

REVIEW ARTICLE

TEMPOROMANDIBULAR JOINT DISORDERS- ETIOLOGY, DIAGNOSIS AND MANAGEMENT-A REVIEW

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ABSTRACT

TMDs are a group of conditions affecting the joint and or the muscles of mastication. TMDs consist of three main groups of conditions: myofascial pain; disc disorders; TMJ arthritides. The gold standard diagnostic criteria for research involving TMDs are the Research Diagnostic Criteria for TMDs (RDC/TMD). A pragmatic clinically applicable alternative is the Clinical examination protocol for TMDs (CEP-TMD). Signs and symptoms can include: pain in masticatory musculature and or the joint; noises associated with joint movements; locking; headache; otalgia. TMDs' aetiology is multifactorial and biopsychosocial in nature. Reversible conservative management as defined by the American Association of Dental Research is the initial management of choice for all subgroups of TMDs.

Key Words: Temporomandibular disorders, Diagnosis, Treatment, Occlusal Splints.

INTRODUCTION

Temporomandibular disorders (TMD) are a heterogeneous group of pathologies affecting the temporomandibular joint (TMJ), the masticator muscles, or both (Okeson, 2008) Patients with TMD describe pain in the pre-auricular area, temple, or ear when chewing or opening the mouth. Pain may radiate to the head, face, or eye. Sounds such as crunching, popping, or grinding are usually described. A few patients may describe a jaw that occasionally locks; the patient may have to wiggle the jaw to unlock it. Behavioral changes associated with TMD include avoiding opening the mouth wide to bite into food such as an apple or a hamburger, cutting food into smaller than usual pieces, and substituting food of a softer texture for other foods. A specific etiopathogenesis is rarely demonstrable, because most cases have to be reconducted to a multifactorial etiopathogenetic pathway, (Dworkin, 1994 and McNeill, 1997). Epidemiological data showed a female pre dominance, which is more marked in patients' populations, and a mean age of onset around 35–45 years, with two distinct age peaks for internal joint derangements and inflammatory-degenerative disorders. The complex etiopathogenesis and the variability of symptoms make it difficult to adopt standardized diagnostic and therapeutic protocols, thus reflecting in the proposal of several different treatment approaches, such as occlusal splints, physiotherapy, behavioral treatments, physical therapy, drugs, minor and, major surgery. In the recent years, many progresses have been made in the attempt to design reference principles

for the diagnosis and treatment. This led to the diffusion of internationally recognized academic guidelines for the assessment and management of patients with TMD in the clinical setting (National Institute of Health Technology Assessment Conference Statement, 1996 and Phillips *et al.*, 1997) and to the adoption of a standardized protocol translated in several languages, viz., the Research Diagnostic Criteria for TMD, for the diagnosis and classification of such disorders in the research setting. Also, some seminal articles provided evidence-based invoices for the adoption of low-technology, high-prudence, and conservative, reversible approaches to TMD. Nevertheless, nonspecialist and non-expert practitioners still refer many uncertainties at both diagnostic and therapeutic levels, thus suggesting that the quality of communication between the research and clinical settings, viz the science transfer process, should be enhanced. This article will discuss the signs and symptoms, diagnosis, and management of TMD.

Signs and symptoms

Signs and symptoms of TMD have a higher incidence in the general population (20–75%) than the proportion of the population who present for treatment (2–4%). The age range of presentation varies from the second to the fourth decade³. Gender differences in symptoms are not observed (1:1) but the ratio presenting for treatment is substantially different, with females outnumbering males. Suggestions that this is due to differences in gender behavior are not scientifically supported. There is a great deal of inter-individual variability in the signs and symptoms of TMD but they can be divided into six broad groups (Gray *et al.*, 1994 and McNeill, 1997):

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- Joint noises – clicking, creptius (grinding);
- Locking – open (inability to close fully) closed (inability to open fully);
- Pain – in head, neck and shoulders;
- Muscular tenderness – in face, neck and shoulders;
- Ear complaints – otalgia, tinnitus
- Psychosocial effects.

The variability in the signs and symptoms of TMD can make diagnosis, and therefore, the standardization of inclusion criteria for trials difficult unless specific criteria are followed.

Diagnosis

History

A detailed history, head and neck evaluation, and general physical examination when indicated, are essential, (Clark *et al.*, 1983).

Physical examination

The masseter muscles and the temporal and pre-auricular areas should be palpated. While the examiner's hands are on the pre-auricular area, the patient should be asked to repeatedly open and close his mouth. It should be noted if any popping or clicking is felt during range-of-motion. The presence of joint sounds should be noted, and if these sounds are associated with joint pain. Have the patient open his mouth as wide as possible, and measure the distance between the anterior maxillary and anterior mandibular teeth; any distance less than 40 mm is considered a restricted mouth opening (Feteih, 2008). The teeth should be examined for unusual wear patterns which may indicate bruxism. The opening pattern of the jaw should be observed, and the clinician should note whether the pattern is straight, laterally deviated or deviated with correction (Hedge, 1989).

Laboratory Studies

Lab work may include calcium, phosphate or alkaline phosphatase to check for possible bone disease. An elevated erythrocyte sedimentation rate (ESR) and positive Rheumatoid Factor may indicate rheumatoid arthritis. If gout is suspected, a serum uric acid level should be ordered. An elevated serum creatinine level may indicate muscle disease, (Hedge, 1989).

Imaging

Imaging of the temporomandibular joints and associated structures is necessary to establish the presence or absence of pathology and stage of disease in order to select the appropriate treatment, assist in prognosis, and assess patient response to therapy. Imaging results will influence treatment strategy. In general, it is recommended that imaging studies be bilateral because of the high incidence of bilateral joint disease. Basic screening radiographs should be used to demonstrate temporal bone and condylar morphology. Radiographs which can provide this information include plain films, panoramic films, and tomograms (frontal and lateral). The disc and associated soft tissue structures should also be imaged. Magnetic resonance imaging (MRI) or arthrography can provide this information. Other radiological studies may also be indicated.

Computed Tomography (CT)

Computed tomography (CT) is very useful to assess bone abnormalities such as ankylosis, dysplasias, growth abnormalities, fractures, and osseous tumors (Katzberg, 1989). 3-D CT is a valuable diagnostic advancement for complex cases needing major reconstructive surgery. Moreover, a stereolithography model of a patient's maxillofacial skeleton can be fabricated utilizing 3-D CT technology.

Magnetic Resonance Imaging

MRI is used to assess soft tissues, bone marrow changes, disc position, morphology, mobility, and joint effusion. Cine MRI has been used to study the "adherent disc" (also known as: "static disc", "stuck disc", "anchored disc", "suction cup effect"), (Dorsay *et al.*, 1994).

Arthrography

MRI has largely replaced arthrography (Wilkes, 1978) as the primary imaging study for disc pathology. However, in selected cases, arthrography still has a role.

Isotope Bone Scan

Radioactive isotope bone scans have a high sensitivity for detecting metabolic activity and inflammation (Matteson, 1985). Increased vascularity on the scan appears as increased isotope activity. Single Photon Emission Computed Tomography (SPECT) is a form of isotope imaging utilizing computer techniques to improve visualization of the plane of interest.

Other Studies

To evaluate other sources of pathology adjacent to or related to the TMJ, other head and neck imaging studies may be necessary. A panoramic radiograph is a valuable screening test for assessing sources of facial pain that are often confused with TMJ pain, such as dental infections, neoplasms, sinus pathology and Eagle's syndrome. Plain radiographs, such as transcranial views, are useful for general determinations of condylar morphology and position in the fossa. In instances where more information is required, tomography is recommended. Diagnostic arthroscopy permits obtaining synovial fluid for analysis and specimens for biopsy.

Diagnostic Criteria

The Guidelines of the American Academy of Orofacial Pain (2008) and the Research Diagnostic Criteria (RDCTMD, 1992) suggest the following criteria:

MMP: A complaint of muscle pain in the jaw, temple, face, or periauricular area, with tenderness on palpation in at least 3 of 20 predetermined muscle sites.

TMJ arthralgia: A complaint of pain over the TMJ, including pain with function or with assisted or unassisted mandibular movements. Pain on palpation of the joint over the lateral pole and/or via external auditory meatus. No coarse crepitus.

TMJ osteoarthritis has the same criteria as for TMJ arthralgia, supplemented by coarse crepitus or positive imaging findings.

Psychosocial comorbidity in MMP or TMJ pain is rated using the Graded Chronic Pain Scale and measurement scales for depression, anxiety, and nonspecific physical symptoms.

Management

TMJ syndrome is a multifactorial issue, and treatment should be viewed on a case by-case basis. To achieve optimum treatment outcomes, clinicians must address the specific pathophysiology. Many patients with TMD experience a remission of symptoms over time and can be treated conservatively. If stress factors are suspected, the clinician may consider antianxiety or antidepressant medication and mental-health counseling, as well as nonsteroidal, anti-inflammatory medications, with the possible addition of muscle relaxants. As with any other painful joint, heat or ice applied to the TMJ may be helpful. Many TMDs can be cyclical and self-limiting, with periods of complete remission of symptoms. Thus, initial treatment should emphasize a conservative and reversible approach, (Okeson, 1996). Primary treatment options include (1) home care (self-care), (2) medical care (nonsurgical care) and (3) surgical care.

Home care (self-care)

Home care generally represents the initial approach to TMD management, at least as part of a more extensive treatment plan. Patient education is a crucial aspect of home care and is one of the most subtle and under-appreciated yet effective treatments for TMDs. Informing and reassuring patients regarding their condition and presenting symptoms may alleviate a great deal of anxiety. In fact, a number of patients report feeling less pain immediately after their initial patient education/counseling visit, perhaps attributable to an immediate reduction in tension related parafunctional activity. A successful home care program consists of resting the masticatory muscles by limiting jaw movements, parafunctional habit modification, emphasizing a soft diet and moist heat and/ or ice therapy, (Randolph, 1990). Muscle rest may involve limited jaw activity (e.g. reduced talking, chewing and yawning) for the treatment duration and perhaps even after symptoms have resolved as a preventative measure. Patients may have a diurnal (daytime) parafunctional habit (clenching, grinding and posturing) that often is not conscious. Patient education and understanding of once proper patient evaluation techniques have been implemented and a working differential diagnosis has been created, the clinician can start treatment planning for the temporomandibular disorder (TMD) patient.

This is not an easy task, primarily due to the wide array of treatment options currently available. In the second and final part of this article, focus will be placed on various treatment modalities for temporomandibular disorders. The physiological rest position (lips together, teeth apart) is imperative in reducing and eventually halting the daytime activity that contributes to the progression of TMDs. If asked to pay attention to their jaw position overtime, many patients will return for follow-up with the recognition that they are in fact engaging in some jaw activity that contributes to their symptoms. Additionally, suggesting habit-controlling cues may be helpful in reminding patients throughout the day to check the position of their bite. As an example, saying the letter n

throughout the day can remind patients to unclench or discontinue grinding their teeth. Also, a soft diet is crucial to muscle and temporomandibular joint (TMJ) pain management so that the condition is not exacerbated while treatment is provided. Finally, a trial of moist heat and/or ice therapy overlying the painful areas of the face, head, and neck can be recommended. Usually, moist heat tends to work better for muscle pain or tension by increasing circulation and relaxing involved muscles, and ice tends to work better for TMJ capsulitis by reducing inflammatory symptoms.

Medical (nonsurgical) care

Physical Therapy

Physical therapy can be performed by an experienced physical therapist or can be provided by a qualified clinician who is treating the TMD. The consistency and regularity of the exercises are critical for achieving a therapeutic effect. Thus, at the outset of treatment planning, an agreement between practitioner and patient regarding compliance will aid in patients understanding of their roles and responsibilities in treatment. Primary goals of the physical medicine component of treatment are to stretch chronically fatigued and contracted muscles, increase range of motion and reduce muscular trigger point activity (Carlson *et al.*, 1991 and Clark, 1990). Some commonly used exercises to treat TMJ associated muscle disorders include (1) n-stretching (placing the tip of the tongue on the roof of the mouth and stretching the jaw), (2) chin-to chest exercises (gently pulling the head forward, bringing the chin toward the chest), and (3) head tilts (turning the head to one side and then tilting it posteriorly). These exercises are most effective if done regularly (4 to 6 times per day). In addition, moist heat application for 10 to 15 minutes followed by ethyl chloride or fluoromethane spray prior to stretching the muscles is helpful. The vapocoolant spray provides a temporary anesthesia effect to the muscles, so a more intense stretch can be achieved without pain. Patients can expect an even higher likelihood of treatment success, if biofeedback training or transcutaneous electrical nerve stimulation (TENS) is added to a strict stretching regimen.

Pharmacotherapy

Commonly used pharmacological agents for the treatment of TMDs include analgesics, nonsteroidal anti-inflammatory drugs (NSAIDs), local anesthetics, corticosteroids, muscle relaxants and antidepressants (Gangarosa, 1982; Gregg, 1983 and Gregg, 1988). The analgesics and corticosteroids are indicated for acute TMD pain; the NSAIDs, local anesthetics, and muscle relaxants are indicated for both acute and chronic conditions; and tricyclic antidepressants are usually indicated more for chronic TMD pain with associated muscle tension headaches, (Gangarosa, 1982; Gregg, 1983 and Gregg, 1988). Clinicians should always consult the physicians' desk reference for proper dosing, side effects, and drug interactions, and make decisions regarding pharmacological treatment based on individual patient medical history and comorbidity. Also, referral to the proper specialist should be made in complex TMD cases.

NSAIDs

NSAIDs are indicated for mild-to-moderate acute inflammatory conditions. Commonly used NSAIDs are

ibuprofen (Motrin) and naproxen (Naprosyn). NSAIDs may be prescribed for a minimum of 2 weeks with time-contingent usage as opposed to a dosing based on the presence of pain.²² Long-term NSAID use is not recommended as long as the parafunctional activity causing the inflammatory process can be reduced. In some chronic arthritic cases, long-term NSAIDs, such as the COX-2 inhibitors (Celebrex, Vioxx), may be considered. However, possible side effects (i.e. GI upset) should be taken into account.

Local Anesthetics

Local anesthetics are primarily used when a myofascial trigger point is present. Myofascial trigger points are usually detected in the muscles of mastication but can also be found in numerous other muscles, such as splenius capitus and upper trapezius. One percent procaine (1 cc) is recommended due to its low toxicity to muscles. However, studies have shown that dry needling of the muscle site may play a prominent role in breaking up the trigger point, with the anesthetic functioning more for pain control. Muscles may be sore for the first 48 hours after the injection, but generally should be less tender after that. The efficacy of trigger-point injections is highly variable and dependent for the most part on the patients compliance with a strict physical therapy regimen in conjunction with the injection. In addition, local anesthetics can be used to block the suspected source of pain in order to confirm a diagnosis.

Corticosteroids

Corticosteroids may be used for acute and chronic TMD symptoms. These medications are used orally as well as injected directly into the joint space. Systemic steroids may be prescribed for the duration of a week. It is suggested that a steroid TMJ injection should be performed when all previous conservative treatments have not worked and the joint is still acutely inflamed, (Kopp, 1991) Tomograms of the TMJ or other radiographic studies are required prior to injecting into the joint space. A long-term study has shown that intraarticular corticosteroid injection has demonstrated a significant reduction in pain, (Dimitroulis *et al.*, 1995). However, the number of steroid injections should be carefully considered due to the possibility of bone resorption in the site of injection.

Muscle Relaxants

Muscle relaxants may be prescribed for muscle tension associated with TMDs. Commonly, they are taken at night before bed because of associated drowsiness. Thus, for patients with poor sleep patterns, these drugs are particularly helpful in alleviating insomnia in addition to their muscle-relaxing effects. A commonly used muscle relaxant is cyclobenzaprine (Flexeril), started at lower dosages and gradually increased until the patient starts noticing relief of symptoms or starts developing side effects. Muscle relaxants tend to be used for the more acute presentation of muscle tension.

Antidepressants

Tricyclic antidepressants like amitriptyline (Triavil) and nortriptyline (Aventyl) may be used for more chronic myofascial pain syndrome. In addition, they can be prescribed for the TMD patient that has tension-type headaches, depression, poor sleep, and/or poor appetite. It is important to

inform the patient that the medication will not usually have antidepressive effects when prescribed at the dosages that are usually necessary to treat muscle pain and/or headaches. Nortriptyline or amitriptyline should be gradually tapered up until the desired therapeutic effect is achieved or side effects such as drowsiness, dry mouth or weight gain develop. Caution should be used in patients who have comorbid heart conditions, concurrent psychotropic use, and/or psychiatric illness (e.g. bipolar disorder).

Occlusal Stabilization Appliance Occlusal stabilization appliances (flat-plane splints) are utilized for the purpose of unloading the joints, equally distributing the forces, reducing the forces placed on the masticatory muscles, and protecting the occlusal surfaces of the teeth from chronic nocturnal bruxing. Usually, the patient is instructed to wear the splint only at night as long as parafunctional activity is controlled during the day with education and bite relation awareness. The splint should cover all of the maxillary or mandibular teeth and have bilateral posterior contacts with little to no anterior contacts. In addition, bilateral clasps may be incorporated into the splint for added retention. The stabilization appliance should feel comfortable to the patient at the time of try-in and be reevaluated in a week. Adjustments should continue every 3 to 6 months because of changes that may result in the form and function of the splint from chronic bruxing.

Anterior Repositioning Appliance

Anterior repositioning splint prescription varies among clinicians, but is usually utilized for the chronic, intermittent closed-locking patient. With the possibility of permanent occlusal and bite changes with long-term use of repositioning appliances, short-term (6 weeks) use of this appliance is strongly recommended. If bite changes start to develop, the patient should be instructed to discontinue the use of the splint, and the splint may need to be converted to a stabilization non repositioning appliance. A few patients may experience increased pain with the use of a splint. In this case, the splint as well as the initial diagnosis should be reevaluated. If the pain persists, discontinuation of splint therapy is recommended.

Surgical Therapy

Surgical therapy for TMD patients is recommended primarily for those that have tried conservative treatments without resolution of symptoms. Surgical recommendations (i.e. arthrocentesis, arthroscopy) will depend on the degree of pathology as well as the result of previous conservative treatments. Also, consideration should be given to the patients extent of impairment and their compliance with previous nonsurgical treatment modalities. Working closely with an oral and maxillofacial surgeon who has expertise with TMJ surgery is strongly recommended.

Arthrocentesis

Arthrocentesis involves irrigation of the joint with lactated Ringer's solution or saline. In certain acutely inflammatory joint conditions, steroid injection may follow arthrocentesis. This procedure is often followed by mandibular manipulation and is recommended for patients who have unresolving joint restrictions and for those individuals who have developed an acute or chronic closed lock²⁵. It is recommended that the patient have a stabilization or repositioning splint ready to be

delivered immediately following the procedure. The procedure may need to be repeated if the lock recurs, and the patient must be reminded to avoid activities that cause locking.

Arthroscopy

Arthroscopy is direct visualization of a joint with an endoscope. It is performed by an oral and maxillofacial surgeon mainly in the upper joint space and is recommended primarily for lysis and lavage and also for ablation of adhesions and biopsy, (Buckley *et al.*, 1993) An MRI of the joint is needed prior to the arthroscopic procedure. It is crucial to keep the procedure as brief and atraumatic as possible.

Arthrotomy

TMJ arthrotomy is an open surgical intervention performed by an oral surgeon. It is recommended for severe osseous pathology involving the TMJ, such as ankylosis and severe osteoarthritis that has not responded to conservative treatments. It is crucial to work closely with an experienced TMJ surgeon to assess the necessity of this procedure. Open surgical procedures include disk repair (discoplasty), disk removal (discectomy) with or without replacement and disk repositioning, and arthroplastic procedures, such as condylar repair and removal (condylectomy).

Conclusion

TMD are a group of complex biopsychosocial chronic illnesses, which may exhibit high placebo response rates to therapy. This along with the lack of a standardized reproducible patient-based outcome measure makes the evidence for TMD management difficult to interpret. The gold standard diagnostic criteria for research involving TMDs are the Research Diagnostic Criteria for TMDs (RDC/TMD). A pragmatic clinically applicable alternative is the Clinical examination protocol for TMDs (CEP-TMD). Reversible therapies are currently considered to be the first-line management of TMD. There may be specific indications for when irreversible therapies might be efficacious in the management of TMD but these are yet to be substantiated by high-quality evidence. There is a need for an accepted standardized reproducible outcome measure for TMD so that large scale meta-analyses of management modalities can be carried out. Only then will truly evidence-based management of TMD be possible.

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