

# TEMPOROMANDIBULAR DISORDERS

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## ABSTRACT

*Temporomandibular joint has been a subject of intense debate and interest for researchers since long. Temporomandibular disorders are one of the most intriguing and controversial subject in the world of dentistry. This study reviews the possible etiological factors and the management protocol for these disorders. The key to successful management is an appropriate diagnosis, for alleviating pain and restoring physiological functions. The choice of treatment provided to the patient depends on the degree of the problem. On time referral to an oral and maxillofacial surgeon is essential for the treatment of temporomandibular disorders to avoid complications.*

**Key words:** Temporomandibular joint, disorders, conservative management, arthroscopy, arthrocentesis, surgical repositioning, dautery procedure, eminectomy

## INTRODUCTION

The temporomandibular joint may be characterized figuratively by nature of its evolution, as a “special creation” in mammals and not an adaptation of a previously existing structure. Among joints, it is a hereditary pseudoarthrosis that struggles postnatally for its cartilage and contour and a transgressor that dwells clinically in the limbo between medicine and dentistry. Moffett (1965) offers this colorful description of the temporomandibular joint (TMJ) that summarizes the complexity with which this structure is comprised.

The TMJ is a part of the human anatomy that has captured the attention of both medical and dental professionals for the past fifty years. <sup>1</sup> Bottlang (1998) considered TMJ the second most difficult anatomical structure to analyze, with the spinal column being the most difficult. Due to the underlying complexity of morphology and movement, TMJ continues to be examined with the goal of achieving a sounder basis from which to create criteria for diagnosis and management of the joint disorders.

Wide variety of terms have been used to identify the functional disturbances of the masticatory system over the past several years. These diversified terms

have contributed more to the confusion that exists in this already complicated field of study. Starting in 1920s, the existence of temporomandibular disorders was recognized by Wright (1920) and Goodfriend (1933). James Bray Costen an Otolaryngologist (1934), first time described a group of symptoms that centered on ear, TMJ and face, and named this group of symptoms as “Costen’s Syndrome”. Shore (1959) introduced the term “TMJ Dysfunction Syndrome”. In 1962, Ramfjord and Ash termed it “Functional Temporomandibular Joint Disturbances”. Voss (1964) stressed on pain and termed it as “Pain Dysfunction Syndrome”; Laskin (1969) named it “Myofacial Pain Dysfunction Syndrome”. Temporomandibular disorder is a term adopted by the American Dental Association in 1983 to facilitate coordination of research and communication. Weldon E. bell (1986) described temporomandibular disorders (TMDs) as the “functional disturbances of the masticatory system”. Okesson (1997) described it as a group of signs and symptoms, which he termed “Occluso-mandibular Disturbances”.

Some authors believed that the previous terms are too limited and that a broader term should be used such as “Craniomandibular Disorders”. It is a collective term embracing a number of clinical problems that involve the masticatory muscles, TMJ and associated structures.

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Temporomandibular disorder (TMD) has become a health problem for many patients who find little comfort in the treatment offered. Although treatment modalities have improved the prognosis, the ability to properly diagnose this disorder nevertheless continues to be challenging. This study aims to describe through literature review some aspects that involve the TMJ anatomy, most common TMJ disorders, available treatment options and the choice of treatment more appropriate to the type of disorder, mainly to create the ability to determine when conservative or surgical management is required.

## METHODOLOGY

Computer databases, including PubMed, Science direct and Google advance search were searched from the earliest available date to June 2011. The electronic search was performed using the keywords: temporomandibular joint disorders; temporomandibular disorders; surgical management of TMDs, diagnosis of temporomandibular joint disorders, and pain dysfunction syndrome. No language restrictions were applied. Articles relevant to the study of temporomandibular joint disorders and its management were selected. Further search were performed from the reference list of all the articles included. 108 related articles were found in Pubmed, an extra 18 articles in science direct and an additional 11 articles in the google advance search. The abstracts of these articles were screened and 42 articles were considered to be relevant to the topic including 12 review articles, 15 abstracts and 08 full case reports.

## Anatomic considerations

The TMJ provides articulation between mandible and the temporal bone of the skull. It is a bilateral, bicondyloid synovial joint, formed by the glenoid fossa of temporal bone and mandibular condyle. These two components are surrounded by a capsule of fibrous tissue brought by a disc consisting of connective tissue. This disc is fixed to the joint capsule and in the condylar process margin. The joint cavity is divided in superior and inferior compartments. The synovial membranes create internally the articular supradiscal and infradiscal spaces. Both joint compartments are irrigated by the synovial fluid, which is responsible for lubrication of the joint cavity and alleviating friction.

TMJ receives vascularization from the posterior temporal artery, deep masseteric artery, anterior tympanic artery, superficial temporal artery, and middle meningeal artery. The veins that drain the joint aris-

ing into the pterygoid plexus correspond to the arteries. TMJ is innervated by the anterior branch of the mandibular nerve, branches of the masseteric nerve and branches of the auriculotemporal nerve from the posterior division of the mandibular branch of trigeminal nerve.

This joint is the most complex articulation of the body capable of performing sophisticated movements. The articulation assists in several vital processes such as chewing, swallowing and speech. It is being protected by the articular disc and ligaments. Functionally, it allows the mandible to open, close, protrude, retrude, and to perform lateral movements as well as the combination of all. The muscles involved in the movement of TMJ are the temporalis muscles, the masseter, medial pterygoid and lateral pterygoid muscles.

The temporalis muscle elevates the jaw when its anterior fibers contract in maximum aperture and subsequently retracts the mandible by the posterior fibers and acts in the contralateral displacement and elevation of the mandible. The masseter muscle helps not only in the mandibular anterior projection but also in lateral movements bilaterally. The medial pterygoid muscle, as well as masseter muscle lifts the jaw acting in protrusion and lateral movements. Another important group is that of the depressor muscles which have the basic function of opening the mouth, and contains lateral pterygoid, digastric muscles, mylohyoid and geniohyoid muscles.

## Etiology

Treatment of any condition involves an accurate diagnosis which in turn entails finding the exact etiology. The etiology of TMDs has been a subject of intense debate for several years. In spite of all the advancements in diagnostic sciences, a conclusive and unanimous agreement regarding the etiology of this disorder is yet to be established.

McNeil and coworkers have described three etiological factors in TMDs. Factor that increase the risk of these disorders are called Predisposing. Factors that cause the onset of these disorders are called Precipitating. Factors that interfere with healing or enhance the progression of TMD are called Perpetuating. The earlier theories regarding etiology are:

- The mechanical displacement theory
- The trauma theory
- The biomedical theory

- The osteoarthritic theory
- The muscle theory
- The neuromuscular theory
- The psychophysiological theory

*The mechanical displacement theory* hypothesized that the lack of molar support or functional occlusal prematurity caused a direct eccentric positioning of the condyle in the glenoid fossa, leading to pain, dysfunction and ear symptoms such as ringing, singing sounds.

*The trauma theory* proposed by Zarb and Speck considered micro/macro trauma as a principal factor that initiate pathologic processes and dysfunction in different parts of the stomatognathic system thus leading to the symptoms of temporomandibular disorders. According to this theory any trauma which can cause structural alteration to the joint or the muscles is considered macrotrauma. Whereas microtrauma refers to any small force that is repeatedly applied to the joint structures over a longer period of time.

*The biomedical theory* by Reade also supported the role of trauma in the initiation of these disorders. Once initiated, the condition will either resolve or in the presence of certain factors like disrupted occlusion, parafunctional habits (particularly bruxism) and occupational activities, will progress further.

*The osteoarthritic theory* by Stegenga proposed osteoarthrosis as the causative factor for TMD. According to this theory muscular symptoms and internal derangement were secondary to joint pathology. Pathological changes in TMJ could be induced by absolute or relative overloading.

*The muscle theory* supported by Travell and Rinzler suggested that the primary etiologic factor was in the masticatory muscles themselves. It suggests that myalgia of masticatory muscles can refer pain to TMJ. This theory placed the temporomandibular pain in the context of a wider muscular disorder and denied any influence of the occlusion.

*The neuromuscular theory* supported by Ramjford proposed that the occlusal interferences were the causative factor for the disorder. This theory proposed that the occlusal interferences caused an altered proprioceptive feedback, leading to incoordination and spasm of the masticatory muscles.

*The psychophysiological theory* by Schwartz and Laskin suggested that the psychological factors are more important than the occlusal disturbances in initiating and perpetuating TMD. According to this theory it is the interaction between physiological predisposition, and psychological stress which causes TMD. The effect on the individual depended on their ability to cope with stress.

Gradually, concepts based on a single factor lost their scientific and clinical credibility. As it became more and more apparent that the etiology was multifactorial and that none of these theories in isolation could explain the etiologic mechanism in patients. This development also led to the conclusion that temporomandibular disorders were not a single disease but a collection of structural and/or functional disorders resulting clinically in comparable and analogue complaints.

The etiology of TMD is multifactorial, where various aspects such as: changes in occlusion (tooth loss, tooth wear, ill-fitting dentures, caries, inappropriate restorations); traumatic or degenerative alterations of the TMJ; skeletal problems; psychological factors and deleterious habits (nail biting, inadequate posture of mandible, smoking, biting objects, thumb sucking, pacifier, bruxism) can be harmful and lead to imbalance and disharmony of the TMJ.<sup>2</sup>

It is likely that the etiology will be different in young and in older patients. With increasing age, there is an increased risk of age-related joint changes and systemic conditions affecting TMJ. With ageing the reparative capacity of the articular cartilage is significantly reduced. TMDs have been reported to be more common in females than males, with the highest prevalence among women of reproductive age.<sup>3</sup>

The etiologic role of occlusal factors is probably the most discussed and controversial one. The degree of occlusal disharmony does not seem to be a good predictor for the severity of the dysfunction. Unstable occlusal conditions can be considered as a predisposing factor.<sup>4</sup>

Trauma is an underestimated factor in the etiology of TMD. It does not necessarily lead to intra-articular dysfunction and derangement but will have an influence on the masticatory muscles which are then more sensitive to palpation and show a high degree of tenderness. It has now been established that psychological and behavioral aspects are strongly related to TMD not only as initiating but also as predisposing and

perpetuating factors. In most studies it is a consistent finding that the TMD sufferers show more anxiety and most likely signs of depression too.

To simplify the etiology a formula has been developed by Okesson which addresses, some events could take place under normal function of masticatory system. The event could resolve without any complication or the event could exceed the physiological tolerance of an individual and could create a response by the system.

**Normal TMJ function + Event > Physical tolerance or Adaptation**



**TMD symptoms**

Flow chart Figure 1.1 gives a representation of main etiological factors which play a vital role in TMDs.

Apart from the local factors, systemic factors like anxiety or increased emotional stress are the most important cause and it accounts almost 75% of all TMDs.

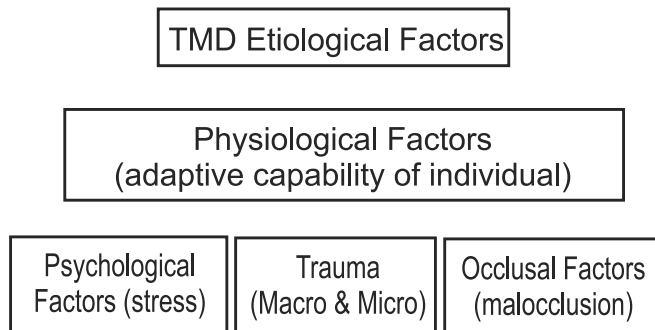
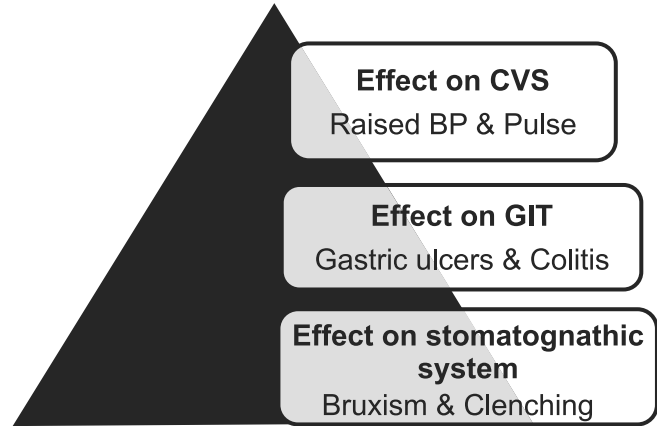


Fig 1.1: Etiological factors of TMD

Each individual channels his tension into a relatively specific organic modality. This process is known as response specificity. The channel in to which tensions are directed determines which psycho-physiological disorder may develop. Hence, if the gastrointestinal tract is involved, gastric ulcer or colitis may develop. Similarly, if the stomatognathic system is involved, and the other requisite elements of the chain of etiology are present the TMDs may develop.

All individuals do not respond to a change in the same manner, this variation reflects the individual's adaptive property or the physical tolerance response. The individual's physical threshold varies from person



Flow chart Figure 1.2 represents the response specificity

to person and it has not been scientifically investigated. Certain systemic factors such as patient's overall physical condition, genetics, gender and diet also does influence physical tolerance.

**History and Examination**

Proper diagnosis is the key to success. The most important information for establishment of accurate diagnosis comes from the history and examination. Once the information is collected, a clinical diagnosis can be established which could be further verified with the help of additional investigations such as radiographs.

American academy of orofacial pain has classified all temporomandibular joint disorders into four broad categories<sup>5</sup> having similar characteristics. (1) Masticatory muscle disorders (2) TMJ disorders (3) Chronic mandibular hypomobility disorders (4) Growth disorders.

Researchers generally agree that the most common TMDs fall into three main categories; (a) Arthritis (b) Internal derangement of joint (c) Myofascial pain.

The purpose of history and examination is to identify any area or structure of the masticatory system that depicts pathology. Hence, the comprehensive history for a TMD patient should include the chief complaint of the patient, the location and onset of pain, the characteristic of pain, aggravating and alleviating factors, past consultations and treatments, relation to other pain complaints, review of the related systems and a comprehensive psychological assessment of the patient.

Clinical examination both intraoral and extraoral includes - general inspection of head and neck, evaluation of TMJ and cervical spine, palpation of joint, range of motion, quality of movement and association of pain. Auscultation and palpation of joint sounds is done in all movements for clicking, crepitations, popping or jolt. Masticatory and cervical muscles are palpated. Examination for soft and hard tissue of the oral cavity, occlusal analysis, both static and dynamic contacts and all the occlusal discrepancies are noted down.<sup>6</sup>

### Imaging of Temporomandibular Joint

Many diagnostic means have been indicated for the TMDs, including electro-diagnostic tests such as jaw-tracking devices, electromyography, thermography and vibration analysis. Radiographs have limited use in the identification of temporomandibular disorders<sup>7</sup> still various imaging techniques can be used to gain additional insight regarding the health and function of the joint.

Four basic radiographs can be used for the evaluation of TMJ including; Panoramic view, Lateral Transcranial view, Transpharyngeal view and Transmaxillary AP view. These screening films do not provide enough information therefore more sophisticated techniques are necessary to establish a diagnosis. Lateral tomography, joint arthrography, computed tomography scanning and magnetic resonance imaging are often being used to confirm the diagnosis.

In recent years MRI has become the gold standard for evaluating the soft tissue and the positional abnormalities of the joint disk. The main advantage of MRI is its 3D imaging and no introduction of radiation that might produce soft tissue damage. But it cannot be carried out in patients with pacemakers and who are claustrophobics. Its use is limited by its cost and the time it takes. While computerized tomography has to be reserved to the pre-surgical phase of treatment planning.<sup>8</sup>

The use of ultrasonography for the diagnosis of TMDs is uncommon, although several reports have been found in the literature suggesting evident advantages of this procedure in depicting effusion in larger joints.<sup>9</sup>

### Management

The management goal for patients with TMDs is to decrease pain, restore function and normal daily activ-

ity. These goals are best achieved by using the optimal combination and sequence of treatment. Treatment may be simple or require more steps for alleviating the condition, depending on the degree of severity. The TMDs can be treated by the conservative/reversible or non-conservative/irreversible methods. The management protocol includes:

1. Education of the patient, active self care, follow up
2. Physical therapy (heat therapy), physical self regulation programs
3. Intraoral occlusal appliances
4. Medication - Analgesics, Muscle relaxants, Non-steroidal anti-inflammatory drugs
5. TMJ surgery

There is a consensus now that conservative therapy should be the first-line of management for TMD, because of its efficacy in relieving symptoms. It should be instituted once the organic pathology is excluded as a possible diagnosis. Although the incidence of these pathologies is very low, rather less than 1% of all cases.

For eliminating the harmful effects of clenching or grinding the teeth and a better positioning of the jaws, self-care including the intake of soft foods, avoiding yawning, and applying moist heat or ice is recommended. Jaw exercises, posture training along with biofeedback, relaxation and stress management techniques are employed to control muscle tension.<sup>10</sup> A proper rehabilitation of the occlusion by means of adjusting the bite, replacement of defective restorations, instituting splints and orthodontic appliances can be done as a part of the conservative management.

The complexity in surgical management, potential complications of the procedures and success in predictability of the conservative therapy, makes TMJ surgery an approach that should be applied only in selected patients such as trauma, true bony ankylosis or organic pathology. TMJ surgery has evolved over the years from open joint surgery to minimally invasive endoscopic procedures.<sup>11</sup>

Recommended surgical procedures for the treatment of temporomandibular disorders are:

1. Arthroscopy
2. Arthrocentesis

3. Condylotomy (indirect arthroplasty)
4. Joint replacement (partial or complete)
5. Other Procedures
  - Coronoidotomy/coronoidectomy
  - Recurrent/chronic dislocation
  - Styloidectomy (Eagle's Syndrome)

Arthroscopy of the TMJ was first introduced by Ohnishi (1975). Initially, it involved merely lavage of the joint and the use of a probe to break up adhesions. However, with the introduction of improved instruments, arthroscopic operations for various intra-articular disorders are made possible. Arthroscopic lysis and lavage can be used to treat patients with painful clicking or popping, to release intra-articular adhesions and anteriorly displaced non-reducing discs, and to confirm other diagnostic findings that could warrant surgical intervention.

In the past, arthrocentesis was used to treat patients with TMJ closed lock and disc adhesion. Now, it is used for various TMJ problems such as with reducible disc displacement and as palliation for acute episodes of degenerative or rheumatoid arthritis. In some seriously injured patients having haemarthrosis, aspiration of the fluid with gentle lavage may render them more comfortable. Murakami et al first described a technique of TMJ arthrocentesis with pumping irrigation and hydraulic pressure to the upper joint cavity followed by manipulation of the jaw. Nitzan et al then described a technique whereby two needles instead of one were introduced into the upper joint space. This adaptation permitted massive lavage of the joint as well as aspiration. If necessary, arthrocentesis can also be done in patients with coagulopathy. As arthroscopy and arthrocentesis are less invasive and associated with minimal complications, they have recently replaced surgery for patients with dysfunction of the TMJ that failed to respond to conservative treatment.<sup>12</sup>

Annandale (1887) described surgical repositioning of the displaced articular disc, Wilkes in 1978 used arthrography to describe the anatomy, form and function of the TMJ, that disc repositioning became an accepted surgical technique. Some authors have also proposed arthroscopic suturing techniques to reposition the disc. The reported clinical results of surgical disc repositioning have been variable and often unpredictable, with failures related to a lack of long-term stability, indicating the need for improved methods of

disc stabilization.<sup>13</sup> Disc displacement is often accompanied by a loss of structural integrity of the posterior, medial, and lateral discal ligaments. Traditionally disc repositioning techniques involve suturing these inflamed and often degenerated ligaments, and can result in instability of the disc. To overcome this problem, Wolford et al. developed a surgical technique of using a bone anchor (Mitek Anchor, Mitek Products Inc., Westwood, MA, USA) for stabilizing the TMJ articular disc.<sup>14</sup>

Surgical techniques used for the chronic dislocation includes partial or complete myotomy, capsular plication (Mayer, 1933) sacrifice of the temporalis tendon (Mawan/McKean, 1973), open condylotomy (James, 1971), insertion of implants into the articular eminence (Findlay, 1964; Cardoso et al., 2005), down-fracturing of the zygomatic arches (Girard, 1943), augmentation of the eminence by allografts (Keith, 1988; Whear et al., 1991) and eminectomy (Myrhaug, 1951; Undt et al., 1997).

Augmentation of the articular eminence involving zygomatic arch down fracture and confining the condylar head by autogenous bone was reported by Deutrey (1975). The technique of down-fracturing of the zygomatic arch is now well known and widely used. The advantage of this method is that it is less invasive, involving a short incision in the hairy temporal region, a small operative field, local anesthesia and short operating time. There is no need for postoperative intermaxillary fixation or bone transplantation. And is considered the most suitable method for edentulous elderly patients.<sup>15</sup>

This technique avoids the need for a separate procedure to harvest bone; it may be complicated by uncontrolled fracture of zygomatic arch with a resulting mobile fragment (Whear et al., 1991). Since the arch is lateral to the Eminectomy was recommended for the patients of advanced age and those with neurological disorders. This technique was described first by Hilmar Myhraug in 1951. Lawlor recommended eminectomy for patients much over 32 years of age, as inherent elasticity of the bone is reduced.<sup>16</sup> Alloplastic implants are not generally indicated for initial surgical treatment of joints. Prosthetic joint replacement may be indicated in selected patients with severe joint degeneration, destruction, or ankylosis.<sup>17</sup>

## CONCLUSION

The field of TMDs is undergoing a major transformation as a result of research findings about pain in

general, as well as specific advances within the field. Correct diagnosis and treatment planning can only be made by thorough history and clinical examination. The majority of patients suffering from temporomandibular disorders achieve good relief of symptoms with conservative therapy such as patient education programs and self education about the problem, cognitive intervention, psychotherapy, pharmacotherapy and physical therapy. But certain surgical procedures are considered equally effective for the management of severe cases. The choice of the treatment provided to the patient thus mainly depends on the degree of problem and the available management options. On time referral to the surgeons is necessary to treat certain temporomandibular disorders to avoid further complications.

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