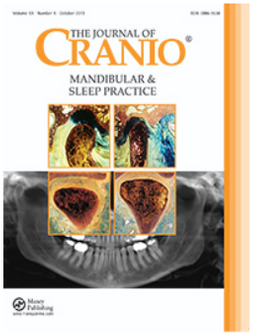

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TMJ

Adolescent internal condylar resorption (AICR) of the temporomandibular joint, part 1: A review for diagnosis and treatment considerations

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ABSTRACT

Background: Adolescent internal condylar resorption (AICR) is a temporomandibular joint (TMJ) pathology that develops predominately in teenage females during pubertal growth (onset between ages 11 and 15 years), with a distinct clinical, radiographic, and magnetic resonance imaging (MRI) presentation.

Clinical and imaging presentation: The condition usually occurs bilaterally with: (1) Progressive retrusion of the mandible; (2) High occlusal plane angle facial morphology; (3) Worsening Class II occlusion; and (4) TMJ symptoms such as pain, headaches, noises, etc. MRI imaging demonstrates decreased condylar head size and anterior disc displacement.

Treatment protocol: AICR can be successfully treated when the condyles and discs are salvageable with the following surgical protocol: (1) Removal of bilaminar tissue surrounding the condyle; (2) Reposition the disc with the Mitek anchor technique; and (3) Orthognathic surgery to advance the maxillo-mandibular complex in a counterclockwise direction.

Conclusion: AICR can be successfully treated using the specific protocol presented herein to provide stable and predictable outcomes.

KEYWORDS

Adolescent internal condylar resorption (AICR); mandibular condylar resorption; mandibular condyle; temporomandibular joint (TMJ); orthognathic surgery; disc repositioning; Mitek anchor; high occlusal plane angle

Introduction

Adolescent internal condylar resorption (AICR) is a progressive disease that affects only the temporomandibular joints (TMJ), resulting in condylar resorption in all three planes of space, malocclusion, facial deformity, and TMJ dysfunction, with or without pain. AICR is poorly understood and commonly unrecognized by those in the dental and medical professions. The onset of this disease is almost always between the ages of 11 and 15 years, predominately in females (8:1), during pubertal growth. These patients have characteristic clinical signs, such as high occlusal plane angle (HOP) facial morphology, slow but progressive mandibular retrusion, and Class II malocclusion with or without anterior open bite [1,2]. Imaging studies, such as cone beam computed tomography imaging, lateral cephalogram, computed tomography, and magnetic resonance imaging (MRI), can demonstrate condylar resorption, articular disc anterior displacement, and associated dentofacial deformity.

AICR is a distinct TMJ pathology, different from other conditions that cause mandibular condylar resorption in reference to etiology, pathophysiology, clinical presentation, imaging characteristics, and treatment protocol. Unfortunately, AICR has been thrown in with other TMJ conditions that cause mandibular condylar resorption, collectively called by different names, such as idiopathic condylar resorption, idiopathic juvenile condylar resorption, idiopathic condylysis, condylar atrophy, progressive condylar resorption, and cheerleader syndrome [3–16]. There are a number of specific TMJ local and systemic pathologies or diseases different from AICR that can cause mandibular condylar resorption. Local factors include osteoarthritis, reactive arthritis, avascular necrosis, infection, traumatic injuries, etc. Connective tissue or autoimmune diseases can cause TMJ condylar resorption, such as juvenile idiopathic arthritis, rheumatoid arthritis, psoriatric arthritis, scleroderma, systemic lupus erythematosis, Sjögren's syndrome, ankylosing spondylitis, and others.

The occurrence of condylar resorption has been identified by many authors [3–12] as having association with orthodontic treatment and orthognathic surgery. However, these treatment modalities are usually coincidental and

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not the specific cause of the problem, although these treatment methods can exacerbate the pathological process. The initiation of AICR usually occurs between the ages of 11 and 15 years; the same time many teenage patients are undergoing orthodontic treatment. If AICR is unrecognized and untreated when a patient undergoes orthodontic treatment and/or orthognathic surgery, post treatment mandibular relapse is predictable.

Previously recommended treatment in the literature for condylar resorption includes the following: (1) Splint therapy to minimize joint loading; (2) Medications to slow down the resorption process; (3) Non-loading orthodontic and orthognathic surgical procedures (e.g. maxillary surgery only) after 6–12 months of disease remission; (4) Arthroscopic lysis and lavage; and (5) Condylar replacement with a costochondral graft [13–16]. None of these methods of management will provide predictable stable outcomes, optimal function, esthetic results, or eliminate pain in patients with AICR. Wolford et al. [1,2] published a highly predictable treatment protocol that effectively stops the AICR disease process and provides predictable functional and esthetic results, as well as eliminates or significantly reduces pain levels. This paper will present the diagnostic factors, the specific treatment protocol, and previously published outcomes.

AICR predisposition

There are specific factors and pre-existing facial morphological characteristics that significantly increase susceptibility to AICR. These factors include: (1) Teenage females (approximately 8:1 female to male ratio); (2) Onset age range from 11 to 15 years old, during pubertal growth; (3) HOP (dolicocephalic) facial morphology (Figure 1(A,B)); and (4) Predominance of Class II skeletal and occlusal relationship with or without an anterior open bite (Figure 2(A,B)). AICR rarely occurs in low occlusal and mandibular plane angle (brachyocephalic) facial types or in Class III skeletal relationships [1,2]. Only the TMJs are affected, and no other joints are involved. There are no known genetic correlations to AICR, and all cases appear to be isolated incidents. The occurrence rate in the general population is unknown.

Pathogenesis of AICR

Although the specific cause of AICR has not been clearly identified, its strong predilection for teenage females in their pubertal growth phase supports a theory of hormonal mediation. Estrogen receptors have been identified in the TMJs of female primates [17,18], human TMJ tissues that appear to correlate to TMJ symptoms [19], and in arthritic knee joints [20]. Estrogen is known to mediate cartilage and bone metabolism in the female TMJ. An increase in receptors may predispose an exaggerated response in the bilaminar tissues where an increase of synovial cells has been identified in this non-inflammatory pathological condition. Increased TMJ loading from parafunctional activity, trauma, orthodontics, or orthognathic surgery may accelerate the resorption process. Gunson et al. propose that abnormally low 17 beta-estradiol contributes to condylar lysis [21].

The authors' hypothesis for the initiation and progression of AICR is as follows: Increased production of female hormones during pubertal growth stimulates female hormone receptors in the TMJ tissues. The female hormones mediate biochemical changes within the TMJ bilaminar tissues, causing hyperplasia of the synovial tissues that then stimulate the production of destructive substrates that initiate breakdown of the ligamentous structures that normally support and stabilize the articular disc in position. This allows the disc to become anteriorly displaced.

The hyperplastic synovial tissue then surrounds the head of the condyle, with the destructive substrates penetrating through the fibrocartilage into the osseous

Figure 1. (A) 18 year old female with adolescent internal condylar resorption (AICR) demonstrates good frontal facial symmetry. (B) In profile, the retruded mandible and high occlusal plane (HOP) facial morphology are evident. (C,D) The patient is seen three years post surgery demonstrating good facial balance. Source: Wolford and Galiano.

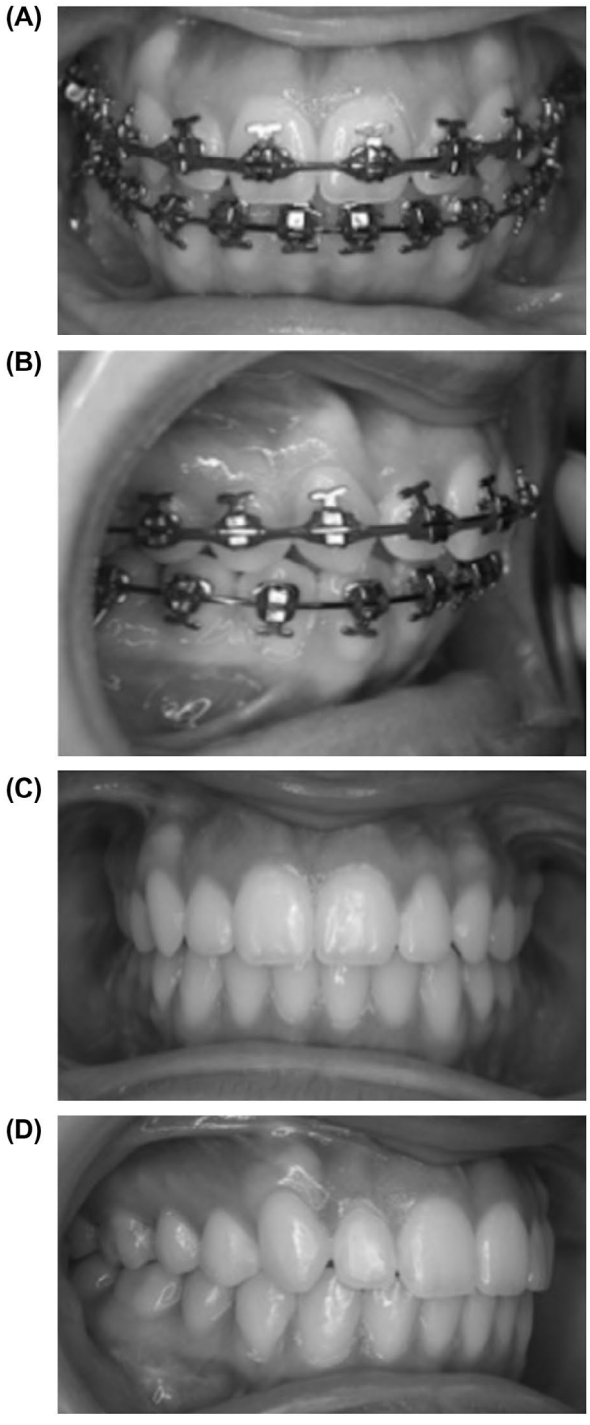

Figure 2. (A,B) The Class II end-on occlusal relationship that has been getting progressively worse is noted. (C,D) At three years post surgery, the patient is noted to have a good, stable occlusal relationship.

structures of the condylar head, creating an internal condylar resorptive phenomena by breaking down the subcortical and medullary bone. The condyle shrinks in size in all three planes of space without apparent destruction of the fibrocartilage on the condylar head and fossa, unlike the other arthritides, where the fibrocartilage is destroyed by the disease progression. AICR is a non-inflammatory process that can progress for a while and then go into remission or proceed on until the condylar head has resorbed. In cases where it goes into remission, excessive joint loading (i.e. para-functional habits, trauma, orthodontics, orthognathic surgery, etc.) can reinitiate the resorption process at a later time.

Clinical characteristics

The diagnosis of AICR can usually be made based on patient history, clinical examination, and imaging. Prior to the onset of AICR, patients may have a relatively normal facial balance or may have a Class II skeletal and occlusal relationship. The disease process usually occurs bilaterally with the following clinical characteristics: (1) A relatively slow but progressive posterior shift of the mandible initiated during pubertal growth; (2) Development of an HOP angle facial morphology with retruded mandible and maxilla; (3) Development or worsening of the Class II occlusal relationship with or without an anterior open bite (Figures 1(A,B); 2(A,B); 3(A)); and (4) TMJ symptoms such as pain, headaches, noises, ear symptoms, etc. In unilateral cases, or in bilateral cases with a differential rate of resorption at the condyles, the following can occur: (1) The mandibular dental midline and chin shift toward the affected side; (2) Development of an ipsilateral Class II occlusion as well as posterior crossbite and occlusal prematurity on the ipsilateral side; and (3) Development of an open bite anteriorly and on the contralateral side. Although TMJ symptoms such as TMJ pain, headaches, myofascial pain, clicking, popping, etc. can be present, sometimes they are mild or non-existent. In fact, 25% of the AICR patients in the authors' previous studies [1,2] had no TMJ symptoms. Clicking and popping may be absent because the disc can become non-reducing relatively early in the pathological process, creating a "silent" joint during jaw function. On the other hand, the hyperplastic synovial tissue can increase in thickness, providing a smooth transition of the condyle onto the displaced disc during condylar translation. The AICR patients without TMJ symptoms and silent joints are very challenging to diagnose; but these patients require treatment just as necessarily as patients with significant symptoms to stop the progression of disease, re-establish function, facial balance, correct obstructive airway problems if present, and eliminate pain. AICR patients commonly have partial nasal airway obstruction with hypertrophied turbinates and a decreased oropharyngeal airway dimension because of the retruded mandibular position.

Other body joints are not involved in TMJ AICR. If a patient has other symptomatic joints, then the TMJ condition may not be AICR but a systemic disorder that may

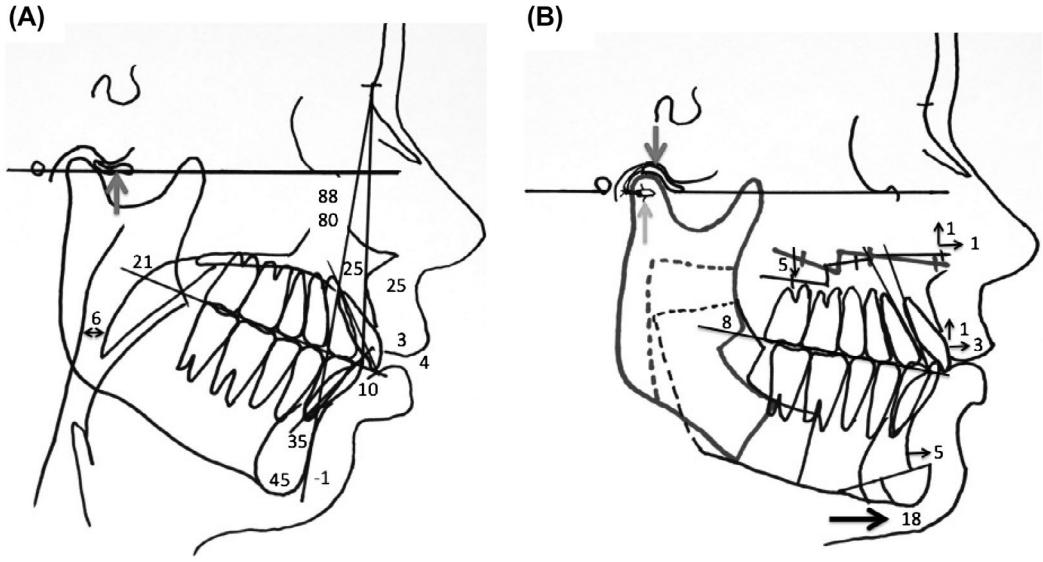

Figure 3. (A) Pre-surgery cephalometric analysis demonstrates the high occlusal plane (HOP) facial morphology with the retruded mandible. (B) The surgical prediction tracing illustrates the counterclockwise rotation of the maxillo-mandibular complex as well as repositioning the articular discs and augmentation genioplasty.

require a different treatment protocol. Laboratory studies may be indicated, particularly if other joints are involved, to evaluate for connective tissue/autoimmune diseases or reactive arthritis that can also cause condylar resorption. There are no laboratory tests specific for AICR.

Imaging characteristics

Imaging modalities most helpful in diagnosis and treatment planning for AICR include: (1) Cone beam imaging; (2) Lateral cephalometric radiograph; (3) TMJ CT scans or tomograms, (4) panographic radiographs, and (5) MRI imaging. AICR findings on the lateral cephalometric radiographic include: (1) Skeletal and occlusal Class II deformity with or without an anterior open bite (Figure 3(A)); (2) High occlusal and mandibular plane angles; (3) Decreased vertical height of the posterior maxilla and mandibular rami; (4) Lower incisors may appear over-angulated; and (5) Significant decrease in the oropharyngeal airway in more severe cases, which may result in the development of sleep apnea symptoms [22]. Serial lateral cephalometric radiographs may demonstrate slow but progressive retrusion of the mandible during the active resorption phase of the disease. Previous studies demonstrated a pre-treatment condylar resorption rate of 1.5 mm per year in AICR patients with pogonion retruding at a rate of 2.5 mm per year [1,2].

TMJ imaging may show relatively normal or excessive joint space because of the hyperplasia of the synovial tissues that can develop within the joint, or there could be decreased joint space. The involved condylar head(s) will appear smaller in size, the degree of which will be dependent on the length of time since the onset of the pathosis and aggressiveness of the disease. Imaging may demonstrate cortical thinning on the condylar head, and there may be some loss of integrity of the cortical bone, or less commonly, the cortical bone may appear relatively normal. Superimposition of serial lateral cephalometric radiographs and TMJ tomograms at 6–12 month intervals will usually document the presence and rate of active condylar resorption.

MRI imaging demonstrates the following important characteristics: (1) Decreased condylar head size and volume; (2) Anterior disc displacement, with or without reduction on opening; (3) May have thinness or loss of continuity of cortical bone on the head of the condyle, or occasionally may appear relatively normal; and (4) May have normal or increased joint space with amorphous appearing soft tissue between the condyle and fossa (Figure 4), or there could be decreased joint space. The degree of deformation and degenerative changes of the disc will be dependent on the length of time that the disc has been displaced and whether it is reducing or non-reducing on opening. Discs deform and degenerate more rapidly when they are non-reducing. Determination must be made if the disc is salvageable and whether there is adequacy of the remaining condyle to withstand normal functional loading and stress forces created by the current situation and indicated orthognathic surgery procedures that usually require counterclockwise rotation of the maxillo-mandibular complex for optimal functional and esthetic outcomes. There is a four-year window from onset of AICR to surgery where the disc is usually still salvageable and a good predictable outcome can be achieved [23].

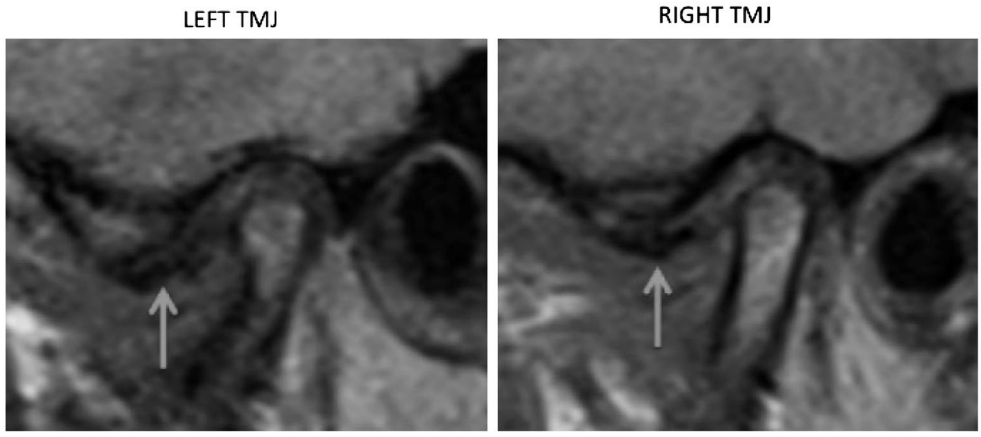

Figure 4. Bilateral MRIs of a patient with adolescent internal condylar resorption (AICR). The condyles appear small in size, and the cortical bone on top of the condyle is somewhat thin. The articular discs are anteriorly displaced (gray arrows). In AICR patients, the articular discs may or may not reduce on opening.

After four years, the disc may become non-salvageable, and therefore, patient-fitted total joint prostheses may be indicated to get the best treatment outcome.

Surgical observations

Entering the superior joint space, the articular disc will be anteriorly displaced and may or may not demonstrate significant deformation and degenerative changes, depending on the length of time that the disc has been displaced and whether it is reducing or non-reducing. The hyperplastic synovial tissue will cover the condylar head and may appear amorphous in nature with little vascular component, and without inflammation. Entering the lower joint space and subsequently removing the portion of the bilaminar tissue surrounding the condyle allows examination of the condylar head that may be significantly smaller than normal. However, the condylar head and glenoid fossa will reveal intact fibrocartilage covering both structures, without evidence of erosion or osteophytic formation. If the fibrocartilage is absent and bony erosion is present on the condyle and fossa, then the disease process is not AICR. Histologically, the bilaminar tissues will usually demonstrate synovial hyperplasia without inflammation.

Surgical treatment protocol

MRI imaging of the TMJ was developed in the mid 1980s [24,25] and provided the initial identification of AICR. Early clinical experience treating AICR patients with traditional orthognathic surgery and ignoring the TMJs resulted in poor outcomes with significant mandibular relapse. It was clearly evident that if the TMJs were not stable and healthy in this pathological process, the orthognathic surgery would be unstable and relapse [26]. Wolford developed a surgical treatment protocol in 1989 to treat AICR, but it wasn't until 1992, with the introduction of the Mitek mini anchor (Mitek Inc., Westwood, MA, USA) technique [27] to stabilize the articular discs in the normal anatomical position, that the treatment protocol became effective and highly predictable for the management of AICR when the condyles and discs are still salvageable [1,2,27–31]. The specific treatment protocol includes: (1) Removal of the hyperplastic synovial tissue surrounding the condyle; (2) The articular disc is mobilized, passively repositioned over the condyle, and stabilized to the condyle using a Mitek mini anchor placed in the posterior head of the condyle, approximately 8 mm below the top of the condyle, just lateral to the mid-sagittal plane, with two 0-Ethibond sutures (Ethicon Inc., Somerville, NJ, USA) attached through the anchor eyelet and attached to the posterior band of the disc that will function as artificial ligaments to secure the discs in position [27–31] (Figure 5); and (3) Mandibular ramus osteotomies with ridged fixation are performed followed by maxillary osteotomies to correct the associated jaw and occlusal deformities with counterclockwise rotation of the maxillo-mandibular complex as well as any other indicated ancillary procedures (i.e. turbinectomies, septoplasty, genioplasty, rhinoplasty, etc.) [30]. The Mitek anchors are very stable and osseo-integrate with the bone in the condylar head [32,33]. This treatment protocol effectively eliminates the TMJ pathology and corrects the functional and esthetic dentofacial deformity in one surgical stage. If the surgeon prefers, the TMJ surgery can be done as a separate surgical stage from the orthognathic surgery, but the TMJ surgery must be done first.

Treating AICR cases with orthognathic surgery alone, ignoring the TMJ pathology, is a strong inducer for: (1) Continued condylar resorption; (2) Redevelopment of functional and esthetic deformities; (3) malocclusion with Class II open bite; (4) Worsening TMJ symptoms and

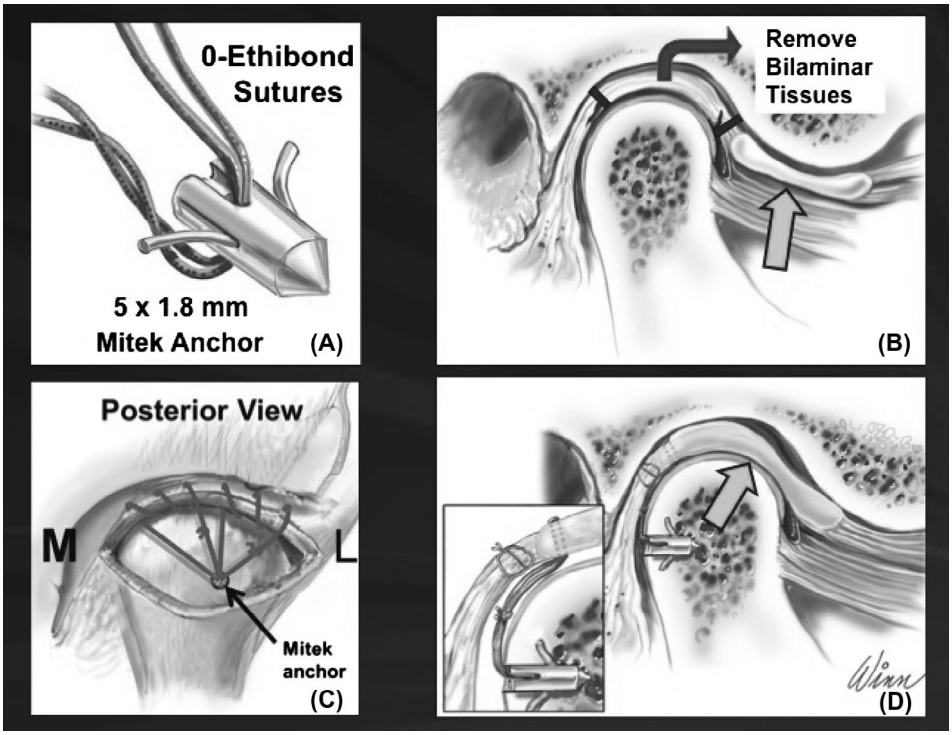

Figure 5. Mitek Anchor Technique: (A) Mitek Mini Anchor is 5 × 1.8 mm in dimension with an eyelet to support two artificial ligaments (0-Ethibond suture). (B) Bilaminar tissues are excised and disc mobilized. (C,D) The disc is passively positioned over the condyle and Mitek anchor placed in the lateral aspect of the posterior head, about 8 mm below the top of the condyle; the sutures are attached to the posterior band of the disc and secured.

dysfunction; (5) Worsening pain; and (6) Requirements for additional surgery [26,31]. Because most of these patients have retruded jaw structures, HOP angle facial morphologies, and decreased oropharyngeal airway dimensions, the more severe cases may have significant sleep apnea symptoms. The optimal functional and esthetic results are often best achieved by the treatment protocol of disc repositioning with Mitek anchors and counterclockwise rotation advancement of the maxilla and mandible. The facial characteristics of individuals with HOP facial morphology have been previously described, and these are commonly seen in AICR patients [34–36]. The authors have demonstrated that counterclockwise rotation of the maxillo-mandibular complex is a very stable procedure in the presence of healthy jaw joints and also when salvageable displaced discs are repositioned with the Mitek anchor technique [1,2,29,31,36]. With an adequate remaining condyle, the TMJs can withstand the loading of the counterclockwise rotation of the maxillo-mandibular complex.

Other treatment considerations

TMJ arthroscopy and arthrocentesis techniques do not remove the hyperplastic synovial tissues, nor do they reposition the articular disc into a normal functional position with adequate stability to withstand the increased joint loading created by the counterclockwise rotation of the maxillo-mandibular complex. The use of arthroscopy and arthrocentesis is predictably unsuccessful and contra-indicated in treating AICR. In AICR cases where the disc is non-salvageable but adequate condyle remains, replacement with autogenous tissues, such as dermal fat grafts, temporalis fascia/muscle grafts, fat grafts, etc. are not predictable relative to long-term stability, function, and pain. A meniscectomy alone is not recommended, as this may introduce additional arthritic and pain conditions and may not stop the pathological process. In more advanced cases, where the patient presents with degeneration of the articular disc rendering it non-salvageable, the authors prefer to use patient-fitted TMJ total joint prostheses (TMJ Concepts system, Ventura, CA, USA) because of the highly predictable outcomes [37–44]. Mercuri [40,45] and Chung et al. [46] also endorse the use of TMJ total joint prostheses for patients with condylar resorption from various etiologies.

Case presentation

An 18-year-old female reported the onset of her TMJ symptoms at about the age of 13, when her joints started to click and pop. By age 16, the clicking stopped, but her TMJ pain and headaches had significantly increased. She

was referred for treatment at the age of 18 years. Although she had good facial symmetry in the frontal view, in profile she had the HOP facial morphology commonly seen with AICR with the retruded mandible and chin as well as an end-on Class II occlusion (Figures 1A,B; 2(A,B)). On a scale of 0–10, where 0 equals no pain and 10 the worst pain imaginable, she rated her headaches at 6, TMJ pain at 7, and myofascial pain at 8. She had significant difficulties eating and chewing related to her pain issues and was on a relatively soft diet. She rated her disability at 7, where 0 indicates no disability and 10 means totally disabled. She was in orthodontic treatment at the time of first evaluation. Her diagnoses consisted of the following: (1) Bilateral TMJ AICR; (2) Maxillary anteroposterior (AP) and posterior vertical hypoplasia; (3) Mandibular AP and posterior vertical hypoplasia; (4) Class II end-on occlusion; (5) HOP angle; (6) Impacted third molars × 4; (7) Hypertrophied turbinates with nasal airway obstruction; and (8) TMJ pain, myofascial pain, and headaches. The single-stage surgical treatment consisted of the following: (1) Bilateral TMJ articular disc repositioning and ligament repair with Mitek anchors (Figure 5); (2) Bilateral mandibular ramus osteotomies to advance the mandible in a counterclockwise direction; (3) Multiple maxillary osteotomies to down graft the posterior aspect; (4) Anterior mandibular horizontal osteotomy to augment the chin; (5) Removal of impacted third molars × 4; and (6) Bilateral partial inferior turbinectomy (Figure 3(B)). The patient was evaluated three years post surgery with the following findings: No TMJ pain, headaches, or myofascial pain; Incisal opening was 43 mm (presurgery was 28 mm); Excursion movements of 5 mm in each direction; Good jaw function and no disability; Good facial balance (Figure 1(C,D)), and stable occlusion (Figure 2(C,D)).

Stability studies

There are two studies that show highly predictable results for the management of patients with AICR. Wolford and Cardenas [1], in 1999, reported on 12 patients with documented active AICR. The average presurgical rate of condylar resorption was 1.5 mm per year, indicating a slow, but progressive disease process. This caused the mandible to become more retruded at point B at a rate of 2.5 mm per year, and the occlusal plane increased 2° per year. Surgical treatment followed the protocol developed by Wolford [1,2] with the mandible advanced an average of 10.9 mm and the occlusal plane angle decreased an average of −7.8°. The post-surgical follow-up average was 33.2 months. Post surgery, the average condylar length change was +0.2 mm. The mandible moved slightly forward an average of +0.3 mm, and the average occlusal plane change was +0.04°. There were no statistically significant cephalometric changes from immediate post surgery to the longest follow-up. Five patients were under the age of 16 years at the time of surgery and exhibited a modest amount of post surgical condylar growth with an average increase in condylar height of +0.43 mm. This indicates a reversal of the disease process from one of resorption and lower jaw progressive retrusion to subsequent return of modest growth. In all 12 patients, jaw function remained unchanged with no statistically significant difference in the presurgery and post surgery incisal opening (47 mm) and excursive movements (greater than 7 mm). There was a statistically significant decrease in pain; the presurgery average pain was 3.5, and the post surgery average pain was 0.7.

Another study [2] evaluated 44 patients with active AICR divided into two groups.

Group 1 ($n = 10$) underwent orthognathic surgery *only*, with no TMJ surgical treatment, average age 19.2 years, and follow-up average of 37 months. Group 2 ($n = 34$) underwent TMJ disc repositioning with the Mitek anchor technique and simultaneous orthognathic surgery, average age 19.4 years, with an average follow-up of 25.5 months. In Group 1, AICR continued in all 10 patients post surgery, resulting in statistically significant skeletal and occlusal instability and relapse with redevelopment of Class II occlusion and anterior open bite as well as continued pain. Group 2 patients all maintained stable Class I skeletal and occlusal outcomes with no statistically significant difference in any of the cephalometric measurements from immediately post surgery to longest follow-up. Group 2 had statistically significant reduction in pain and improved jaw function compared to Group 1.

The best results for the management of AICR involves early detection of the disease process and early surgery management adhering to the presented protocol. The earlier AICR is treated, the more likely the following will occur: (1) Arrest resorption of the condyle, thus, maintaining a greater condylar dimension and volume; (2) Less distortion and degeneration of the articular disc; and (3) Better postsurgical distribution of loading forces on the joint structures. The high predictability of treatment outcomes with this protocol for AICR substantiates that an early diagnosis and initiation of this specific treatment protocol will provide the best success functionally, occlusally, and esthetically, with elimination or significant reduction in pain, and long-term stability, as long as the condyles and discs are salvageable.

The importance of the articular disc being in a normal stable position for orthognathic surgery stability cannot be over emphasized. Wolford et al. [26], in 2003, evaluated 25 consecutive patients with jaw deformities and anteriorly displaced discs treated with orthognathic surgery *only*. All but one patient had the mandible advanced. Pre-surgery,

36% of the patients had TMJ related pain or discomfort. At an average of 2.2 years post surgery, 84% of the patients had TMJ related pain, with a 70% increase in pain severity. The average mandibular relapse at point B was 36% of the original mandibular advancement. In addition, post surgery, 25% of the patients developed Class II occlusions and anterior open bites from condylar resorption. New onset/aggravation of TMJ symptoms occurred at an average of 14 months post surgery. Twelve patients (48%) required TMJ surgery and repeat orthognathic surgery. Nine additional patients (36%) required long-term medications and/or splint therapy for pain control at the conclusion of the study. This study clearly demonstrates the problems associated with performing orthognathic surgery *only* on patients with co-existing TMJ disc dislocations.

Wolford et al. [23] published a study in 2002 that included 70 patients with anteriorly displaced discs, treated with disc repositioning and orthognathic surgery. The study showed that pre-surgery, 80% of the patients had preoperative TMJ pain, but at longest follow-up, 60% had complete relief of pain, and an additional 33% had significant reduction in pain. All but one 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%. The success rate was significantly better (95%) if the TMJ discs were repositioned surgically within the first four years of onset of the TMJ dysfunction. After four years, the progression of irreversible TMJ degenerative changes resulted in a significantly lower success rate.

Gonçalves et al. [31] evaluated 72 patients (59 females, 13 males) who had double-jaw orthognathic surgery with counterclockwise rotation of the maxillo-mandibular complex. The patients were divided into three groups. Group 1 (G1), with healthy TMJs, received orthognathic surgery only; Group 2 (G2), with bilateral articular disc dislocation received articular disc repositioning with the Mitek anchor technique concomitantly with orthognathic surgery; and Group 3 (G3), with bilateral articular disc dislocation, received orthognathic surgery only.

Average post surgical follow-up was 31 months. At surgery, the average occlusal plane angle decreased significantly in all three groups G1 (−6.3°), G2 (−9.6°), and G3 (−7.1°). The maxillo-mandibular complex advanced and rotated counterclockwise similarly in all three groups, with average advancement at menton in G1 (12.4 mm), G2 (13.5 mm), and G3 (13.6 mm). Post surgery, the occlusal plane angle increased in G3 (37% relapse), while G1 and G2 remained stable. Mandibular post surgical changes demonstrated a significant anteroposterior relapse in G3 at menton (28%), while the G1 and G2 groups remained stable. This study demonstrated that maxillo-mandibular advancement with counterclockwise rotation of the occlusal plane and maxillo-mandibular complex is a stable procedure for patients with healthy TMJs and for patients with simultaneous TMJ disc repositioning, using the Mitek anchor technique. Patients with preoperative TMJ articular disc displacement who underwent double-jaw orthognathic surgery and no TMJ intervention experienced significant relapse.

Al-Moraissi and Wolford [47] recently published a meta-analysis on the effect of TMJ pathology with or without surgical management on stability of counterclockwise rotation (CCWR) of the maxillo-mandibular complex (MMC) in orthognathic surgery. There were 12 studies with 345 patients who met the inclusion criteria. There was significant relapse of the occlusal plane, B-point, and menton for studies with untreated TMJ disc displacement undergoing CCWR of the MMC. Studies with healthy TMJs with discs in normal position, TMJs with displaced discs repositioned with the Mitek anchor technique, and TMJs reconstructed with patient-fitted total joint prostheses were stable.

TMJ surgery (e.g. disc repositioning, arthroplasties, high condylectomies) can alter the position of the mandible and the occlusion significantly. Therefore, the surgical sequencing for performing TMJ and orthognathic surgery at one operation or divided into two operations (the TMJ and orthognathic procedures performed separately) is important to achieve good outcomes and includes: TMJ surgery first, followed by mandibular ramus sagittal split osteotomies with rigid fixation, and then maxillary osteotomies with rigid fixation. With the mandibular osteotomies being performed after the TMJ surgery, the mandible will be positioned into its final predetermined position regardless of the amount of mandibular condylar displacement resulting from the TMJ surgery. The maxillary surgery then follows as well as any other ancillary procedures such as genioplasty, rhinoplasty, turbinectomies, septoplasty, etc., to maximize the functional and esthetic results. The jaws are not wired together post surgery because rigid fixation (bone plates and screws) is used to stabilize the mandibular and maxillary osteotomies. Light vertical elastics (3.5 oz) with a slight Class III vector are usually used post surgery to control the occlusion and minimize the TMJ intercapsular edema.

Closely monitoring and managing the occlusion in the post surgery period, as well as controlling the parafunctional habits (i.e. clenching, bruxism), are very important to provide high quality outcomes. The authors do not use splints to control clenching and bruxism post surgery, but commonly use Clonazepam or other muscle relaxers to control these parafunctional habits; it is rarely needed for more than a few weeks. With elimination of the TMJ pathology, correction of the occlusion,

and eliminating sleep apnea symptoms by increasing the oropharyngeal and nasal airways, it is very unusual for AICR patients to experience long-term issues with clenching and bruxism.

When end-stage TMJ AICR pathology requires reconstruction with total joint prostheses, then the mandible can be advanced, counterclockwise rotated if indicated, and asymmetries corrected with custom-fitted total joint prostheses without requiring additional mandibular osteotomies [37–46].

Conclusion

AICR may be a hormonally mediated TMJ pathology predominately occurring in teenage females initiated during pubertal growth, causing condylar resorption and mandibular retrusion but can go into remission. It can be reactivated with loading or stress to the TMJ with subsequent orthodontics and orthognathic surgery. Further studies related to hormonal mediation in TMJ pathologies may provide new and different treatment methods.

When the articular discs and condyles are salvageable, TMJ disc repositioning and stabilization using the Mitek anchor technique with removal of the hyperplastic synovial tissues arrests the AICR disease process.

AICR managed with this specific TMJ surgical protocol concomitantly with maxillo-mandibular counterclockwise rotation is a stable and predictable procedure when the condyles and discs are salvageable and surgery is performed within four years of AICR onset.

Conflict of interest

Neither the authors nor any members of their families have a financial arrangement or affiliation with any corporations, commercial products, or services that may be discussed in this article.

Disclosure statement

The authors have stated explicitly that there are no conflicts of interest in connection with this article.

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