

REVIEW ARTICLE

Orthodontic Treatment and Its Relation to Temporomandibular Joint Pathologies

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ABSTRACT

There are many temporomandibular joint (TMJ) conditions that can cause orthodontic treatment instability and relapse. These conditions are often associated with dentofacial deformities, malocclusion, TMJ pain, headaches, myofascial pain, TMJ and jaw functional impairment, ear symptoms, etc. Many of these TMJ conditions can cause progressive and continuous changes in the occlusion and jaw relationships. Patients with these conditions may benefit from corrective orthodontic and surgical intervention. 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. This paper will discuss the most common TMJ pathologies that can adversely affect orthodontic stability and outcomes as well as present the treatment considerations to correct the specific TMJ conditions and associated jaw deformities to provide stable and predictable treatment results.

Keywords: Orthodontic treatment, Orthognathic surgery, Relapse, Temporomandibular joint.

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INTRODUCTION

The problems associated with the diagnosis and management of temporomandibular disorders (TMD) have aroused interest to the orthodontists. Their attention to signs and symptoms associated with TMD has modified the clinical management before and during orthodontic treatment.¹⁻⁴ According to the American Academy of Orofacial Pain, the term TMD refers to a set of clinical

problems that involve the masticatory musculature, the temporomandibular joint (TMJ) and associated structures, or both, being identified as the leading cause of nondental pain in the orofacial region and is considered as a subclass of musculoskeletal disorders.⁵ There are many TMJ conditions that can cause orthodontic treatment instability and relapse. The most common of these conditions include: (1) Articular disk dislocation, (2) reactive arthritis, (3) adolescent internal condylar resorption (AICR), (4) condylar hyperplasia (CH), and (5) end-stage TMJ pathology (i.e., connective tissue/autoimmune diseases, advanced reactive arthritis and osteoarthritis, traumatic injuries, ankylosis, etc.). These conditions are often associated with dentofacial deformities, malocclusion, TMJ pain, headaches, myofascial pain, TMJ and jaw functional impairment, ear symptoms, etc. Many of these TMJ conditions can cause progressive and continuous changes in the occlusion and jaw relationships. Patients with these conditions may benefit from corrective orthodontic and surgical intervention. 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. This paper will discuss the most common TMJ pathologies that can adversely affect orthodontic stability and outcomes as well as present treatment considerations to correct the specific TMJ conditions and associated jaw deformities to provide stable and predictable treatment results.⁶

RELATION BETWEEN TEMPOROMANDIBULAR JOINTS AND RELAPSE

The TMJs are the foundation and support for jaw position, function, occlusion, and facial balance necessary for quality treatment outcomes in orthodontics and orthognathic surgery. If the TMJs are not stable and healthy (nonpathological), treatment outcomes may be unsatisfactory relative to function, esthetics, stability, and pain. Contrary to popular belief, orthognathic surgery to correct a malocclusion and jaw deformity will not "fix" or eliminate coexisting TMJ pathology and symptoms. Studies demonstrate that performing orthognathic surgery only on patients with coexisting TMJ pathology can result in unsatisfactory treatment outcomes, such as relapse, malocclusion, TMJ pain, headaches, myofascial pain, and masticatory dysfunction. Clinical, radiographic imaging,

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dental model, magnetic resonance imaging (MRI), and/or computed tomography scan evaluations, as well as patient history are very important for accurate diagnosis of the TMJ pathology and treatment planning. With appropriate selection and execution of the orthodontics and surgical procedures, as well as proper postsurgical management, good outcomes can usually be achieved.^{7,8} Temporomandibular joint surgery (i.e., disk repositioning, arthroplasties, high condylectomies, etc.) can significantly alter the position of the mandible and the occlusion. Therefore, the surgical sequencing for performing TMJ and orthognathic surgery at one operation or divided into two operations (the TMJ and orthognathic procedures are done separately) is important to achieve good outcomes and includes TMJ surgery first, followed by mandibular ramus sagittal split osteotomies with rigid fixation, and then if indicated, maxillary osteotomies with rigid fixation. With the mandibular osteotomies being performed after the TMJ surgery, the mandible will be positioned into its predetermined position regardless of the amount of mandibular displacement resulting from the TMJ surgery. The jaws are not wired together postsurgery since rigid fixation (bone plates and screws) is used to stabilize the osteotomy sites. Light vertical elastics (3/16 inch, 3½ ounce) with a slight class III vector are usually used postsurgery to control the occlusion and minimize intercapsular edema. Close monitoring and managing of the occlusion in the postsurgery period as well as controlling the para-functional habits (i.e., clenching, bruxism) are very important to provide quality outcomes. Open TMJ surgery provides direct access to the TMJ allowing manipulation, repair, removal, and/or reconstruction of the anatomical structures that cannot be accomplished by other means, such as arthroscopy, arthrocentesis, splint therapy, orthodontics, or other nonsurgical treatment modalities. Although, arthroscopy and arthrocentesis may have a role in some TMJ conditions, these procedures are contraindicated when jaw deformities coexist and orthognathic surgery is required. Arthroscopy and arthrocentesis do not reposition the articular disk into a proper anatomical position with adequate stabilization to withstand the increased TMJ loading that is unavoidable in orthognathic surgery, particularly with mandibular advancements. Rather, arthroscopy and arthrocentesis tend to displace the disk further.^{9,10}

ARTICULAR DISK DISLOCATION

The most common TMJ pathology is an anteriorly displaced disk. This condition can initiate a cascade of events leading to arthritis and TMJ-related symptoms.¹¹ Simultaneous surgical treatment would include repositioning the TMJ disk into a normal, anatomical, functional position

and stabilize it using the Mitek anchor (Mitek Surgical Products Inc., Westwood, MA) technique,¹² and then perform the indicated orthognathic surgery. The Mitek anchor technique uses a bone anchor, i.e., placed into the lateral aspect of the posterior head of the condyle with subsequent osseointegration of the anchor.

REACTIVE ARTHRITIS

Reactive arthritis (also called seronegative spondyloarthropathy) is an inflammatory process in joints commonly related to bacterial and/or viral factors, usually occurring in the 3rd to 4th decade, but can develop at any age. These bacteria are known to stimulate the production of substance P, cytokines, and tissue necrosis factor, which are all pain modulating factors. We have also identified specific genetic factors, human leukocyte antigen markers that occur at a significant greater incidence in TMJ patients than the normal population indicating a genetic predisposition to TMJ pathology.¹³ Patients with localized TMJ reactive arthritis will usually have displaced disks, pain, TMJ and jaw dysfunction, ear symptoms, headaches, etc. As the disease progresses, condylar resorption and/or bony deposition can occur, causing changes in the jaw and occlusal relationships, as well as function. Patients with moderate to severe reactive arthritis may have other body systems involvement, such as other joints, genitourinary, gastrointestinal, reproductive, respiratory, cardiopulmonary, ocular, neurological, vascular, hemopoietic, immune, etc.¹⁴ Most patients with mild to moderate reactive arthritis, without significant involvement of other body systems, may respond well to articular disk repositioning and the appropriate orthognathic surgery procedures.

ADOLESCENT INTERNAL CONDYLAR RESORPTION

Adolescent internal condylar resorption is a pathological, hormonally mediated condition primarily affecting teenage females (ratio 9:1, females to males), which get initiated as they enter their pubertal growth phase. Patients with AICR have a classic facial morphology: (1) Retruded mandible, (2) high occlusal plane angle, and (3) tendency for a class II open bite that worsens with time. In AICR, it is postulated that the female hormones stimulate the hyperplasia of the synovial tissues, which then produce chemical substrates that destroy the ligaments that normally stabilize the disk to the condyle. The disk becomes anteriorly displaced, and the condyle is then surrounded by the hyperplastic synovial tissue that continues to release chemical substrates that penetrate the condylar head causing internal condylar resorption, creating a slow but progressive decrease in size of the condyle and retrusion of the mandible. In AICR, the

condylar resorption is internal with inward collapse of the overlying thinned cortical bone and fibrocartilage. Other TMJ resorptive pathologies resorb the condyle from the outside. Interestingly, 25% of the patients with AICR are asymptomatic relative to pain and joint noises increasing the challenge for diagnosis.^{15,16}

Condylar Hyperplasia

Condylar hyperplasia indicates pathological enlargement of the mandibular condyle. Normal facial and jaw growth is usually 98% complete in females at age 15 years, and in males at age 17 to 18 years. Condylar hyperplasia type 1 is an accelerated and prolonged growth condition of the "normal" condylar growth mechanism – creating mandible (prognathism), often continuing into the patient's mid 20s, but is self-limiting. Bilateral occurrence is classified as CH type 1A causing progressive and worsening prognathism, but relatively asymptomatic for TMJ symptoms. On MRI examination, the articular discs in CH type 1A patients are commonly very thin and sometimes very difficult to identify. The condylar heads and necks are usually excessively long. The unilateral condition is classified as CH type 1B that can cause progressively worsening deviated prognathism, facial asymmetry, disk dislocation, and arthritic changes on the contralateral side, TMJ pain, headaches, masticatory dysfunction, etc. Not all prognathic mandibles are caused by CH; only those demonstrating accelerated, excessive mandibular growth, and/or growth continuing beyond the normal growth years. Differential diagnosis includes prognathism with normal growth of the jaws, or deficient maxillary growth with a normal growing mandible. The treatment protocol developed by the author¹⁷ for these CH type 1 includes: (1) High condylectomy to arrest the condylar growth; (2) TMJ disk repositioning over remaining condyle; and (3) simultaneous orthognathic surgery. This protocol predictably stops mandibular growth and provides highly predictable and stable outcomes with normal jaw function and good esthetics.

END-STAGE TEMPOROMANDIBULAR JOINT PATHOLOGY

The TMJ can become end-stage, nonsalvageable (not amendable to autogenous tissue reconstruction) as a result of the following conditions: (1) Connective tissue/autoimmune diseases (i.e., rheumatoid arthritis, psoriatic arthritis, lupus, scleroderma, Sjogren's syndrome, ankylosing spondylitis, etc.); (2) reactive arthritis; (3) osteoarthritis; (4) neoplasms; (5) multiply operated joints; (6) failed TMJ autogenous grafts or alloplastic implants; (7) traumatized joints; (8) absence of the joint (i.e., Hemifacial microsomia); or (9) ankylosis. Some patients with these conditions may

have severe pain, TMJ and jaw dysfunction, facial deformities, and major disability issues. Patients with these TMJ pathologies, regardless of the severity, may benefit from TMJ reconstruction and mandibular repositioning with total joint prostheses as well as simultaneous maxillary orthognathic surgery, if necessary, to achieve the best outcome results relative to function, stability, esthetics, and pain.^{18,19}

DISCUSSION

Research has clearly demonstrated that TMJ and orthognathic surgery can be safely and predictably performed at the same operation, but it does necessitate the correct diagnosis and treatment plan, as well as requires the surgeon to have expertise in both TMJ and orthognathic surgery. The surgical procedures can be separated, but the TMJ surgery should be done first. Poor TMJ surgery outcomes are usually related to wrong diagnosis, wrong surgical procedure, poorly executed surgery, inadequate follow-up care, and/or unrecognized or untreatable local, and/or systemic factors. With the correct diagnosis and treatment plan, the simultaneous TMJ and orthognathic surgical approach provides complete and comprehensive management of patients with coexisting TMJ pathology and dentofacial deformities. Patients who develop significant changes in their occlusion, jaw alignment, and masticatory function (with or without TMJ pain, headaches, myofascial pain, ear symptoms, etc.) commonly have TMJ pathology that is either causing condylar resorption (i.e., AICR, reactive arthritis, connective tissue/autoimmune diseases, etc.) or condylar growth (i.e., CH types 1 or 2, etc.). Postorthognathic surgery outcome instability (relapse) is usually related to poor surgical technique (jaws improperly positioned or inadequately stabilized) and/or undiagnosed and untreated TMJ pathology. In cases with poorly performed or inadequately stabilized surgical procedures, relapse is usually evident immediately or within 2 to 3 weeks postsurgery. Temporomandibular joint pathology that causes "relapse" usually involves condylar resorption or condylar growth and occurs over time, often taking months until the problem is identified.³

CONCLUSION

To properly treat patients to achieve consistently high quality and predictable outcomes, orthodontists and oral and maxillofacial surgeons must understand the common TMJ pathologies, adverse affects on treatment outcomes if ignored, methods of diagnosis, and the predictable results that can be achieved by application of indicated orthodontic and surgical treatment protocols.

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