Temporomandibular disorder (TMD) represents a multiplicity of conditions expressed in the masticatory system affecting the temporomandibular joints, masticatory muscles, and/or the associated structures. Many of these conditions share common signs and symptoms, yet require differing treatment/management approaches. Therefore, it is important to identify the specific subcategory of TMD in order to develop a case-specific plan of care.

In addition, etiologic variables and factors associated with perpetuation or recurrence of TMD must be appreciated and determined for each patient. A complete evaluation of each case from historical, clinical presentation and physical/psychological perspectives must be accomplished. Treatment outcomes can be enhanced by the identification of and management strategies that address all the components involved.

The development of a diagnosis-specific plan with a prioritized problem list is necessary to enhance our treatment prognosis. The primary goals of treatment of TMD are to reduce or eliminate pain, restore a more normal function, allow return to the activities of daily living, and reduce long-term health care needs for the problem.

A multi-disciplinary model that includes patient education and self-care, cognitive behavioral intervention, pharmacotherapy, physical therapy and orthopedic appliance therapy (interocclusal splints) is favored for the management of the vast majority of TMD patients. It is important to understand that the natural course of TMD does not reflect a progressive disease process, but rather TMD appears to be a complex disorder that is affected by a multitude of interacting factors serving to maintain the disorder or result in recurrence.

Most TMD patients will obtain significant improvement of signs and symptoms with a conservative model (non-surgical modalities). Many studies have supported that most TMD patients have minimal or no symptoms after treatment with conservative therapy. Studies related to intracapsular disorders have demonstrated that in patients with disc displacement (with or without reduction), the natural progression of the disease can allow for changes that are favorable for a significant number of patients in terms of function and symptoms.

Involving the patient in the physical and behavioral management of his/her condition is essential in the treatment outcome. As clinicians in the development of an individualized plan of management, we must determine if intervention is necessary, if healing to take place. The success of self-care depends on patient motivation, cooperation and compliance. The most important aspect of self-care is ongoing encouragement and reinforcement by the clinician. Self-directed care typically includes limitation of mandibular function, habit awareness and modification, a home exercise program and stress management. Voluntary limitation of mandibular function, maintaining a soft diet, avoidance of foods that require a great deal of chewing, opening wide, yawning or other activities that promote excessive mandibular function should be avoided.

Clenching, bruxism, maladaptive tongue position habits and other habitual behaviors must be identified. Correction or behavior modification may require clinical assistance. An individualized home exercise program with a detailed description of the program will not only enhance the doctor-patient relationship, but also assure the patient’s compliance, thus making treatment more effective and resulting in a faster rehabilitation.

A program of moist heat and/or ice to the affected areas, massage of the affected muscles, and controlled
mandibular movement can enhance joint lubrication and nutrition by encouraging the production of physiological quality and quantity of synovial fluid and minimizing the accumulation of metabolic by-products and pain mediating substances.

Identification of the source(s) of stress and the importance of the patient understanding the association and adverse influence of stress and the course of TMD are also vital. Clinical and health psychologist participation in your multidisciplinary approach may be required to enhance your treatment outcome.

Pharmacotherapy

Rational utilization of pharmacological agents can be a valuable adjunct in the treatment of TMD. Drugs must be considered on a case-specific basis. A clinician must remember that the treatment of TMD is not a substitute for a single drug for all cases. Understanding the variety of drugs utilized in the treatment of musculoskeletal conditions, their potential drug interactions and their side effects can result in a useful tool in our armamentarium.

The most effective pharmacological agents for the management of TMD include analgesics, non-steroidal anti-inflammatory drugs (NSAIDs), corticosteroids, anxiolytics, muscle relaxants and antidepressant at very low dosages.14,15

Non-steroidal anti-inflammatory drugs

This category is effective for the management of mild to moderate pain and inflammatory conditions, particularly those of muscle origin. Relief of symptoms is typically achieved prior to the anti-inflammatory effect. In order to obtain anti-inflammatory effects, these mediations should be taken for a minimum of two weeks following the recommended schedule. NSAIDs differ in formulation, efficacy and toxicity. It is suggested that if one NSAID fails, another agent should be considered. Common side effects to be considered include gastric distress, inhibition of platelet aggregation, tinnitus/dizziness, and renal/liver toxicity. A list of the most commonly NSAIDs utilized is found in Table 1.

Stereoids

Corticosteroids are typically indicated in cases of non-infectious inflammation when NSAIDs have proven to be ineffective. Systemic corticosteroids are not commonly prescribed in the treatment of TMD due to their side effects. They could be considered when in association with the polyarthritides. Intra-articular temporomandibular injection of corticosteroids has been made on a selective and limited basis in cases of severe joint pain or in cases of flare ups where conservative therapy has failed.16,17 We must recognize that multiple intra-articular steroid injections may have detrimental effects. These medications are also effective in the treatment of inflammatory conditions such as tendinitis or tendynmiositis where, due to the decreased blood flow to the areas, oral medications will provide less than desirable results. Side effects include decreased resistance to infection, fluid retention weight include drowsiness and nausea. Benzodiazepines are contraindicated in patients with narrow-angle glaucoma, and can increase CNS depression. A list of anxiolytic agents typically utilized in TMD, sleep disturbances to include insomnia, and the quality and quantity of sleep. Its combination with an NSAID can be a very effective tool for the treatment of acute TMD. Diazepam, a benzodiazepine, is also utilized as a muscle relaxant. A list of commonly used muscle relaxants is shown in Table 4.

Antidepressants

These medications are helpful with chronic diffuse pain due to myofascial pain, especially when it has been recognized that sleep disturbance is a contributing factor. The analgesic properties of the tri-cyclic antidepressants are independent of the antidepressant effect. They have shown pain modification properties at therapeutic dosages much lower than those prescribed for antidepressant effect.

The therapeutic effect of the drugs is thought to be related to their ability to increase the availability of the neurotransmitters serotonin and norepinephrine at the synaptic junction in the central nervous system. Studies have shown that use of these drugs in the treatment of sleep related bruxism, tension type headache, migraine headache prophylaxis, fibromyalgia and various neuropathic conditions.21,22

Side effects are mainly related to the anticholinergic activity that induces xerostomia, dry mouth, constipation, fluid retention and weight gain. Patients occasionally complain of sedation upon awakening. Contraindications include cardiac arrhythmias, seizure disorders and patients suffering from panic attacks. Dosages should begin at the lowest level (10 mg) at bedtime and be increased each week only if needed and tolerated by the patient. Table 5 shows a list of some of the most commonly utilized drugs in this class.

Opioids

Typical indications for opioids in the TMD population include exacerbation of pain, postoperatively and in cases of overt trauma. These medications are best indicated for moderate to severe pain over a brief period of time. Most common side effects are nausea, respiratory depression and physical dependence. Opioids may be considered in cases of pain refractory for appropriately integrated multi-disciplinary care when properly monitored.

Local anesthetics can be useful in the TMD population as a diagnostic tool and also in selective cases as a therapeutic modality. Indications are as a diagnostic block and in the management of myofascial trigger points. Injections into skeletal muscle with local anesthetics that contain a vasoconstrictor can increase the toxicity of the solution. Typically, lidocaine or carbocaine without a vasoconstrictor is recommended, especially when injected into muscle (to minimize myotoxic effects). Diagnostic anesthesia may be as simple as the usage of a topical agent, somatic blocks (filtration, field blocks and division blocks), trigger points injections,
program is recommended with isometric exercises. Iso-
tension, focus on breathing, and posture are designed to achieve a different
motor function and are often used to improve the outcome.

Electrical stimulation is often uti-
lized. In addition, transcutaneous electrical nerve
stimulation (TENS), iontophoresis, anaesthetic agents and acupuncture.

The use of heat can help relax the muscle and increase blood flow to the
compromised muscle. Electroc-therapy devices produce thermal, histochemical and physiological
changes in the muscles and joints. Short-wave diathermy provides
heat to superficial tissues whereas ultrasound can transmit heat
through tissues to a depth of 5 cm.26

The purpose of these modalities is to
decrease pain, hyperactivity, increase tissue distensibility and may
be neuro-modulating. Anesthesia is also been used for the treatment of
chronic musculoskeletal pain.28

Postural re-education

Maladaptive posture (head/ neck or mandibular) may be a con-
tributing factor in the TMJ patient. The relationship between
the trigeminal nerve and the upper cer-
vical region is well recognized. Pos-
tural re-education throughout exer-
cises and behavior modification
should be considered. The participa-
tion and guidance of a physiothera-
pist is required for long-term stabi-
licity of the masticatory system.

Behavioral/psychotherapy

The TMJ patient’s cognitive, emotional and behavioral responses
to pain are key issues in the overall
evaluation and treatment. The pa-
tient’s perception to pain may be
maladaptive in the nature of sensitiza-
tion, catastrophizing and mood and
subconscious habitual behavior. Failure to identify and address these
factors will likely compromise the
treatment outcome.

Cognitive-behavioral strategies
such as behavior modification, life
style counseling, progressive relax-
atation, guided imagery, hypnosis and
biofeedback may be beneficial.29,26

This care is typically provided by a
clinical health psychologist. Occa-
sionally, TMD may be related to an
underlying psychosocial or psychi-
atriic disorder such as depression or
conversion disorder. In these cases,
a psychiatric or clinical health
psychologist referral is indicated.

Occlusal appliance therapy

Occlusal orthosis therapy is the
most common form of treatment. They are commonly referred to as
interocclusal splints, orthotics, ortho-
sis, bite guards, bite planes, night
guards and bruxism appliances. An
occlusal appliance is a removable
device, usually made of hard acrylic, that is custom made to fit over the
occlusal surfaces of the teeth on
either arch. There are generally two
types of appliances — the flat plane
(stabilization) appliance and the
anterior reposition appliance.

The effects of appliance therapy
include prevention/reduction in
abnormal mandibular function, alteration of the normal pattern of the
masticatory musculature by altering peri-
odental ligament proprioception,
alteration of muscle length, enhanced
to the structures of the temporomandi-
bular joint (TMJ). It consists of TMJ
lavage placement of medications
into the joint. Arthrocentesis is usu-
ally performed as an office-based
procedure under local anesthesia
assisted with conscious intravenous
sedation. It has been suggested to be
more effective as arthrocentesis in the
management of joint restriction in con-
ditions such as internal derange-
ment without reduction.

Surgical treatment includes
arthroscopy, condylectomy, and open
joint procedures, such as disk repo-
sition and diskectomy. Arthroscopy
is a minimally invasive technique
that is used in the treatment of
fibrous tissue and is as stable as possible.
Accurate orthognathic surgery predictions for the obstructive sleep apnea patient

by R. Scott Conley, DMD

Abstract

Orthognathic surgery has been performed routinely since the mid-1970s to correct severe skeletal malocclusion. Because of its inception, various forms of prediction have been utilized to attempt to educate the patient regarding potential profile changes. Initially, lateral cephalometric tracings were used to create a visual treatment objective. Later, with the advent of computers and computer imaging, multiple computer programs were developed to assist the process. Now, surgical predictions have become a routine part of the standard of care for offices recommending orthognathic surgery to their patients.

Instead of utilizing surgery as a tool merely for the correction of skeletal malocclusion, it is now being used as one of the more successful treatment modalities in the treatment of severe obstructive sleep apnea (Riley, Powell et al. 2000). Surgery for the obstructive sleep apnea patient typically involves surgery to reposition the mandible and advancement of both the maxilla and the mandible. With these larger surgical advancements, questions have developed regarding the accuracy of surgical predictions. Are the values that were developed for use with single jaw surgery still valid? Do the previous prediction methods overestimate or underestimate the potential treatment changes?

Orthognathic surgery history

One of the earliest reported maxillary surgical procedures was performed by Cheever in 1864. The precursor of today’s LeFort I osteotomy was performed to remove a nasopharyngeal carcinoma from the patient. Anesthesia and sterilization techniques were quite nascent at the time. The surgery was a success, the tumor was resected, but the patient died approximately three days later. Around the turn of the 20th century, surgical procedures to correct severe skeletal malocclusions were again attempted. This time, surgery was attempted in the mandible. Because the biological basis for orthognathic surgery was not yet well understood, surgery was generally reserved for individuals with severe facial deformities, or to address a traumatic injury. These early surgical procedures were largely unsuccessful and unpredictable in both the short term (intra-operative and immediate post-operative time) as well as the long term (months to years postoperative). With the advent of the bilateral sagittal split ramus osteotomy by Obwegeser in the late 1950s, predictable and successful advancement of the mandible became possible (Trauner and Obwegeser 1957). However, successful routine maxillary surgery took nearly another quarter century. In 1975, Bell performed a microangiographic study of Macaca mulatta monkeys who had undergone maxillary surgery to begin to understand the healing process (Bell, Fonseca et al. 1975). This landmark paper led to a significant increase in both the frequency and success of maxillary surgery.

History of obstructive sleep apnea

The first paper describing what is now classified as obstructive sleep apnea (OSA) referred to the disease as “Pickwickian Syndrome” (Bicklemann, Burwell et al. 1956). The description reportedly refers to a character from Charles Dickens’ “The Pickwick Papers” serial from the 1830s, where one of the characters was severely overweight. The character was further described as being able to fall asleep nearly anytime of the day regardless of the setting or circumstances. In recent years, the condition has become much more studied across several disciplines of medicine.

One of the early reported forms of surgical treatment included mandibular advancement surgery (Bear and Priest 1980). Later, other authors describe performing two-jaw surgery to augment the flow of oxygen during sleep (Hochhan, Brandenburg et al. 1994; Riley, Powell et al. 1993; Prinsell 2002). Though patients underwent surgery for severe quality of life reasons, little information was presented regarding the effect orthognathic surgery would have on the facial profile since the advancements were nearly 10 mm.

Effects of maxillary and mandibular surgery on the profile

Several papers have been written to examine outcomes of maxillary surgery on the overlying soft tissue profile. One of the earlier papers found that the soft tissue changes were approximately 40 percent of the hard tissue changes (Dann, Fonseca et al. 1976). The paper reported changes based on only eight patients, two of whom had surgery on the maxilla due to cleft lip and palate. A subsequent paper examined 21 patients and demonstrated a 46 percent soft tissue to hard tissue ratio (Stella, Streater et al. 1989).

A subsequent paper that became the standard set of predictive rules also utilized 21 patients, however only 14 were advancement only patients; the other seven were maxillary impaction (Mansour, Burstone et al. 1985). Their results demonstrated an increased soft tissue to hard tissue change of 60 percent when examining the change in the upper lip position. With the advent of distraction ostegenesis, investigators theorized that greater soft tissue changes would be observed due to the simultaneous distraction histogenesis that reportedly occurs. In recent papers examining the effects of distraction osteogenesis on the profile, an 80 percent soft tissue to hard tissue change is reported for the upper lip. In addition, a 60 percent soft tissue to hard tissue change was observed at the superior sulcus (soft tissue A point).