

Diagnosis and Treatment Modalities for Temporomandibular Disorders (Part I): History, Classification, Anatomy and Patient Evaluation

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ABSTRACT

Temporomandibular disorder (TMD) is not just one disorder, but a group of conditions, often painful, that affect the temporomandibular joint, and the muscles that control chewing. Many psychological and physical factors cause myofascial pain, internal derangement of the joint, degenerative joint diseases which ultimately leads to temporomandibular disorder. Scientists are exploring how behavioral, psychological and physical factors may combine to cause temporomandibular disorders and researchers are working to clarify temporomandibular disorders symptoms, with the goal of developing easier and better methods of diagnosis and improved treatment. In part 1 of this 2-part series on temporomandibular disorders, emphasis will be placed on the history and classification of temporomandibular disorders, structure and function of the temporomandibular joint (TMJ), and patient evaluation techniques.

Keywords: Temporomandibular disorders, Orofacial pain, Temporomandibular joint.

INTRODUCTION

Temporomandibular disorders (TMDs) include a number of clinical problems that involve the masticatory musculature, the temporomandibular joint and associated structures.¹ They are considered to be a subclassification of musculoskeletal disorders. Detailed history taking and standardized examination techniques are crucial in forming a proper differential diagnosis. The patient may present with jawache, earache, toothache, facial pain, and/or headache; however, the chief complaint may be as a general facial tightness or fatigue. Treatment planning is dependent on various factors such as the chief complaint, health history, presenting symptoms, examination and diagnosis. In the past, TMD cases have sometimes been regarded as problematic to diagnose and difficult to treat; however, with continuing research in orofacial pain and pain management, clinicians are able to use specific diagnostic methods and standardized classification systems to offer patients treatment modalities with higher success rates.

HISTORY AND EVOLUTION OF THE MANAGEMENT OF TMD (TABLE 1)

As a result of Costen's work, awareness of the TMJ and its relationship to facial pain increased greatly among practitioners.² He noted that a number of his patients with pain in the TMJ region seemed to experience a reduction of symptoms following therapeutic alteration in their occlusion. These findings were significant on two fronts. First, Costen's

writings introduced hypotheses that occlusion and TMD may be linked. Second, he emphasized the practitioner's role in providing treatments aimed at affecting the TMJ region. Thus, in the first half of the century, generally accepted concepts of patient management focused on occlusal adjustment as the major treatment modality for TMD.³⁻⁷

Eventually, concepts were proposed that challenged occlusally-based treatments.^{8,9} In 1969, Laskin¹⁰ postulated a theory emphasizing the role of chronic oral habits brought on by emotional stress and its effect on muscle spasm, pain and fatigue. Hence, clinicians began considering stress as one of the prime etiological contributors to TMD and the term myofascial pain dysfunction syndrome emerged. In the 1970s, detailed focus on the anatomical structure of the TMJ led to increased understanding of TMD etiology. Wilkes,¹¹ Farrar, and McCarthy^{12,13} were among those who studied the disk-condylar complex. During this time, Solberg and Rugh¹⁴ continued to emphasize the role played by psychological factors and stress on the musculature.

The concept of internal derangement of the TMJ was introduced by Ireland¹⁵ in 1953 but was not widely accepted until the 1970s, following imaging techniques, such as arthrography. Also in the late 1970s and 1980s, surgical intervention with disk repositioning started gaining popularity. Subsequently, TMJ disk removal procedures were recommended, with some surgeons choosing to maintain the joint complex without a disk while others opted for prosthetic TMJ disk implant placement. Unfortunately, use of certain

Table 1: History of the clinical management of temporomandibular disorders

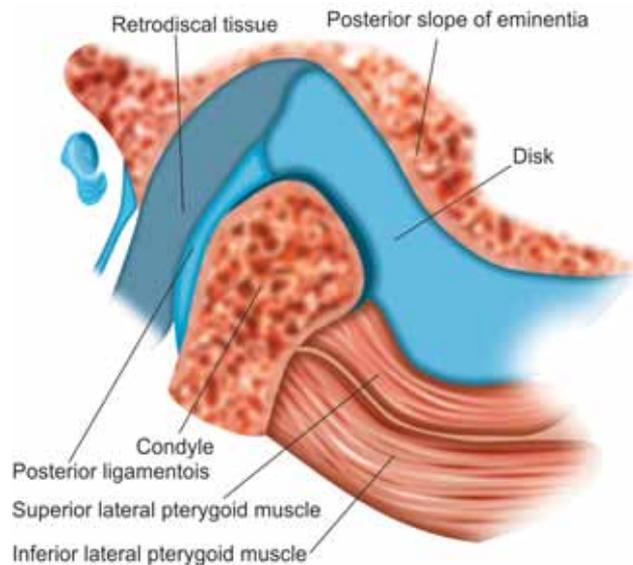
Years	Investigators	Concepts
1920-30s	McCullum, Stallard and Stuart	Gnathological concepts
1934	Costen	Overclosure/vertical dimension of occlusion was the primary cause of TMD
1950s	Shore	Occlusal equilibration
1951	Ireland	Mechanisms of TMJ clicking
1952	Travell and Rizzler	Myofascial genesis of pain
1956	Schwartz	Emotional tension as a contributing factor
1961	Ramfjord	Occlusal equilibration
1969	Laskin	Pain dysfunction syndrome secondary to oral habits and muscle pain
1970	Ohnishi	Arthroscopy in the TMJ
1971	Farrar	Internal derangement
1974	Greene and Laskin	Myofascial pain dysfunction syndrome
1976	Rugh and Solberg	Stress as an etiological factor
1978	Wilkes	TMJ arthrography
1983	Scapino	Pseudodisk formation
1986	Sanders	Arthroscopic surgery of TMJ
1991	Nitzan, Dolwick and Martinez	Arthrocentesis
2000	American Academy for Orofacial Pain	Comprehensive orofacial pain management

prosthetic implants, such as Vitek proplast/teflon resulted in severe complications, such as giant cell foreign body reactions. In some implant cases, this led to extremely painful joint conditions with limited range of motion (ROM). Less-invasive surgical techniques, such as arthrocentesis and arthroscopy proved to be highly effective for chronic TMJ conditions (e.g. unresolving joint pain and closed lock).¹⁶⁻¹⁸

Today, there is a greater knowledge of the complex mechanisms involved in chronic pain conditions as well as a greater appreciation of the role played by the affective and cognitive components of pain. Together with increased emphasis on evidence-based treatments, practitioners are using less-invasive treatment modalities. Clinicians, having learned to equate TMD with other chronic pain conditions, can now manage TMD in a comprehensive and scientific manner.

STRUCTURE AND FUNCTION

TMJ has been a source of interest since the fifteenth century, when this anatomical structure was studied by Leonardo da Vinci. Other notable contributors include Vesalius in the sixteenth century, Meyers in the nineteenth century, and Sicher¹⁹ and Rees²⁰ in the early twentieth century. The TMJ has been described as a ginglymoarthrodial synovial compound paired joint. A compound joint consists of three bones; however, in the case of the TMJ, the functional disk operates as the third nonossified bone and therefore fulfills the criteria (Fig. 1). As a synovial joint, it is governed by the same basic orthopedic principles that apply to other human synovial joints, ranging from pathologic disorders to treatment protocols. The TMJ, however, has many unique features that distinguish it from other synovial joints. These include (1) rigid end point of closure; (2) one side cannot function without movement of the opposite joint; (3) both joints act as one functional unit; (4) any movement or functional alteration in one joint will affect the other joint; and (5) no hyaline cartilage is present.

**Fig. 1:** Structure of the temporomandibular joint

The TMJ articulates between the condyle of the mandible and the glenoid fossa of the temporal bone, situated between the bony components is the articular disk. It consists of dense fibrous connective tissue and is devoid of nerves and blood vessels in the articulating portion; however, the posterior attachment has rich vascularization and innervation via the auriculotemporal branch of the mandibular division of the trigeminal nerve. It is biconcave in shape, with the thickest portion in the posterior zone, a moderately thick anterior zone, and a thin intermediate zone. The joint capsule is attached to the disk and divides the joint into two compartments. The associated ligaments include the functional ligaments (collateral, capsular and temporomandibular) and the accessory ligaments (sphenomandibular and stylomandibular). The purpose of the ligaments is to protect the joint by restricting and limiting border movements. The associated muscles of mastication include the masseter, temporalis, medial and lateral

pterygoid and the digastric. A clear understanding of the anatomical components and the function of the TMJ is crucial in forming a proper differential diagnosis and ultimately developing an individualized treatment plan.

HISTORY

In a study on symptoms associated with TMD, Rasmussen²¹ found that most patients with a clicking TMJ usually did not evolve into an open or closed locking state. According to his findings, acute TMD symptoms lasted a mean of 5 years, and although joint noises generally did not disappear, most painful and disabling symptoms subsided in time. Similar results were shown by Könönen et al, who followed 128 Finnish adults over 9 years.²² They found that the incidence of clicking in these patients increased with age. However, none of the patients developed locking. These studies demonstrate the importance of reversible and noninvasive treatments for the acute TMD patient. In an epidemiological study by Solberg,²³ 76% of subjects aged 18 to 25 had one or more signs associated with TMD and 26% had at least one symptom associated with TMD. Of this group, only 10% had symptoms that were considered by the subjects to be severe enough to seek treatment.

Most epidemiological studies clearly demonstrate that TMD symptoms are more commonly seen in women than in men.¹ Symptoms often arise from adolescence to early twenties and may continue intermittently well into middle age. Multiple etiological factors have been associated with TMD (Table 2).

Table 2: Possible etiological factors in the development of temporomandibular disorders

- Stress
- External trauma
- Bruxism
- Systemic poly joint arthritis
- Hypermobility disorder
- Neoplasia
- Developmental/growth abnormality
- Dental morphologic abnormality
- Daytime habitual behavior
- Infection
- Idiopathic

CLASSIFICATION (TABLES 3 AND 4)

Internal Derangement (ID)

Internal derangement of the TMJ is characterized by an anatomical disturbance in the relationship of the components of the disk-condyle complex. This term encompasses a number of clinical entities, including the following:

Disk-condyle incoordination: This term describes patients with a distinct joint noise, such as a click or pop, with deviation in the pattern of opening. Other terms used to describe this condition are (1) disk displacement with reduction and (2) anterior or medial disk displacement.

Table 3: Classification of temporomandibular disorders

1. Articular
 - Internal derangement
 - Inflammatory joint disorders
2. Muscular
 - Myalgia
 - Myositis
 - Myofascial pain

Table 4: Inflammatory joint disorders osteoarthritis

- Osteoarthritis
- Polyarthritis
- Traumatic
- Infectious
- Rheumatoid
- Hyperuricemia
- Psoriatic
- Ankylosing spondylitis

Disk-condyle restrictions: This usually occurs in a patient with a history of clicking. On examination, the patient reports a sudden onset in hypomobility, usually measurable as an opening of less than 30 mm, and a cessation of joint noises. The patient deflects to the locked side on opening, often with pain. In a majority of cases, the disk is anteriorly displaced, while posterior disk displacement happens rarely. Alternative terms include disk displacement without reduction and closed locking.

Open locking: In this scenario, the condyle is anterior to the eminence and the patient is locked in a wide-open position. The patient may be able to self-reduce without any assistance.

Condyle dislocation: This differs from open locking in that the condyle has undergone excessive translation well beyond the eminence and requires manual manipulation to return to a normal position. A TMJ tomogram or MRI can help confirm this diagnosis.

Partial open lock: These patients complain of an inability to close their jaw after opening, but on radiographic examination, the condyle is not beyond the eminence. The disk may be dislocated in a posterior position, thus preventing the condyle from seating correctly.

Inflammatory Joint Disorders

Arthralgia: This describes a joint that displays increased tenderness on palpation. Osseous changes are usually not noted on radiographic examination. Various terms have been used to specifically characterize this condition depending upon the location of the pain (e.g. capsulitis, retrodiscitis and synovitis).

Arthritides: An inflammatory process of the articular surface of a joint that may be localized to one joint or may be generalized, affecting multiple joints (polyarthritis).

Muscle Disorders

Myalgia/myofascial pain (MFP): This is a dull, aching pain varying in intensity. The primary difference between MFP and myalgia is that MFP produces pain referred to other satellite muscle trigger points upon palpation, whereas myalgia results in pain that is localized to the muscle that is being palpated. MFP tends to be seen in more chronic muscle pain conditions compared to the usually acute presentation of myalgia. Palpation of the trigger points should duplicate the patient's pain complaint, thus confirming the diagnosis. In addition, blocking the source of the pain (i.e. masseter muscle) utilizing a vapocoolant spray or local anesthetic injection can also provide a definitive diagnosis.

Myositis: This presents as a localized transient inflammation involving muscle tissues. Classically, there is increased pain with mandibular movement and localized tenderness, usually following injury or infection.

Patient Evaluation

Temporomandibular disorder assessment should include a general examination of the head and neck, a detailed examination of the masticatory muscles, an evaluation of the temporomandibular joints, an evaluation of mandibular range of motion and a detailed intraoral examination.²⁴

Evaluation of the Muscles of Mastication

The muscles of mastication are palpated bilaterally for firmness and tenderness utilizing approximately 2 to 3 pounds of pressure. A pain pressure algometer may be used to reproduce reliable palpation pressure²⁵ or the amount of pressure needed to cause blanching of the fingernail. Upon muscle palpation, the patient is asked to report the severity of the tenderness, pain referral to multiple sites or single-site pain localization and replication of the chief complaint. The primary muscles to be palpated include the temporalis (Fig. 2), the superficial and deep masseter (Fig. 3), the medial and lateral pterygoid, the suprahyoid and the upper cervical muscles. Note that palpation of the lateral pterygoid from an intraoral perspective is difficult.²⁶ It may be pertinent to ask patients about their use of analgesic prior to palpation in order to account for reduced symptoms upon examination.

Evaluation of the Temporomandibular Joint

The TMJs are palpated bilaterally for tenderness or swelling with slightly less pressure than used for muscle palpation, especially in the presence of an existing capsulitis (Fig. 4). The clinician should palpate the preauricular region as well as the anterior walls of the external auditory canal. Lateral palpation may be utilized to assess joint pain in the lateral capsule, whereas the intrameatal approach via the external auditory canal is better for locating pain emanating from retrodiscal tissues.¹



Fig. 2: Palpating the temporalis muscle



Fig. 3: Palpating the superficial and deep masseter muscles



Fig. 4: Bilateral palpation of the TMJs

Evaluation of Mandibular Range Motion (ROM)

Initially, patients' opening and closing patterns are closely observed to note any mandibular deviations. Evaluation of mandibular ROM consists of measuring with a millimeter ruler the (1) comfort opening, (2) active opening, (3) passive

opening, (4) protrusion and (5) left and right lateral excursions while noting the severity and location of pain with jaw movement (Fig. 5). This can be particularly helpful in differentiating between joint and muscle pain. Comfort opening is determined by (1) the patient opening as wide as possible without any pain, (2) active opening with the patient opening as wide as possible with pain and (3) passive opening with the clinician gently stretching the patient presumably past active opening while noting a soft or hard end feel. A reasonably normal interincisal distance is approximately 40 mm or the width of 3 of the patient's fingers as a crude measure (Fig. 6). Usually, with proper questioning, the patient will reliably reveal any recent limitations in ROM. The occurrence of TMJ clicking, crepitus, or jaw opening interferences with or without pain should also be noted at the initial examination. These baseline findings will aid in establishing the differential diagnosis and treatment options as well as providing a comparison for future change in TMD symptoms.

Evaluation of the Cervical Spine

Patients who present with TMD may have a coexisting pain complaint in the neck, shoulder or upper back region. Poor posture may lead to a forward head position, rounded shoulders,



Fig. 5: Evaluating mandibular range of motion using a millimeter ruler



Fig. 6: A crude measure of reasonably normal interincisal distance is approximately the width of 3 of the patient's fingers

and/or added tension in the head, neck or back. Thus, an evaluation of the cervical spine may aid in assessing the patient's head ROM in flexion, extension and rotation. In addition, if range of motion is limited, it is pertinent to note any areas of pain that the patient experiences while performing various head and neck movements. This may help in localizing additional trigger areas that may have been missed on the palpatory examination.

SUMMARY

The study of temporomandibular disorders has undergone many changes throughout its history. Focus on the structure and function of the TMJ continues to improve our understanding of these complex disorders. A more standardized classification system allows practitioners and researchers to discuss findings in a common language. With improved patient evaluation techniques, the clinician can establish a proper working differential diagnosis and begin focusing attention on treatment planning.

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