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Concomitant Temporomandibular Joint and Orthognathic Surgery

*Larry M. Wolford, DMD**

Why consider performing temporomandibular joint (TMJ) and orthognathic surgery at the same time when a patient has coexisting TMJ pathology and a dentofacial deformity? Isn't that too aggressive? How could the condylar position be controlled? Wouldn't orthognathic surgery alone correct the TMJ problems? These are certainly suitable questions, but the author believes that appropriately trained and experienced surgeons are able to more completely treat patients with improved effectiveness and outcome using concomitant TMJ and orthognathic surgery.

There are patients requiring orthognathic surgery for correction of dentofacial deformities who have coexisting TMJ pathology. In addition, there are patients with good skeletal and occlusal relationships who have TMJ pathology, but when the TMJ pathology is surgically corrected the occlusion may change significantly, creating a malocclusion. These patients can benefit from concomitant TMJ and orthognathic surgery, by a surgeon with surgical expertise in open TMJ surgery and orthognathic surgery. Few surgeons currently use this approach but instead ascribe to 1 of the following 4 philosophies when managing patients with coexisting TMJ pathology and dentofacial deformities: 1) perform orthognathic surgery only to correct TMJ pathology; 2) perform TMJ treatment but ignore the dentofacial deformity; 3) ignore TMJ problems altogether; or 4) perform orthognathic surgery first and then try to deal with the TMJ pathology later. The difficulty for many clinicians may lie in identifying the presence of a TMJ condition, diagnosing the specific TMJ pathology, and selecting the proper treatment for that condition. Further complicating the situation is that some TMJ conditions may be relatively asymptomatic presurgery, increasing the difficulties in diagnosis and understanding the necessity for TMJ surgery. In addition, unpredictable and sometimes devastating outcomes from TMJ surgery techniques used in the 1980s and early 1990s have created a skeptical attitude toward TMJ surgery.

Why Perform Temporomandibular Joint Surgery?

The TMJs are the foundation for orthognathic surgery. If the TMJs are not stable and healthy (pathologic), orthognathic surgery outcomes may be unsatisfactory relative to function, aesthetics, stability, and pain. Orthognathic surgery to correct dentofacial deformities cannot "fix" or eliminate coexisting TMJ pathology.

Our studies[1-3] and those of others[4-8] have shown that patients with coexisting TMJ and dentofacial deformities, treated with orthognathic surgery only, can have unsatisfactory outcomes. In fact, some problems associated with orthognathic surgery relapse that have been reported in the literature may well be related to untreated or unrecognized TMJ pathology. Preexisting TMJ pathology (symptomatic or not) that can cause unfavorable outcomes when only orthognathic surgery is performed include 1) articular disc dislocation, 2) idiopathic condylar resorption (ICR), 3) condylar hyperplasia, 4) osteochondroma, 5) congenital deformities, and 6) nonsalvageable joints. These conditions can all be associated with dentofacial deformities, TMJ pain, headaches, myofascial pain, TMJ dysfunction, etc.

Most of these TMJ conditions, when occurring with dentofacial deformities, can be predictably treated with concomitant TMJ and orthognathic surgery. With accurate diagnosis and treatment planning, appropriate selection and execution of the surgical procedures and proper postsurgical management, good outcomes can be achieved. In the author's experience, the TMJ conditions are best treated by open joint surgery. Although arthroscopic surgery, arthrocentesis, and splint therapy have a place in our armamentarium, these procedures are of little benefit and could be detrimental to treatment outcomes, because

*Clinical Professor of Oral and Maxillofacial Surgery, Baylor College of Dentistry, Texas A&M University System, and Private Practice, Baylor University Medical Center, Dallas, TX.

Address correspondence and reprint requests to Dr Wolford: 3409 Worth St, Suite 400, Dallas, TX 75246; e-mail: Lwolford@swbell.net

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these procedures maintain the disc out of position and/or do not put the disc back into its proper anatomic location with predictable stability when orthognathic surgery is also required.

Our research has shown that performing orthognathic surgery only (particularly requiring mandibular advancements) on patients with TMJ displaced articular discs resulted in unfavorable outcomes relative to function, aesthetics, and pain.[1-3] We evaluated 25 consecutive patients with jaw deformities and displaced articular discs, operated on by one surgeon, and treated with orthognathic surgery only, including mandibular advancement. Before surgery, 36% of the patients had pain. At an average of 2.2 years after surgery, 84% of the patients had TMJ-related pain, with a 70% increase in pain severity. In addition, 25% of the patients developed open bites from condylar resorption. New onset/aggravation of TMJ symptoms averaged 14 months after surgery. Twelve patients (48%) required TMJ and repeat orthognathic surgery. Nine additional patients (36%) required medications for pain control. This study clearly shows the problems associated with performing orthognathic surgery only on patients with coexisting TMJ articular disc dislocations.

Factors Affecting Condylar Position

A major concern for many surgeons in reference to concomitant TMJ and orthognathic surgery is condylar position and control. The condylar position, size, and/or morphology can be significantly altered, affecting the position of the mandible, with the following surgical factors: 1) repositioning the articular disc (usually displaces the condyle and mandible downward and forward); 2) removal of tissue from the joint (ie, high condylectomy, removal of osteochondroma); 3) incisions through the capsular ligaments adversely affecting joint stability; and 4) intraoperative and postsurgical edema or hemarthrosis. These factors can present challenges for the surgeon during and after the orthognathic surgery phase, particularly in double-jaw surgery.

The surgical sequencing for concomitant surgery is important in achieving good outcomes. The author's sequencing includes TMJ surgery first, followed by mandibular ramus sagittal split osteotomies with rigid fixation, and then maxillary osteotomies with rigid fixation. Surgical correction of TMJ pathology can significantly alter the occlusion and mandibular position. However, because the TMJ surgery is done first, the displacement of the mandible from the TMJ surgery is of little consequence, because the mandibular ramus sagittal split osteotomies will allow placement of the mandible into the best occlusal fit with the maxilla in single-jaw surgery. In double-jaw surgery, the mandible is placed into a predetermined position via ramus sagittal split osteotomies and an intermediate splint, with rigid fixation applied, before performance of the maxillary osteotomies.

The author manages the other factors affecting condylar position in the following manner. 1) Minimize soft tissue dissection from the condyle (maximize soft tissue attachment, thus maximizing vascular supply to the condyle). 2) Achieve good hemostasis at surgery. 3) Use a modified sagittal split osteotomy that facilitates seating the condyle into the depth of the fossa[9,10] (Fig 1). 4) Use an intermediate splint to reposition the mandible in double-jaw surgery. 5) Place gentle but firm upward pressure at the angle of the mandible to seat the condyle vertically into the fossa while applying mandibular rigid fixation (Fig 1C). 6) Place gentle but firm upward pressure at the angles of the mandible to vertically seat the condyles when positioning and applying rigid fixation to the maxilla. 7) Do not create posterior open bites, but instead maximize interdigitation of the occlusion at the completion of surgery. 8) Perform careful and accurate surgery. 9) After surgery, use light vertical elastics with a slight Class III vector for 3 to 7 days to control the occlusion and minimize intercapsular edema; then monitor and manage the occlusion appropriately. 10) After surgery, control parafunctional habits (ie, clenching, bruxism).

Benefits of Concomitant Surgery

The benefits of concomitant surgery provided to patients with coexisting TMJ pathology and dentofacial deformities include the following: 1) that it requires one operation and general anesthetic; 2) that it balances occlusion, TMJs, jaws, and neuromuscular structures, at the same time; 3) that it decreases overall treatment time; 4) that it eliminates unfavorable TMJ sequelae that can occur when performing orthognathic surgery only; and 5) that it avoids iatrogenic malocclusion that can occur when performing open TMJ surgery only. Although postsurgical active physical therapy can begin at the surgeon's discretion, passive therapy (rarely necessary) should be delayed for at least 2 months, because excessive forces to the jaws immediately postsurgery could displace the surgically repositioned maxilla and mandible.

Our research[11-33] has shown that concomitant surgical correction of TMJ pathology and coexisting dentofacial deformities, in one operation, provides

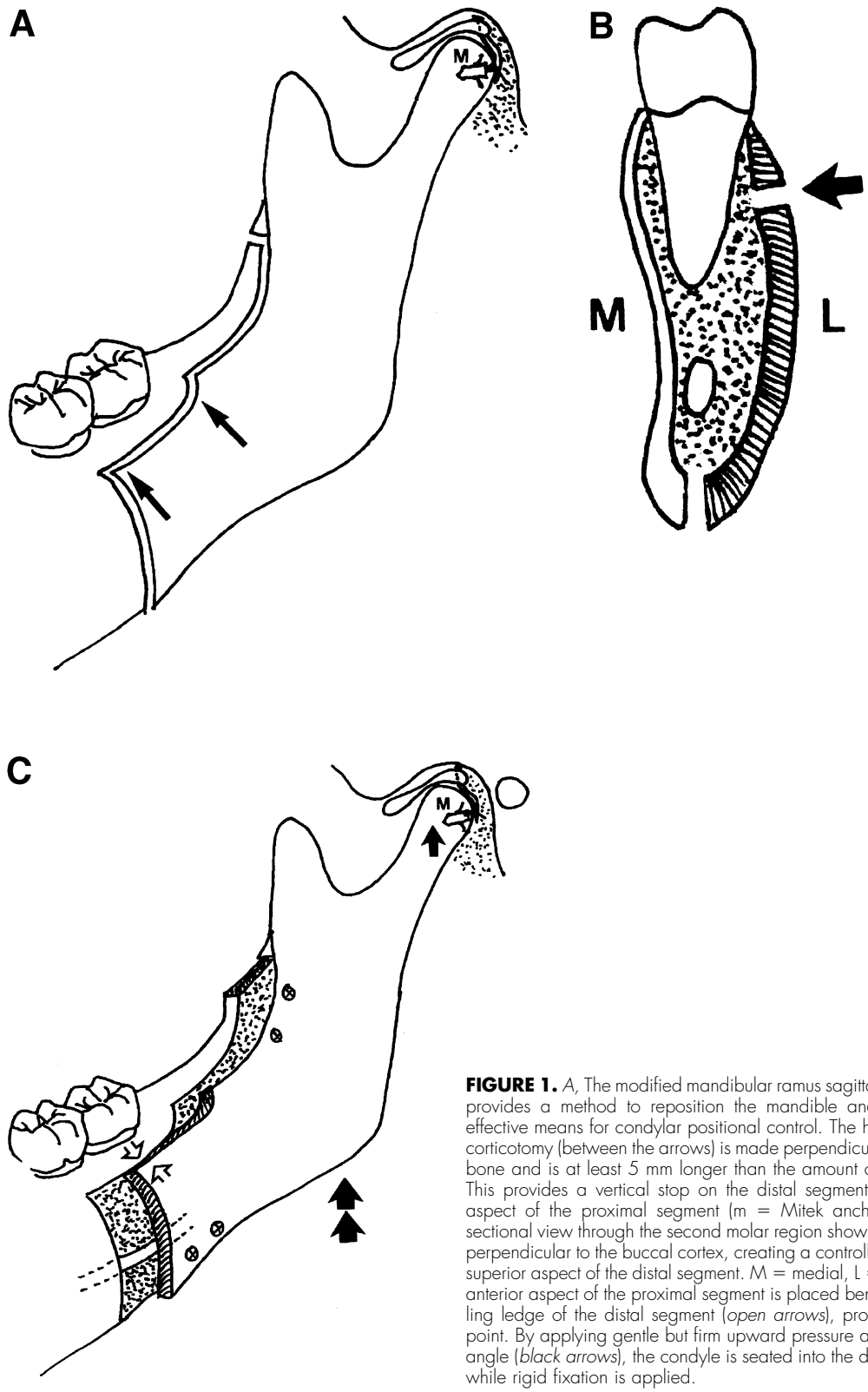

FIGURE 1. *A,* The modified mandibular ramus sagittal split osteotomy provides a method to reposition the mandible and a simple, but effective means for condylar positional control. The horizontal buccal corticotomy (between the arrows) is made perpendicular to the cortical bone and is at least 5 mm longer than the amount of advancement. This provides a vertical stop on the distal segment for the anterior aspect of the proximal segment (m = Mitek anchor). *B,* A cross-sectional view through the second molar region shows the corticotomy perpendicular to the buccal cortex, creating a controlling ledge on the superior aspect of the distal segment. M = medial, L = lateral. *C,* The anterior aspect of the proximal segment is placed beneath the controlling ledge of the distal segment (*open arrows*), providing a fulcrum point. By applying gentle but firm upward pressure at the mandibular angle (*black arrows*), the condyle is seated into the depth of the fossa while rigid fixation is applied.

high-quality treatment outcomes for most patients relative to function, aesthetics, elimination or significant decrease in pain, and patient satisfaction. Equivalent results can also be achieved by separating the TMJ and orthognathic surgical procedures into 2 operations, but the TMJ surgery should be performed first, with the use of a splint to control the occlusion between the procedures.

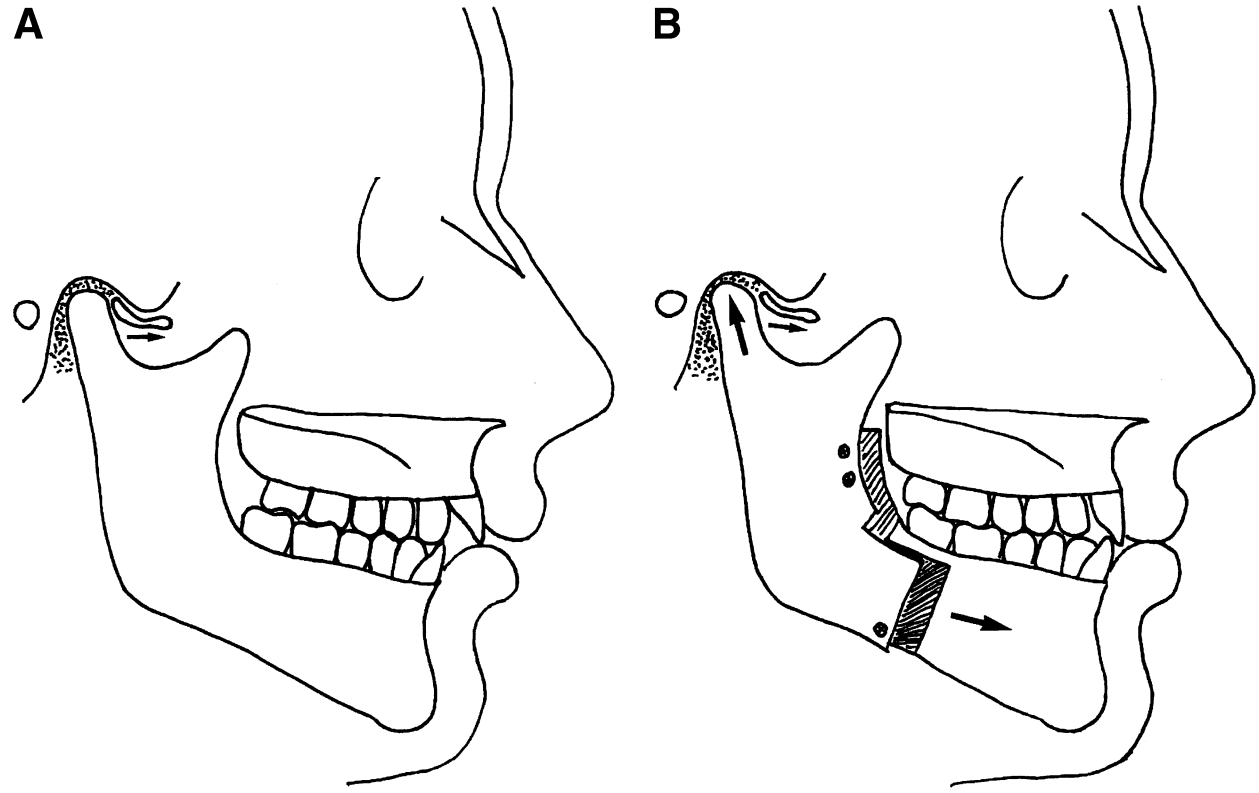

FIGURE 2. *A*,This illustration shows a hypoplastic mandible with a displaced TMJ articular disc. *B*, Advancing the mandible (without TMJ surgery) will maintain the disc in the displaced position, because the condyles will seek the most superoposterior position in the fossa. This can initiate or worsen TMJ pain and dysfunction, headaches, condylar resorption, etc.

Articular Disc Dislocation

The most common TMJ pathology is an anterior and/or medial displaced articular disc that can initiate a cascade of events leading to arthritis and TMJ related symptoms.[3,4] When a mandible is advanced in a patient with displaced discs, the discs remain displaced as the condyles seek a superoposterior position in the fossa (Figs 2A, B). Therefore, a logical treatment would be to put the disc back into a normal, anatomical, functional position. Concomitant treatment (when the discs are salvageable) would include articular disc repositioning and stabilization using the Mitek anchor (Mitek Surgical Products Inc, Westwood, MA) technique[11-18] and performing indicated orthognathic surgery (Fig 1).

Our study[13] using this treatment protocol on 70 patients showed that presurgery, 80% of the patients had TMJ pain, but at longest follow-up, 60% had complete relief of pain, and an additional 33% had significant reduction in pain. All but 1 patient had stable orthognathic surgery outcomes. Using the criteria of incisal opening greater than 35 mm, stable skeletal and occlusal relationships, and significant reduction in pain, the success rate was 91%. In addition, the success rate was significantly better if the TMJ articular discs were surgically repositioned within the first 4 years of onset of the TMJ dysfunction. After 4 years, the progression of irreversible TMJ degenerative changes may preclude a good result. Another study[14] evaluated 88 different patients with concomitant TMJ and orthognathic surgery that likewise showed a statistically significant decrease in TMJ pain and headaches, while improving jaw function and providing stable occlusal and skeletal results.

Idiopathic Condylar Resorption

ICR is a pathologic condition that primarily affects teenage females. In a patient with ICR, the articular disc is anteriorly displaced (magnetic resonance imaging is the best diagnostic tool) and condylar resorption occurs, creating a slow but progressive retrusion of the mandible, with 25% of the patients being asymptomatic. A treatment protocol developed by the author proved to eliminate the pathological condition and allow optimal correction of the associated dentofacial deformity includes the following: 1) removal of the hypertrophied bilaminar and synovial tissues, 2) repositioning and stabilization of the articular disc to the condyle with the Mitek anchor technique, and 3) performance of orthognathic surgery.[19,20]

Our initial study[19] involved 12 patients with active ICR who underwent concomitant TMJ and orthognathic surgery. The average postsurgical follow-up was 33 months, with very stable results and a significant reduction in pain.

A more recent study[20] evaluated 44 patients with active ICR, divided into 2 groups. Group 1 (n = 10) underwent orthognathic surgery only, with no TMJ surgical treatment. Group 2 (n = 34) underwent TMJ articular disc repositioning with the Mitek anchor technique, as well as concomitant orthognathic surgery. In group 1, ICR continued after surgery, resulting in statistically significant skeletal and occlusal instability and relapse. All group 2 patients maintained stable skeletal and occlusal outcomes and had a statistically significant reduction in pain and improvement in jaw function compared with group 1.

Condylar Hyperplasia

Condylar hyperplasia (CH) affects the mandibular condyles, creating excessive overgrowth of the mandible, often continuing into the patient's mid-20s. Bilateral active CH causes progressive prognathism. Unilateral CH can cause progressive deviated prognathism, facial asymmetry, and articular disc dislocations. However, not all prognathic mandibles are caused by CH—only those showing accelerated excessive mandibular growth and/or growth continuing beyond the normal growth years. The treatment protocol of the author for these patients includes 1) high condylectomy to arrest the condylar growth, 2) articular disc repositioning, and 3) concomitant orthognathic surgery.[21,22] This protocol, when properly performed, stops mandibular growth and provides highly predictable and stable outcomes with great jaw function.

Our recent study[22] included 54 patients (32 females and 22 males; average age, 17 years) with confirmed active CH followed for 5 years postsurgery and divided into 2 groups. Group 1 patients (n = 12) were treated with orthognathic surgery only, and group 2 patients (n = 42) were treated with high condylectomy, articular disc repositioned over the remaining condyle, and orthognathic surgery. All patients in group 1 redeveloped skeletal and occlusal Class III relationships. In group 2, all 42 patients remained in a stable Class I skeletal and occlusal relationship with excellent jaw function.

Mandibular Condylar Osteochondroma

An osteochondroma is a unilateral pathologic process that can cause enlargement of the mandibular condyle, creating a progressive, asymmetric dentofacial deformity. The pathology can be predictably treated with a low condylectomy, preserving the condylar neck, which is recontoured to function as a "new condyle," and the articular disc is stabilized to it. Concomitant orthognathic surgery can be performed to provide optimal functional and aesthetic results and long-term stability. Our study[23] of 6 patients treated by this protocol showed at 4 years postsurgery no recurrence of the tumors, and the jaw structures and occlusions were stable.

Congenital Deformities

Patients with congenital conditions such as hemifacial microsomia, Treacher-Collins syndrome, etc may benefit greatly from TMJ reconstruction and concomitant orthognathic surgical procedures. When condyles are congenitally missing, autogenous grafts (ie, rib grafts,[35,36] sternoclavicular grafts[24,25]) are most commonly used for condylar and ramus reconstruction. The mandible can be advanced or vertically lengthened with either autogenous graft system. Our previous studies[24,25] showed that sternoclavicular grafts and concomitant orthognathic surgery worked well in the adolescent and older patient population, resulting in good function, aesthetics, and long-term stability. In late adolescent and adult patients or those with failed autogenous grafts or multiply operated, excellent outcomes can be achieved using custom-made total joint prosthesis (TMJ Concepts Inc, Camarillo, CA) for TMJ reconstruction and mandibular repositioning.[14] A custom-fitted fossa component can be attached to the temporal bone even if there is no fossa or zygomatic arch present. Other indicated orthognathic surgical procedures can be completed concomitantly.

Nonsalvageable Joints

The TMJ can become nonsalvageable (not amendable to autogenous tissue reconstruction) as a result of the following conditions: 1) connective tissue/autoimmune diseases (ie, rheumatoid arthritis, psoriatic arthritis, lupus, scleroderma, Sjörgen's syndrome, ankylosing spondylitis, etc); 2) reactive arthritis (ie, Reiter's syndrome); 3) severe osteoarthritis; 4) neoplasms; 5) multiply operated joints; 6) previously placed alloplastic implants (ie, Proplast/Teflon [Vitek, Houston, TX], Silastic [Dow Corning, Midland, MI], metal fossa liners); 7) severely traumatized joints; or 8) ankylosis. Patients with these conditions may benefit from TMJ reconstruction and repositioning of the mandible with total joint prostheses, as well as concomitant orthognathic surgical procedures.[26-32]

Two studies[27,28] showed very good outcomes in treating connective tissue/autoimmune diseases affecting the TMJ with custom-made total joint prosthe-

ses (TMJ Concepts system) for TMJ reconstruction and simultaneous advancement of the mandible with concomitant orthognathic surgery on the maxilla. The average mandibular advancement was 15 mm at point B with very stable results and significant improvement in pain levels and jaw function. Another study[26] showed good outcomes using these custom-made total joint prostheses and orthognathic surgery in treating other TMJ disorders including multiply operated joints and those having previous alloplastic TMJ implants. However, the quality of results decreases as the number of previous operative procedures increases, particularly in reference to pain.[26]

Conclusions

During the past 2 decades, our specialty has made significant advancements in TMJ diagnostics and the development of procedures to treat and surgically rehabilitate the dysfunctional and pathological TMJ. Our research showed that TMJ and orthognathic surgery can be safely and predictably performed at the same operation, but it does require the surgeon to have expertise in both TMJ and orthognathic surgery. Poor TMJ surgery outcomes are usually related to any of the following: wrong diagnosis, wrong surgical procedure, poorly executed surgery, inadequate follow-up care, and/or unrecognized or untreatable local and/or systemic factors. The concomitant approach may be considered controversial by some but offers a means to provide complete and comprehensive surgical management of patients with coexisting TMJ pathology and dentofacial deformities. The author has operated on hundreds of patients using concomitant TMJ and orthognathic surgery, who are now pain free or have a significant decrease in pain, with good jaw function and stable occlusions, as well as good facial balance. Interestingly, a significant percentage of those patients were previously treated elsewhere with the "orthognathic surgery only" philosophy and sought retreatment because their TMJs were degenerated, dysfunctional, and painful, and their occlusions and aesthetics compromised. We should continually strive for better methods of treatment and patient care. The author recommends that the reader more completely educates himself or herself on this subject and becomes able to provide comprehensive surgical treatment for these challenging patients.

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