICATORY MUSCLE DISORDERS		
Muscle pain	A- Myalgia	1. Local myalgia 2. Myofascial pain 3. Myofascial pain with referral
	B- Tendonitis	
	C -Myositis	
	D- Spasm	
Contracture		
Hypertrophy		
Neoplasm		
Movement Disorders	A- Orofacial dyskinesia B- Oromandibular dystonia	
Masticatory muscle pain attributed to systemic/central pain disorders	Fibromyalgia/widespread pain	
III. HEADACHE Headache attributed to TMD		
IV. ASSOCIATED STRUCTURES Coronoid hyperplasia		

**Table2. Diagnostic Classification of TMJ Disorders (American Academy of Orofacial Pain) (6)**

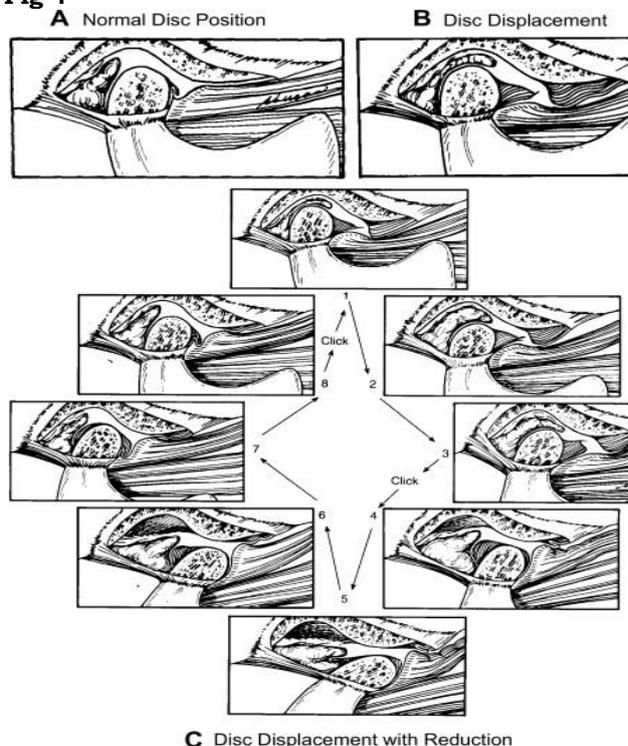
I-Articular disorders of the TMJ	
1-Ankylosis	
2-Congenital or developmental disorders	1-Aplasia, hyperplasia, or hypoplasia of the cranial bones or mandible 2-Neoplasia of the TMJ or associated structures
3-Disk derangement disorders	Articular disk displacement with or without reduction
4-Fracture of the condylar process	
5-Inflammatory disorders	Synovitis, capsulitis, polyarthritides including the TMJ Osteoarthritis
5-TMJ dislocation	
II-Masticatory muscle disorders	Local myalgia (unclassified) Myofascial pain Myofibrotic contracture Myositis Myospasm Neoplasia

Fig 3



Disc Displacement without Reduction

Fig 4



C Disc Displacement with Reduction

Fig3, 4 showing articular disc displacement with or without reduction (10).

**Diagnostic imaging**

Following history and physical examinations, the establishment of differential diagnosis should be made. Then confirmation or exclusion of the diagnosis requires further investigation. This may take the form of panoramic radiography; to assess the condition of the teeth, maxilla, and the mandible. For more detailed information of the bony structure of TMJ, other radiograph such as transcranial oblique lateral view, conventional transpharyngeal radiograph, multidetector computed tomography (CT), cone-beam CT or magnetic resonance imaging (MRI) can be taken. See the table.1 below for the advantages and the

disadvantages of different diagnostic imaging modalities (11).

**Table 3. Advantages and disadvantages of different imaging modalities used to evaluate the TMJ.**

Imaging Modality	Advantages	Disadvantages
Conventional tomography	Optional technique on panoramic units, accessibility	Does not depict subtle osseous changes or soft tissues, technique sensitive
Transcranial, transmaxillary, transpharyngeal projections	These techniques were used in the past to evaluate gross osseous changes	Do not depict subtle osseous changes or soft tissues, technique sensitive, limited trained personnel
Submentoverte projection	Optional technique on panoramic units	Provides limited diagnostic information
Posteroanterior and lateral cephalometric projections	Low radiation dose	Provides limited diagnostic information for TMJ
Panoramic radiography including open and closed views of the TMJ	Availability, expense, low radiation dose	Does not depict subtle osseous changes or soft tissues
Multislice computed tomography (MSCT)	Availability, 3-dimensional technique	High radiation dose
Cone beam computed tomography (CBCT)	Typically low radiation dose relative to MSCT, 3-dimensional technique	Availability, variable radiation dose based on imaging parameters, advanced training for interpretation
Magnetic resonance imaging (MRI)	Depicts soft tissue and osseous changes, uses nonionizing radiation, 3-dimensional technique	Time, expense, certain metallic implants preclude use, pacemakers preclude use

(12)

**Management of TMDs**

**Non-surgical management (non-invasive)**

This is considered to be the first line of management of TMDs because 80% of patients response well to this modality. These treatment modalities are effective for the common TMJ disorders (synovitis, osteoarthritis, adhesions, displaced disc, acute closed lock) as well as the common muscle disorders seen in TMD (myalgia, myospasm, tendonitis) (2).

**1. Reassurance and counselling**

The first step in the management should include a thorough explanation of the findings. The patient should be educated and reassured that the pain usually subsides with simple treatment

and that a more serious condition does not exist. The prescription of a home care program that includes jaw rest, a soft diet, limitation of wide mouth opening, and application of warm moist heat is of great therapeutic benefits (13).

## 2. Physical therapy

After a period of jaw rest, muscle massage and physical therapy, including stretching and strengthening exercises, ultrasonography, and iontophoresis should be encouraged. The physical therapy program should be kept simple with exercises consisting of opening and closing the mouth, protrusion, and right and left lateral excursion of the mandible (13).

## 3. Medical therapy

It has been shown that topical and systemic Non-steroidal Anti-inflammatory drugs are of benefits for joint pain secondary to inflammation. It is recommended to be used every six hours for 4 weeks in the first instance. A temporary pain relief over the joint in the case of 'acute closed lock' can be achieved by injection of 2ml of local anaesthesia. The steroid injection is not routinely recommended unless inflammatory changes have been proven by arthroscopy, which has not response to arthrocentesis. Likewise, muscle pain and spasms can be managed by local anaesthetic in the muscle, and it is believe to provide long-term relief due to the release of endogenous endorphins in the area of injection (14). Muscle relaxants are also proven to improve the muscle spasm and can be prescribed when indicated.

In addition to the above mentioned medications, antidepressant drugs proved to play an important role in the management of TMDs for more than 3 decades. Tricyclic antidepressant (TCAs) and selective serotonin reuptake inhibitors (SSRIs) are the most effective antidepressants used for orofacial pain relieve. Although the exact mechanism of the analgesic action of these drugs is as yet unknown, the analgesic effect of TCAs may be a result of serotonin and noradrenaline reuptake inhibition at the synaptic level in the CNS. Blocking these 2 amines increases their concentration and availability in the synaptic space at the nerve endings in the posterior horn of the spinal cord (which is involved in the transmission of pain), thus, favouring or prolonging inhibitory action in the transmission of this pain.

The TCAs, amitriptyline, nortriptyline and desipramine, are frequently prescribed in the treatment of TMD pain. TCAs are associated with certain adverse events, which include sedation, dizziness, blurred vision, constipation and dry mouth (15)(16).

## 4. Occlusal appliances

Different types of occlusal appliances are presents for the TMDs treatment. These devices are made from processed hard acrylic in a form of retainers or removable dentures. The occlusal appliances are designed to improve the function of TMJ by modifying the joint mechanics and increasing potential mobility, to improve the functions of masticatory muscles while decreasing the abnormal functions, and to

prevent teeth attrition and fracture that result from jaw clenching.

The most common occlusal appliance used is the custom-made hard acrylic, which fits over all teeth. These devices play a role in relieving pain and dysfunction in 70%-90% of patients (17).

Different types of oral appliances exist including; flat plane stabilization appliance, (also known as the Michigan splint, muscle relaxation appliance, or gnathologic splint) is fabricated for the maxillary arch. Traditional anterior bite plane; this is designed as a palatal-coverage horseshoe shape with an occlusal platform covering 6 or 8 upper anterior teeth. Anterior repositioning appliance; which is currently recommended as a temporary therapeutic measure to allow for symptomatic control of painful internal derangements, but not to "permanently" recapture the TMJ disk. The potential dangers with prolonged use of this appliance are permanent and irreversible occlusal and skeletal changes. Posterior bite plane appliances, (also known as mandibular orthopaedic repositioning appliances) are customarily made to be worn on the mandibular arch. Neuromuscular appliances and minianterior appliances have their own uses (18).

There is not strong evidence to link malocclusion, tooth loss, tooth-tooth occlusal interference with the primary TMJ and muscle symptoms, although any occlusal discrepancies should be eliminated to provide optimum occlusion for the patients (17).

## 5. Behaviour modification

This step is aimed to help patient understand and avoid stress-related lifestyle habits, for example, clenching, bruxism and excessive gum chewing. For stress management, psychological consultation is indicated (19).

### Surgical management

The indications for the surgical management if TMDs are divided into absolute and relative; the absolute indication are reserved to the cases where the surgery has unquestionable central role, such as tumours, growth anomalies and ankyloses. Whereas the relative indication involves the cases where the surgery has less define role and the non-surgical options have predominant role. The most common TMDs, as internal derangement and arthritis, fall into this category (20).

Temporomandibular joint (TMJ) surgery is indicated for the treatment of a wide range of pathologic conditions, including developmental and acquired deformities, internal derangements, arthritis, functional abnormalities, ankylosis, and infection (21).

### 1. Minimally invasive treatment

#### Intra-articular injections

A wide variety of therapeutic materials have been injected directly into the joint space. These materials can be injected into the upper, the lower joint space or both. Although the upper space is commonly used, a recent study confirmed that the inferior joint space injection or the spontaneous superior and inferior injection appear to be more effective in increasing mouth

opening and relieving the associated pain. Table 4 shows the most commonly used material for injection (4).

**Table 4. Types of intra-articular injections used in treatment of TMJ and articular disk disorders**

	Hyaluronic Acid	Corticosteroids
Benefits	A natural component of TMJ synovial fluid and lubricates and maintains the normal internal environment of the joints	Reduction of inflammatory factors and reducing the activity of the immune system
Adverse effects	Mild pain and swelling at injection site, mostly transient	Infection and destruction of articular cartilage; avoid long-term repeat injections
Efficacy	Improved long-term clinical signs of TMD and overall improvement of symptoms in comparison with placebo; no difference in radiological progression of disease <sup>32</sup>	Same short-term and long-term improvements in symptoms, clinical signs, and overall condition compared with hyaluronic acid

### Arthroscopy

Arthroscopy is a minimally invasive procedure that permits direct removal of pathologic intra-articular tissues with a success rate of 85-90%. Arthroscopic telescope is inserted in the upper joint space and another access instrument is placed 10-15 mm in front of the arthroscope which provides an outflow portal for irrigation. Lysis of adhesions is performed by sweeping the arthroscope or the cannula through the adhesions and tearing them (13).

### Arthrocentesis

This procedure is defined as lavage of the joint without viewing it. Arthrocentesis is used as a treatment measure for variety of TMDs such as TMJ synovitis and limited mouth opening in 'acute lock', which is considered as a consequence of non-reducedable, deformed anteriorly displaced disk (20). This technique is accomplished by insertion of two 18-gauge needles in the joint space under local anaesthesia with or without intravenous sedation followed by irrigation with normal saline. The objective of this treatment is to wash the inflammatory mediators causing inflammations in the joint and to improve joint mobility (2).

## 2. Invasive treatment

### Arthroplasty

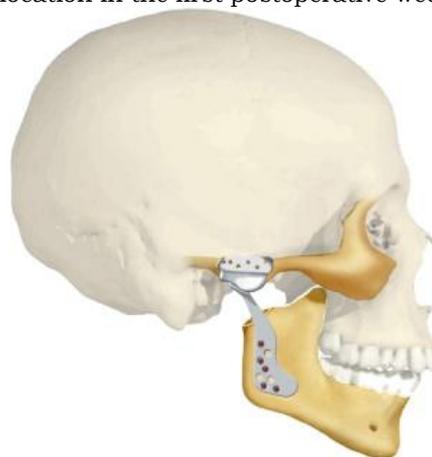
TMJ arthroplasty involves reshaping of the articular surface to remove osteophytes, erosion and irregularities present in osteoarthritis, and the patients also present with disc displacement with can be repaired, repositioned, or removed entirely. This procedure is done under general anaesthesia using open surgical approach through periauricular incision. The complications include; wound infection, facial

nerve damage, alteration in occlusion, and relapsing joint pain, and fatal vascular damage. Physical therapy and joint exercises are vital in early postoperative period to achieve the long-term functional improvements (4).

### Total joint replacement

This is considered to be an effective therapy for relieving intractable pain and improving function of TMJ end-stage disease. Previously, autogenous costochondral bone graft has been used in TMJ reconstruction as it is similar anatomically to the condyle. However, because of donor-site morbidity the use of alloplastic materials has become increasingly more popular in the adult population. Currently, various custom and stock titanium joint designs are available, which consist of both a fossa and a condylar component held in place by screw fixation. Studies have shown that both custom and stock alloplastic TMJ replacements resulted in statistically significant improvement in pain level, jaw function, and incisal opening. (fig5) (4)

The main problem is that replaced joint is prone to dislocation in the first postoperative week (23).



**Fig5.** Alloplastic joint

### Conclusion

Management of patients with temporomandibular joint disorders is one of the most challenging problems facing oral and maxillofacial surgeons. The problem exists because of the diverse collection of conditions affecting the masticatory system, temporomandibular joint and related structure that have similar symptoms and signs of pain or dysfunction, or both which may lead to misdiagnosis.

The most common disorders are disk derangements, associated localized myalgia, osteoarthritis, and trauma-induced disorders. Identification of etiologic factors is the key to diagnosis and appropriate treatment; this is best achieved by a thorough history taking and clinical examination. A better understanding and evaluation of the structures is possible with advanced imaging techniques. Management modalities include home-based self-therapy, pharmacological therapy, physical therapy, behavioural management, injections, and surgical therapy.

**Abbreviations and Acronyms**

TMD= Tempromandibular Disorders  
 TMJ= Tempromandibular Joint  
 RDC= Research Diagnostic Criteria  
 CT= computed tomography  
 MRI= Magnetic Resonance  
 MSCT= Multislice Computed Tomography  
 CBCT= Cone Beam Computed Tomography  
 TCAs= Tricyclic Antidepressants  
 SSRIs= Selective serotonin Reuptake Inhibitor  
 CNS= Central Nervous System

**References**

- [1]- Cooper BC, Armijo-Olivo S, Al-Saleh MQ, Flores-Mir C, Thie NMR. MORE ABOUT TMD. The Journal of the American Dental Association. 2012;143(10):1074-80.
- [2]- Dym H, Israel H. Diagnosis and Treatment of Temporomandibular Disorders. Dental Clinics of North America. 2012;56(1):149-61.
- [3]- Posnick JC. 9 - Temporomandibular Disorders: Effects of Occlusion, Orthodontic Treatment, and Orthognathic Surgery. In: Posnick JC, editor. Orthognathic Surgery. St. Louis: W.B. Saunders; 2014. p. 264-86.
- [4]- Liu F, Steinkeler A. Epidemiology, Diagnosis, and Treatment of Temporomandibular Disorders. Dental Clinics of North America. 2013;57(3):465-79.
- [5]- Guarda-Nardini L, Manfredini D, Ferronato G. Temporomandibular joint total replacement prosthesis: current knowledge and considerations for the future. International Journal of Oral and Maxillofacial Surgery. 2008;37(2):103-10.
- [6]- Buescher JJ. Temporomandibular joint disorders. Am Fam Physician. 2007;76(10):1477-82.
- [7]- Stern I, Greenberg MS. Clinical Assessment of Patients with Orofacial Pain and Temporomandibular Disorders. Dental Clinics of North America. 2013;57(3):393-404.
- [8]- Peck CC, Goulet JP, Lobbezoo F, Schiffman EL, Alstergren P, Anderson GC, et al. Expanding the taxonomy of the diagnostic criteria for temporomandibular disorders. Journal of oral rehabilitation. 2014;41(1):2-23.
- [9]- Schiffman E, Ohrbach R, Truelove E, Look J, Anderson G, Goulet JP, et al. Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) for Clinical and Research Applications: recommendations of the International RDC/TMD Consortium Network\* and Orofacial Pain Special Interest Groupdagger. J Oral Facial Pain Headache. 2014;28(1):6-27.
- [10]- Okeson JP, de Leeuw R. Differential Diagnosis of Temporomandibular Disorders and Other Orofacial Pain Disorders. Dental Clinics of North America. 2011;55(1):105-20.
- [11]- de Boer EWJ, Dijkstra PU, Stegenga B, de Bont LGM, Spijkervet FKL. Value of cone-beam computed tomography in the process of diagnosis and management of disorders of the temporomandibular joint. British Journal of Oral and Maxillofacial Surgery. 2014;52(3):241-6.
- [12]- Hunter A, Kalathingal S. Diagnostic Imaging for Temporomandibular Disorders and Orofacial Pain. Dental Clinics of North America. 2013;57(3):405-18.
- [13]- Dolwick FM, Abramowicz S, Bagheri SC. Chapter 98 - Diagnosis and Management of Temporomandibular Joint Pain and Masticatory Dysfunction. In: Khan SCBBBA, editor. Current Therapy In Oral and Maxillofacial Surgery. Saint Louis: W.B. Saunders; 2012. p. 859-68.
- [14]- Sidebottom AJ. Current thinking in temporomandibular joint management. British Journal of Oral and Maxillofacial Surgery. 2009;47(2):91-4.
- [15]- J Can Dent Assoc 2017;83:h7.
- [16]- Cascos-Romero J, Vázquez-Delgado E, Vázquez-Rodríguez E, Gay-Escoda C. The use of tricyclic antidepressants in the treatment of temporomandibular joint disorders: Systematic review of the literature of the last 20 years. Med Oral Patol Oral Cir Bucal. 2009 Jan 1;14 (1):E3-7.
- [17]- Scrivani SJ, Keith DA, Kaban LB. Temporomandibular disorders. New England Journal of Medicine. 2008;359(25):2693-705.
- [18]- Klasser GD, Greene CS. Oral appliances in the management of temporomandibular disorders. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology. 2009;107(2):212-23.
- [19]- Guidelines for diagnosis and management of disorders involving the temporomandibular joint and related musculoskeletal structures. Cranio. 2003;21(1):68-76.
- [20]- Dimitroulis G. The role of surgery in the management of disorders of the temporomandibular joint: a critical review of the literature: Part 2. International Journal of Oral and Maxillofacial Surgery. 2005;34(3):231-7.
- [21]- Koslin MG, Indresano AT, Mercuri LG. Temporomandibular Joint Surgery. Journal of Oral and Maxillofacial Surgery. 2012;70(11, Supplement 3):e204-e31.
- [22]- Al-Belasy FA, Dolwick MF. Arthrocentesis for the treatment of temporomandibular joint closed lock: a review article. International Journal of Oral and Maxillofacial Surgery. 2007;36(9):773-82.
- [23]- Mustafa EM, Sidebottom A. Risk factors for intraoperative dislocation of the total temporomandibular joint replacement and its management. British Journal of Oral and Maxillofacial Surgery. 2014;52(2):190-2.