CASE REPORT

Surgical correction of a Class II skeletal malocclusion associated with anterior open bite and temporomandibular joint pain

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This case report describes the treatment of a 25-year-old woman with anterior open bite, Class II skeletal malocclusion, and a history of temporomandibular joint pain and sounds. She also had significant anteroposterior and vertical discrepancies and a convex profile with protrusive lips. Intraorally, she had an anterior open bite of 3 mm and an overjet of 5 mm. Mandibular surgical rotation, associated with mandibular incisor extraction, was performed to reduce the protrusion, close the open bite, and minimize the temporomandibular joint disorder. (Am J Orthod Dentofacial Orthop 2007;132:400-7)

Anterior open bite associated with a Class II skeletal pattern in adults can be a challenging orthodontic problem. Basically, 3 treatment alternatives are available: tooth extraction, molar intrusion, and distalization using a skeletal anchorage system or orthognathic surgical correction.[1-4] Unfortunately, the outcome obtained with nonsurgical extraction therapy or orthodontics using absolute anchorage has limited impact on the facial profile and in many cases poor stability. Correction with maxillary surgery has become the standard of care, although technical advances now allow clinicians to close open-bite discrepancies using bilateral split osteotomies to rotate the mandibular distal segment counterclockwise.[5]

Patients with Class II malocclusion or mandibular retrognathia and an increased occlusal plane angle have the highest incidence of temporomandibular joint (TMJ) problems.[6] Currently, there is controversy regarding the appropriate management of patients with preexisting TMJ disorder (TMD) symptoms who require orthognathic surgery. Some investigators that orthognathic surgery helps reduce TMD symptoms,[7-9] whereas others contend that orthognathic surgery in such patients causes further deleterious effects to the TMJ and thus worsens the symptoms and dysfunction postsurgery, so this philosophy proposes surgical management of the TMJ pathology at an initial separate procedure or concomitantly with the orthognathic surgery.[10,11]

The following case report illustrates the treatment of a patient with Class II malocclusion complicated by dentoalveolar protrusion, anterior open bite of 3 mm, TMD symptoms, and a Class II skeletal pattern.

DIAGNOSIS AND ETIOLOGY

The patient was a 25-year-old white woman whose main complaints were an anterior open bite, TMJ pain, and TMJ sounds (Figs 1-4). A facial evaluation showed a symmetric, elongated face; a retrognathic mandible; a prominent nose; and strain of the mentalis muscle (Fig 1). She had a Class II Division 1 malocclusion with a 30-mm anterior open bite, a 5-mm overjet, and reduced gingival attachment on the mandibular right central incisor. Space analysis showed approximately 2 mm of crowding in the mandibular arch, with a mandibular midline deviation of 1 mm to the right. Cephalometric analysis showed a skeletal Class II relationship (ANB angle, 6°) with mandibular retrusion (SNB angle, 76°), a steep mandibular plane (FMA, 36°; SN-GoGn, 39°), and protrusive incisors (interincisal angle, 104°; 31° from maxillary incisor to NA angle; 8 mm from maxillary incisor to NA; 39° from mandibular incisor to NB angle; 10 mm from mandibular incisor to NB; IMPA, 102°).

TREATMENT OBJECTIVES

The primary objectives of treatment were to close the anterior open bite, obtain Class I canine and molar relationships with ideal overjet and overbite, and improve facial esthetics. The complementary treatment

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Submitted, July 2005; revised and accepted, January 2006.
0889-5406/$32.00

doi:10.1016/j.ajodo.2006.01.033

Fig 1. Pretreatment facial photographs.

Fig 2. Pretreatment intraoral photographs show negative overbite of 3 mm.

objectives were to establish good functional and stable occlusion, avoid extrusion of the molars and clockwise rotation of the mandible during presurgical treatment, correct the axial inclinations of the maxillary and mandibular anterior teeth, enhance the facial profile and lip closure, improve smile characteristics and dental esthetics, and improve the shape of both arches.

TREATMENT ALTERNATIVES

Three approaches were considered. Extracting only 2 maxillary first premolars would reduce the overjet and close the anterior open bite, resulting in a Class I canine relationship; mandibular crowding would be relieved by interproximal reduction. This approach, however, would flatten the upper lip, jeopardizing the profile, and a Class I molar relationship could not be achieved.

The third approach included surgically advancing and rotating the distal segment of the mandible counterclockwise to close the open bite. The diagnostic wax setup showed that, after the mandibular advance, a Class I molar relationship could not be achieved because of protrusion of the mandibular incisors. Therefore, mandibular incisor extraction would also be

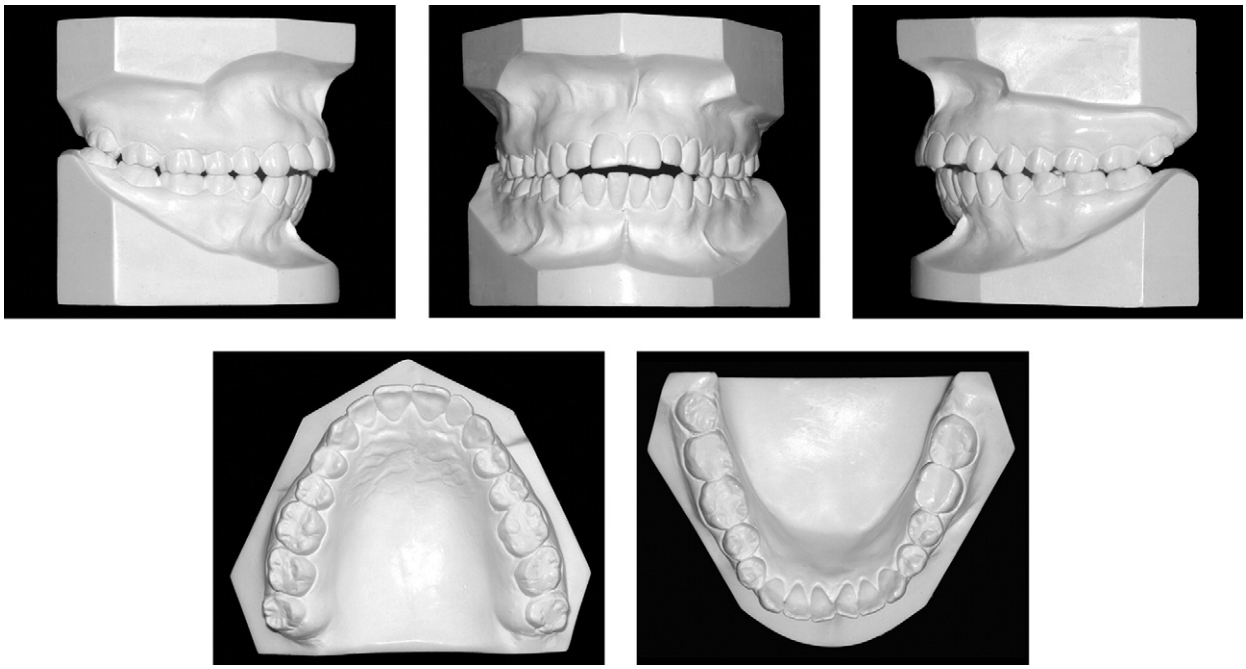

Fig 3. Pretreatment study models.

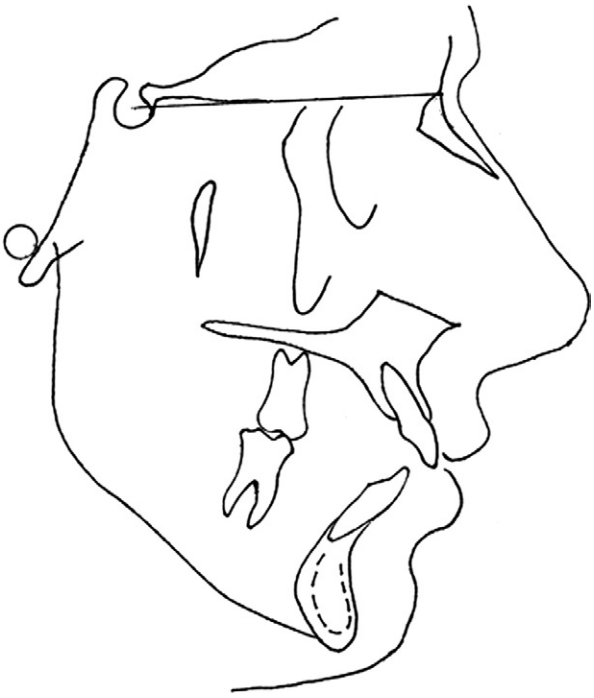

Fig 4. Pretreatment cephalometric tracing.

needed to allow the large mandibular advancement and improve the facial profile. Due to the TMD symptoms, surgical stabilization would be accomplished with nonrigid fixation to decrease the load or stress on the TMJ.[6]

The second treatment possibility would be the use of miniplates or microscrews for intrusion and distalization of upper and posterior teeth. The retraction of upper incisors, whether caused by premolar extraction or distalization of posterior teeth would have the same flattening effect on the upper lip.

TREATMENT PROGRESS

In order to obtain a balanced profile, the surgical-orthodontic alternative was chosen. The maxillary and mandibular third molars were extracted. The molars were banded and the remaining teeth bonded with preadjusted .022-in straight-wire fixed appliances. The mandibular right central incisor was chosen for extraction because of the loss of gingival attachment on the facial surface. The root was removed from the crown with a high speed bur, and the crown was used as a prosthetic. Periodical interproximal reduction was performed on the crown to allow closure of the extraction space. Initial leveling was accomplished with a .016-in nickel-titanium archwire in the maxillary arch and a .020 × .020-in BioForce NiTi (GAC, Bohemia, NY) archwire in the mandibular arch. The remaining space in the mandibular arch was closed, and the incisors retracted with a .017 × .022-in stainless steel (SS) archwire by using sliding mechanics with a power chain. The maxillary arch was aligned with a .016-in progressing to a .020-in SS archwire. The mandibular second molars were banded and leveled with an .018-in SS boot loop superimposed

Fig 5. Presurgical intraoral photographs.

Fig 6. Posttreatment facial photographs.

archwire. Presurgical rectangular archwires were placed, the maxillary arch received a .019 × .025-in progressing to a .021 × .025-in SS archwire, and the mandibular arch received a .019 × .025-in SS archwire. The presurgical orthodontic phase lasted approximately 17 months. Surgical hooks were then soldered to the SS archwires and placed in both arches (Fig 5).

The surgery involved sagittal split osteotomies with approximately 5 mm advancement of the mandible and counterclockwise rotation to allow overjet reduction and closure of the open bite. Nonrigid fixation was selected to avoid more TMJ complications. Three months after surgery, a mandibular .018 × .025-in beta-titanium (TMA, Ormco, Orange, Calif) archwire and a maxillary .018-in SS archwire were placed, and bilateral Class II elastic mechanics were initiated. A maxillary continuous .018 × .025-in beta-titanium wire was used during finishing, along with the elastics. Twenty-four months after initial bracket placement, the teeth were in acceptable positions, and the appliances were removed.

For retention, the patient was instructed to wear a maxillary circumferential Hawley retainer 24 hours a day for 2 years and at night for another 6 months. In addition, a fixed lingual mandibular retainer was bonded from canine to canine. Because of the potential for bite opening, the patient was highly motivated to comply with daily tongue exercises and received a modified Hawley retainer with a palatal crib to be used at night.

TREATMENT RESULTS

Because of the skeletal pattern and the surgical approach that was chosen, excellent facial and occlusal results were achieved. The most significant changes were a dramatic decrease in TMD symptoms after surgery and an improvement in occlusal function. Esthetically, facial convexity decreased, the face became less retrognathic, and lower face height decreased. Lip competency was improved significantly, and the patient was satisfied with the results of treatment. Well-established Class I canine and molar relationships were obtained, rotations were corrected, and

Fig 7. Posttreatment intraoral photographs.

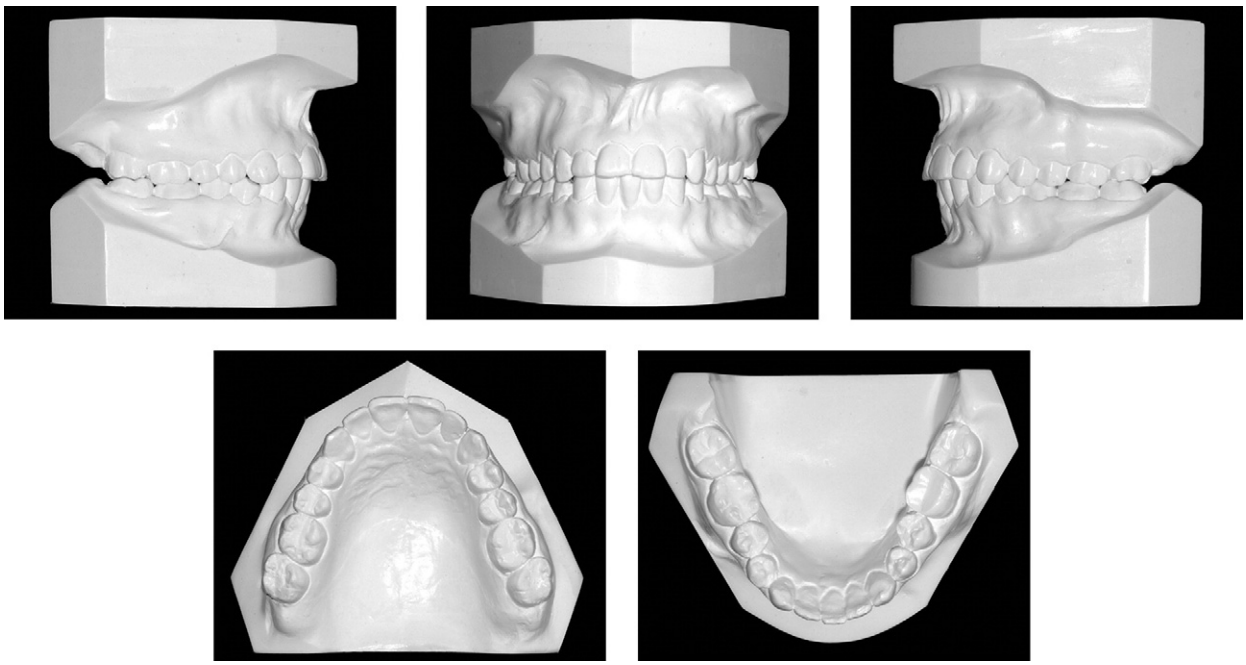

Fig 8. Posttreatment study models.

the teeth were aligned. The maxillary midline was centered with the face, and the midpoint of the middle mandibular incisor was in line with the maxillary midline. Ideal overjet and overbite were established (Figs 6-8), and the final panoramic radiograph (Fig 9) confirms root parallelism and proper space closure in the mandibular incisor area.

Cephalometric analysis and superimpositions showed the mandibular advancement and closing of the open bite (Figs 10 and 11). The mandibular incisors were uprighted and retracted 2.5 mm (from 10 mm at 39° to 7.5 mm at 28°), and the maxillary incisors were uprighted 2 mm (from 8 mm at 31° to 6 mm at 25°). The ANB angle improved (from 6° to 1°), the occlusal plane remained stable (from 19° to 18°), and lower anterior face height, SN-GoGn angle, Frankfort man-

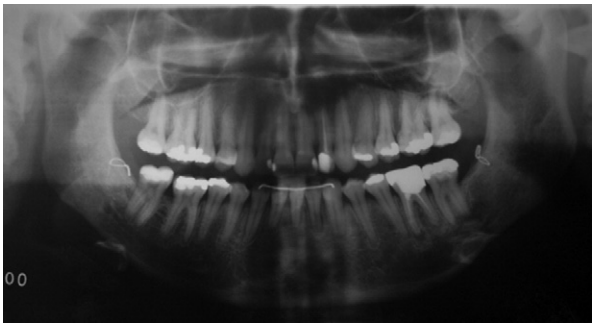

Fig 9. Posttreatment panoramic radiograph.

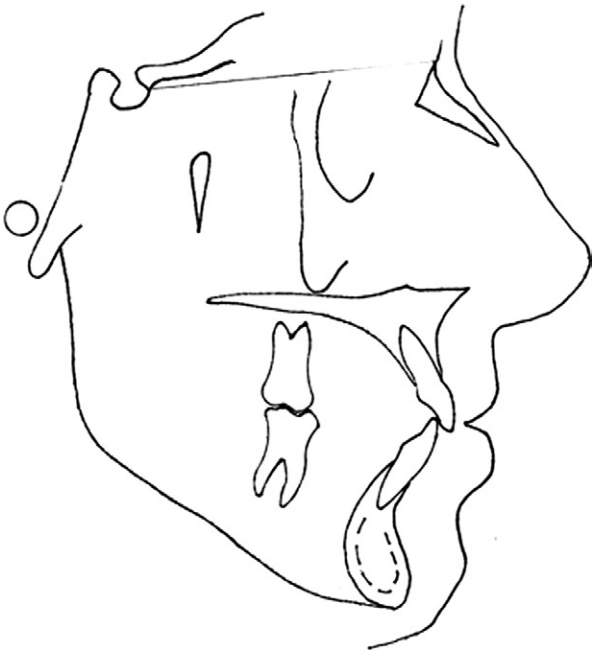

Fig 10. Posttreatment cephalometric tracing.

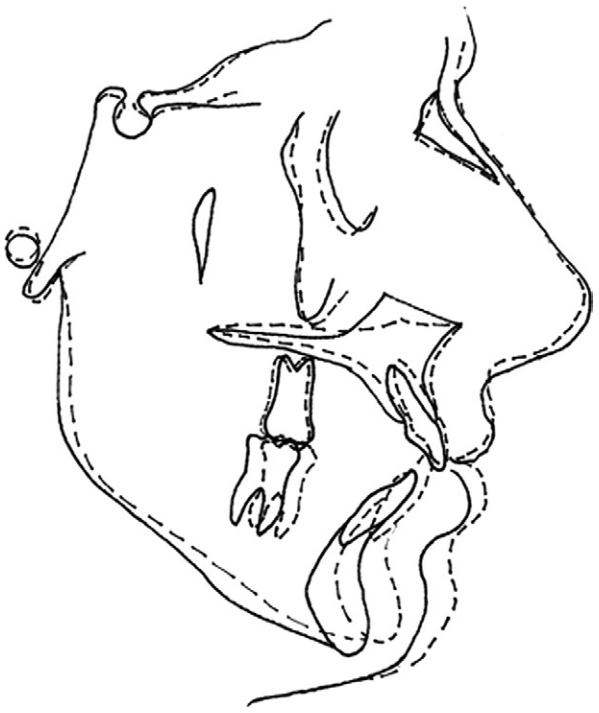

Fig 11. Superimposed cephalometric tracings.

Table. Summary of cephalometric analysis

	Standard	*Pretreatment*	*Posttreatment*
SNA angle (°)	82	82	82
SNB angle (°)	80	76	80
ANB angle (°)	2	6	2
FMA (°)	25	36	30
SNGoGn (°)	32	39	34.5
1/NA (°)	22	31	25
1-NA (mm)	4	8	5.6
1/NB (°)	25	39	28
1-NB (mm)	4	10	7.5
1/1 (°)	131	104.5	123
IMPA (°)	93	102	92

dibular plane angle, and Y-axis to SN angle were all reduced (Table). The corrected occlusion at 5 years posttreatment shows excellent stability, esthetics, and periodontal health (Figs 12 and 13), without signs or symptoms of TMD.

DISCUSSION

Orthodontists are aware of the difficulty of managing a Class II malocclusion with an open bite and a skeletal Class II pattern. Faced with the limitations of orthodontic treatment, most orthodontists would agree that this situation is best treated with a combination of orthodontics and orthognathic surgery.[12] The advantages of orthognathic surgical treatment are that the profile can be improved and relapse is less likely than with a nonsurgical option.[12,13] Although maxillary impaction surgery has been considered the most stable orthognathic procedure, in this case, mandibular advancement was chosen because of the maxilla's good position and the reported stability of mandibular advancement surgery.[14,15]

The TMJs are the foundation for stable results with orthognathic surgery. Although counterclockwise advancement of the maxillomandibular complex might further increase the loading of the TMJ by stretching

Fig 12. Postretention facial photographs.

Fig 13. Postretention intraoral photographs.

the associated soft tissues, it is a stable procedure when the joints are healthy.[16,17]

Common symptoms of TMJ dysfunction include sounds, pain, headaches, limited movement, change in occlusion, masticatory difficulty, earaches, tinnitus, vertigo, and others.[11] There is controversy concerning the adequate management of patients with preexisting TMD who require orthognathic surgery to correct jaw deformities and malocclusion. In a retrospective study, Wolford et al[11] concluded that orthognathic surgery in patients with TMD can lead to the initiation or exacerbation of problems. However, several studies comparing TMD symptoms before and after bilateral sagittal split ramus osteotomy suggest that in patients with severe maxillomandibular discrepancy, surgical-orthodontic therapy is a good choice of treatment for reducing myogenous TMJ pain and discomfort.[18-22]

An alternative approach advocated by many practitioners is not to decrease the occlusal plane angle in patients with Class II relationships but, rather, to maintain or increase it. By minimizing load or stress on the TMJ, the likelihood of problems and relapse is decreased, and TMJ surgery is avoided. This concept can be supported by the success of techniques such as condy-

lar repositioning via bilateral sagittal split ramus osteotomy with nonrigid fixation to increase joint space.[6]

In our patient, orthognathic surgical correction of the Class II malocclusion with anterior open bite and TMJ pain was selected to improve the functional status of the TMJ, reduce pain levels, and avoid posterior surgery.[18,19,22] Despite concerns about stability, counterclockwise surgical advancement of the mandible with nonrigid fixation was performed to reduce stress on the TMJ, allowing the open bite to close and the overjet to be reduced. In other attempts to avoid TMJ surgery, orthognathic surgery was conducted to minimize occlusal plane changes, and the occlusal plane angle decreased by only 1° (Table).

A mandibular incisor was extracted to maximize the mandibular advancement and the open-bite closure. A diagnostic wax setup of the arches was performed with extreme accuracy, indicating no need for interproximal reduction of the maxillary anterior teeth to allow maxillary and mandibular arch coordination.[23-26] Long-term stability can be considered an advantage of this approach. Riedel suggested that incisor extraction may give greater stability in this area in the absence of permanent retention.[27,28]

The final outcome of treatment was a substantial improvement in function and esthetics. Through this approach, the patient had excellent skeletal, dental, and occlusal improvements, with a significant decrease in TMJ pain. As an additional benefit, she has reported improved self-esteem and greater satisfaction with her appearance. At the retention check 60 months after removing the appliances, the occlusion was stable, without TMD symptoms (Fig 13). Long-term follow-up will need to continue because open bites tend to relapse more than most other types of malocclusion.

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