Long-term stability of conservative orthodontic treatment in a patient with rheumatoid arthritis and severe condylar resorption

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Rheumatoid arthritis is a chronic inflammatory condition that can result in progressive destruction of the articular surfaces of the joints, including the temporomandibular joint. The purpose of this article is to report the conservative correction of a Class II malocclusion in a woman with rheumatoid arthritis. The patient was 32 years 6 months old at the start of treatment. She had a convex profile and a skeletal Class II jaw-base relationship caused by severe condylar resorption. An anterior open bite of −2.0 mm and an excessive overjet of 10.0 mm were observed. Severe crowding was shown in the mandibular incisors. After 8 months of splint therapy, all first premolars were extracted, and 0.018-in preadjusted edgewise appliances were placed in both arches. Class II elastics were used during space closure. After 41 months of active orthodontic treatment, an acceptable occlusion was achieved, and the facial profile was considerably improved. From the cephalometric evaluations, the mandible was rotated counterclockwise, and the mandibular plane angle was significantly decreased. However, the anteroposterior position of the chin was not changed. The condylar resorption was not changed during and after orthodontic treatment. Conclusively, the proper facial profile was maintained, and the occlusion was stable after a 5-year retention period. Our results suggest the possibility of compromised treatment in a Class II malocclusion with an anterior open bite because of rheumatoid arthritis. (Am J Orthod Dentofacial Orthop 2012;141:352-62)
patients with severe condylar resorption caused by rheumatoid arthritis. This article demonstrates the long-term successful outcome of conservative orthodontic treatment in a rheumatoid arthritis patient with a Class II malocclusion caused by severe condylar resorption.

**DIAGNOSIS AND ETIOLOGY**

A woman, aged 32 years 6 months, had a chief complaint of masticatory disturbance. She had felt spontaneous pain in both TMJs when she was a teenager, but it had disappeared without therapeutic measures. At 23 years of age, she was diagnosed as having rheumatoid arthritis and started therapy with an antirheumatoid agent (D-penicillamine) and a nonsteroidal anti-inflammatory drug (diclofenac sodium). She had to be treated for edema of the knees by removing water once each month. As a result of the administration of these medications for about 10 years, the symptoms of the rheumatoid arthritis were reduced. Dull arthritic pain still remained, but she had no functional disturbances in her daily life.

Her facial profile was convex with a retrognathic mandible (Fig 1). An acute nasolabial angle, an increased lower facial height, and circumoral musculature strain on lip closure were observed. The molar relationships were Angle Class II on both sides (Fig 2). Overjet and overbite were 10.0 and −2.0 mm, respectively. Two distinct occlusal planes were present in the maxillary arch, and occlusal contacts were found only in the molar regions at maximum intercuspation. Severe crowding was evident in the mandibular dentition.
because of the excessive tooth size compared with the available arch length. The maxillary and mandibular dental midlines almost coincided with the facial midline. Gingival recession was found labially to the mandibular incisors and canines, and all premolars in both arches.

The radiographs showed that the third molars were present, and severe condylar resorption had occurred.
on the both sides (Fig 3). The cephalometric analysis, when compared with the Japanese norm, showed a skeletal Class II jaw-base relationship (ANB, 13.0°) with mandibular retrusion (SNB, 68.5°) (Table). The mandibular plane angle was extremely steep (mandibular plane-Frankfort horizontal plane, 52.5°). Ramus height was significantly decreased because of severe condylar resorption (Ar-Go, 32.0 mm), but the mandibular body length was within the normal range. The maxillary incisors were lingually inclined (U1-FH, 103.0°), and the maxillary and mandibular incisors were significantly extruded (U1/palatal plane, 35.0 mm; L1/mandibular plane, 50.5 mm).

According to the results of an examination with a jaw trajectory recording system (Sirognathograph analyzing system; Tokyo Dental, Tokyo, Japan), the jaw movement paths during mastication were functionally normal (Fig 4, A and B). However, the anterior displacement of the jaw movement area compared with the horizontal axis during speech suggested retro positioning of the mandible in the intercuspal position (Fig 4, C).

### TREATMENT OBJECTIVES

The patient was diagnosed as having an Angle Class II malocclusion with a skeletal Class II jaw-base relationship, a skeletal anterior open bite caused by severe condylar resorption, and severe crowding in the mandible. The treatment objectives were (1) to correct the anterior open bite and establish ideal overjet and overbite, (2) to achieve an acceptable occlusion with a good functional Class I occlusion, (3) to resolve the crowding of the mandibular incisors, and (4) to correct the mandibular retrusion and improve the retrognathic appearance of the facial profile.

### TREATMENT ALTERNATIVES

Several procedures were explored to achieve a proper facial profile and an acceptable occlusion. Mandibular advancement surgery with or without surgical condylar reconstruction was considered the most effective treatment method to improve her anterior open bite, mandibular retrusion, and retrognathic profile. The evaluation of the jaw movements during speech at the initial examination also indicated the mandibular retroposition in her intercuspal position. However, the patient did not complain of her retrognathic profile and was concerned only about chewing problems. Additionally, she had neither pain nor functional disturbance of her TMJs at the initial visit, although severe condylar resorption was observed. Therefore, she did not want the surgical-orthodontic treatment, because

<table>
<thead>
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<th>Variables</th>
<th>Japanese norm</th>
<th>SD</th>
<th>Pretreatment 32 y 10 mo</th>
<th>Posttreatment 37 y 3 mo</th>
<th>Postretention 42 y 7 mo</th>
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<td>ANB</td>
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<tr>
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<td>4.5</td>
<td>68.5</td>
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<tr>
<td>Mand pl-FH pl</td>
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<td>3.6</td>
<td>52.5</td>
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**Mand, Mandibular; pl, plane; FH, Frankfort horizontal.**

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of physical and psychological concerns about the invasive treatment.

Conservative orthodontic treatment was planned, even though the treatment might be a compromise. We designed the force system to move the mandible as far forward as possible using an occlusal splint and Class II intermaxillary elastics. Nevertheless, a space gain was required for retraction of the maxillary incisors to reduce the excessive overjet and the mandibular crowding. Meanwhile, gingival recession was observed labially to the mandibular incisors and the premolars in both arches at the beginning of orthodontic treatment. This further complicated the lateral expansion in both jaws. Additionally, the patient had a disproportionate tooth size compared with the available arch length. Therefore, we chose extraction of 4 premolars.

**TREATMENT PROGRESS**

Before the start of orthodontic treatment, an occlusal splint was placed in the maxilla to increase the range of the jaw movements by relaxing of the masseter muscles. Eight months later, the occlusal splint was replaced in the mandible, and the maxillary first premolars were extracted. A transpalatal arch was cemented between the

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**Fig 4.** Pretreatment jaw movements: **A,** mastication on the left side; **B,** mastication on the right side; **C,** speech. Anterior displacement of the jaw movement area (green line) compared with the horizontal axis during speech suggests the retro position of the mandible in the intercuspal position.
maxillary first molars for anchorage reinforcement. Then, 0.018-in slot preadjusted edgewise appliances (Alexander discipline,Ormco, Orange, Calif) were placed in the maxillary arch. After leveling and alignment with nickel-titanium archwires, canine retraction was started with a stainless steel round wire. During the retraction phase, the maxillary left third molar and the mandibular first premolars were extracted. After leveling of the mandibular arch, the maxillary incisors were retracted with Class II elastics to reduce the excessive overjet. At the same time, myofunctional treatment was performed for 14 months. After removal of the edgewise appliances, a circumferential retainer on the maxillary arch and a spring retainer on the mandibular arch were placed to be worn during the daytime. At night, a tooth positioner was used instead of these retainers. The total active treatment time was 41 months.

**TREATMENT RESULTS**

The posttreatment facial photographs showed significant improvement of the convex profile and a reduction of the strain in the circumoral musculature during lip closure (Fig 5). The occlusion was much more stable, and an acceptable intercuspation of the teeth was achieved, although the Class II molar relationship remained on both sides (Fig 6). The posttreatment cephalometric evaluation showed clockwise rotation of the mandible (mandibular plane—Frankfort horizontal
plane, 50.5°), but the SNB angle was not changed (SNB, 68.5°), and the skeletal jaw base relationship was Class II (ANB, 13.0°) (Figs 7 and 8, Table). Overjet and overbite were improved to 4.0 mm without incisor elongation in either jaw. Condylar resorption did not worsen, and no temporomandibular symptoms were observed throughout active orthodontic treatment (Fig 7).
Five years after appliance removal, the occlusion was stable, and a good facial profile was maintained (Figs 9 and 10). Cephalometric analysis showed minimal changes in the dentition (Figs 8 and 11, Table). The radiographic findings showed no morphologic changes in the TMJs after 5 years; perhaps, this was due to her consistent mandibular position.

**DISCUSSION**

We planned to enhance the mandibular position as forward as possible to improve her facial profile and Class II malocclusion. The occlusal splint was placed initially to increase the range of jaw movements by relaxing the masseter muscles before orthodontic treatment. Class II elastics were also used to reinforce the anchorage and to stabilize the advanced mandibular position during the multi-bracket treatment. Additionally, 4 premolars were extracted, and the succeeding counterclockwise rotation of the mandible produced a wedge effect. These procedures produced an acceptable functional occlusion with adequate interincisal relationships, and the overall facial balance was improved with reduction of the nasolabial angle and lip protrusion. However, the anteroposterior chin position was still retrognathic and was not advanced in the cephalometric superimposition.

Counterclockwise rotation of the mandible generally results in chin protrusion, especially in patients with steep mandibular plane angles.\(^\text{15,16}\) Our patient had a severely high mandibular plane angle; however, she also had severe condylar resorption caused by rheumatoid arthritis. Therefore, no definitive mandibular guidance for mandibular positioning was available for the TMJs. So, forward movement of the chin was not achieved, although rotation of the mandible was observed. To improve the facial profile more definitely, advancement genioplasty was proposed. But she did not desire further treatment. In general, Japanese laypersons prefer a retrognathic facial appearance rather than a prognathic profile.\(^\text{17-19}\) Thus, she was probably satisfied with her profile.

Five years after appliance removal, the occlusion was quite stable, and the cephalometric analysis showed minimal relapse. Several previous reports have documented relapse of mandibular position after reconstructive orthognathic surgery in the patients with rheumatoid arthritis.\(^\text{20,21}\) Leshem et al\(^\text{20}\) surgically corrected the Class II anterior open bites in 8 rheumatoid arthritis patients with bilateral sagittal split ramus osteotomy at a mean age of 18 years. But they reported an average relapse of 2.1 mm in the mandibular anteroposterior position during a 36-month follow-up study. Consequently, conservative orthodontic treatment of rheumatoid arthritis patients might be considered acceptable.

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**Fig 8.** Cephalometric tracings at pretreatment (*black line*), posttreatment (*red line*), and 5 years postretention (*green line*) superimposed on: A, the sella-nasion plane at sella; B, the anterior palatal contour; C, the mandibular plane at menton.
The posttreatment radiographs showed that condylar resorption did not worsen during and after orthodontic treatment. The patient’s rheumatoid arthritis had been well controlled by medication before orthodontic treatment. This could be a key component for a favorable prognosis in the orthodontic treatment of patients with rheumatoid arthritis. In addition, researchers have shown that the major direct cause of mandibular condylar cartilage breakdown is overloading. Occlusal reconstruction by orthodontic treatment should attempt to reduce the load on the TMJs to prevent further condylar resorption.

On the other hand, remodeling of the TMJs was not observed in our patient. Tanaka et al. reported that adaptive remodeling of the condyle was found after comprehensive orthodontic treatment in Class II patients with anterior open bite and temporomandibular disorders, although repositioning of the disc was not achieved. Sasaguri et al. also reported condylar remodeling after 4 years of retention in a patient with rheumatoid arthritis and suggested that orthodontic therapy might comprehensively reconstruct the occlusion, enhance the functioning of the mandible, and induce remodeling of the eroded condyles. Sato et al. showed that remodeling of the condylar heads in adults with rheumatoid arthritis occurred after prosthetic reconstruction, but the remodeling was observed in only 2 of 6 patients. In our patient, both condyles were almost completely destroyed, and the damage to the TMJs was considered more severe than that in previously reported cases. Therefore, notable remodeling of the condyles might not have been possible in this patient. This suggests that remodeling of eroded condyles after occlusal reconstruction might depend on the degrees of resorption and damage.

Fig 9. Five-year postretention facial and intraoral photographs.
CONCLUSIONS

We conservatively treated a rheumatoid arthritis patient with a Class II malocclusion and an anterior open bite. Her retrognathic profile was improved, and her occlusion was stable for 5 years after treatment, even though severe condylar resorption was observed on

Fig 10. Five-year postretention dental casts.

Fig 11. Five-year postretention radiographs: A, lateral cephalogram; B, panoramic radiograph; C and D, transcranial radiograph of TMJ (C, right; D, left).
both TMJs before orthodontic treatment. Our results suggest the possibility of compromised treatment in a Class II malocclusion with an anterior open bite caused by rheumatoid arthritis.

REFERENCES