Distalization of the mandibular dentition of an adult with a skeletal Class III malocclusion

Haikun Hu,a Jianwei Chen,a Jing Guo,b Fan Li,a Zeping Liu,a Shushu He,a and Shujuan Zouc
Chengdu, China, and Amsterdam, The Netherlands

This case report describes the orthodontic treatment of an 18-year-old woman with a skeletal Class III malocclusion and a midline deviation. The treatment plan consisted of distalizing the mandibular dentition asymmetrically and producing space for retraction of the mandibular anterior teeth. Short Class III elastics, an open-coil spring, and the multiloop edgewise archwire technique were used, combining the entire maxillary dentition as integrated anchorage. The active treatment period was 26 months. Normal overbite and overjet were obtained, and facial balance was improved. (Am J Orthod Dentofacial Orthop 2012;142:854-62)

A skeletal Class III malocclusion is a common orthodontic problem, with a prevalence of 8% to 22% of all orthodontic patients.1 For an adult patient with no potential for growth, treatment approaches depend on the growth, severity of the skeletal discrepancy, facial profile, and the patient’s desires.2 Generally, this malocclusion can be corrected by camouflage orthodontic treatment or orthodontic treatment combined with orthognathic surgery. In some borderline cases, the patient’s opinion of the soft-tissue profile plays a decisive role in treatment planning.3 For patients with an acceptable facial profile, camouflage treatment is the best choice, and various methods have been used, including multibrackets with Class III elastics with or without tooth extractions.4-6 Class III elastics often result in unexpected rotation of the mandible and proclination of the maxillary incisors and extrusion of the molars.7 This can cause an esthetic problem and instability, especially in long-faced adults.

Therefore, microscrew and miniplate implant anchorage for distalization of the mandibular posterior teeth was introduced.8 However, some patients do not readily accept this invasive approach because of the high cost and the risk of various complications, including injury to adjacent structures, inflammation, infection around the implant site, failure, and fracture.9 The goal of providing these patients a satisfactory facial profile and a stable occlusion without microimplant anchorage is worth consideration.

The purpose of this case report is to present an adult with a skeletal Class III malocclusion and a midline deviation treated with fixed orthodontic appliances, short intermaxillary elastics, and an open-coil spring to move the mandibular molars distally. This treatment produced a satisfactory facial profile and a stable occlusion.

DIAGNOSIS AND ETIOLOGY

An 18-year-old woman was referred to Department of Orthodontics, West China School of Stomatology, Chengdu, China, for treatment, with the chief complaint of dissatisfaction with her dental alignment. Cephalometric and panoramic radiographs, extraoral and intraoral photographs, and dental casts were obtained.

The extraoral examination (Fig 1) showed that she had a relative long lower face and an acceptable profile with a slightly protrusive chin. The intraoral examination (Fig 1) showed a complete Class III molar relationship on the left and a mild Class III malocclusion on the right, and Class III canine relationships bilaterally. There was an edge-to-edge anterior occlusion, and the maxillary left second molar was positioned buccally and overerupted. Mild crowding of 2.5 mm was present in the mandibular anterior region, and a little crowding was found in the maxillary dentition. The maxillary
The midline was coincident with the facial midline, whereas the mandibular midline was deviated 2 mm to the right side (Fig 2). The functional examination showed no abnormal features, and there were no symptoms of temporomandibular disorder. The patient was in good general health with no history of major systemic diseases.

The lateral cephalometric analysis (Fig 3; Table) indicated a skeletal Class III jaw relationship (ANB, –3.4°/C14) with mandibular protrusion (SNB, 85.2°). The mandibular plane angle (MP-SN, 36.0°) had a mild vertical growth pattern. The maxillary incisors were labially proclined (U1-NA, 32.0°), and a lingual inclination was observed at the mandibular anterior teeth (IMPA, 86.8°). The panoramic radiograph showed that all teeth were present except for the mandibular left third molar, and the maxillary and mandibular right third molars were impacted.

The patient was diagnosed with a dental Class III malocclusion, a mandibular midline deviation, mandibular incisor crowding, and a skeletal Class III jaw relationship caused by the mandibular protrusion.

**TREATMENT OBJECTIVES**

The treatment objectives were to (1) correct the anterior edge-to-edge occlusion and establish a normal incisor relationship, (2) achieve Class I molar and canine relationships by uprighting and distalizing the mandibular posterior teeth, (3) resolve the crowding in the mandibular arch, (4) correct the mandibular midline deviation, and (5) maintain the straight pretreatment facial profile.

**TREATMENT ALTERNATIVES**

Three treatment options were considered and presented to the patient. The first alternative consisted of...
combined surgical and orthodontic treatment with
a mandibular setback. This proposal would be the best
way to modify the skeletal pattern and produce a dra-
matic facial profile change. The second consisted of
camou-
flege orthodontic treatment with extraction of
the mandibular left
first premolar. This would be a rela-
tively simple and stable way to resolve the anterior cross-
bite, but there would be no contact between the

Fig 2. Pretreatment dental casts.

Fig 3. Pretreatment radiographs: A, pretreatment pan-
ographic radiograph; B, pretreatment cephalograph.

Table. Cephalometric measurements

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Normal mean</th>
<th>SD</th>
<th>Pretreatment</th>
<th>Posttreatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNA (°)</td>
<td>81.69</td>
<td>2.54</td>
<td>81.8</td>
<td>83.2</td>
</tr>
<tr>
<td>SNB (°)</td>
<td>78.94</td>
<td>2.19</td>
<td>85.2</td>
<td>84.1</td>
</tr>
<tr>
<td>ANB (°)</td>
<td>2.75</td>
<td>1.16</td>
<td>-3.4</td>
<td>-0.9</td>
</tr>
<tr>
<td>MP-SN (°)</td>
<td>32.85</td>
<td>4.21</td>
<td>36.0</td>
<td>37.6</td>
</tr>
<tr>
<td>UI-LI (°)</td>
<td>123.22</td>
<td>6.18</td>
<td>132.4</td>
<td>120.8</td>
</tr>
<tr>
<td>U1 to NA (mm)</td>
<td>5.56</td>
<td>3.6</td>
<td>9.9</td>
<td>9.1</td>
</tr>
<tr>
<td>U1 to NA (°)</td>
<td>23.26</td>
<td>6.17</td>
<td>32.0</td>
<td>36.4</td>
</tr>
<tr>
<td>L1 to NB (mm)</td>
<td>5.76</td>
<td>2.29</td>
<td>5.0</td>
<td>5.5</td>
</tr>
<tr>
<td>L1 to NB (°)</td>
<td>27.38</td>
<td>4.74</td>
<td>28.0</td>
<td>23.7</td>
</tr>
<tr>
<td>FMIA (°)</td>
<td>54.6</td>
<td>6.5</td>
<td>64.8</td>
<td>68.5</td>
</tr>
<tr>
<td>IMPA (°)</td>
<td>96.3</td>
<td>5.8</td>
<td>86.8</td>
<td>82.0</td>
</tr>
<tr>
<td>UL-EP (mm)</td>
<td>-0.46</td>
<td>1.92</td>
<td>-2.6</td>
<td>-1.2</td>
</tr>
<tr>
<td>LL-EP (mm)</td>
<td>1.31</td>
<td>1.92</td>
<td>0.1</td>
<td>0.7</td>
</tr>
</tbody>
</table>
The maxillary left second molar and the opposing tooth. The other treatment alternative was a nonextraction camouflage orthodontic approach with distalization of the mandibular dentition. If the mandibular left second molar could not be distalized effectively because of the maxillary left second molar, the latter tooth would be extracted and replaced by the third molar. This would solve the problems of the posterior malposition and the molar relationship at the same time.

The patient refused the orthodontic-surgical treatment because she did not think that the esthetic improvement with surgery would be worth the risk and cost. She chose the third plan of distalizing the mandibular dentition because she cared about her dental and facial midlines and wanted to obtain complete function of her posterior teeth.

In most skeletal Class III cases, intraoral or extraoral anchorage is required to retract the mandibular dental arch. There were 2 anchorage alternatives for this patient to choose from. One was distalizing the mandibular posterior dentition with a microimplant combined with intra-arch elastics. The other was interarch elastics.

Fig 4. Progress photographs: mandibular left second molar distalized by open-coil spring and short Class III elastics.

Fig 5. Progress photographs: multiloop edgewise archwire of 0.019 × 0.025-in stainless steel was placed in the mandibular arch with short Class III elastics.
with the whole maxillary dentition as anchorage to retract the mandibular arch, with an open-coil spring to move the mandibular left molars distally. The patient was concerned about the invasive approach with potential complications and additional costs and refused the placement of a microimplant.

TREATMENT PROGRESS

The treatment objectives and alternatives were explained to the patient, and informed consent was obtained. A 0.022 × 0.028-in preadjusted edgewise appliance was used. At the first session, banding and bonding were performed from first molar to first molar in the maxillary arch. A coordinated archwire for the maxillary dentition of 0.018 × 0.025-in stainless steel was placed with a boot loop as a hook for short Class III elastics (3/16 in, 3.5 oz). A sectional archwire (0.018 × 0.025-in stainless steel) was used from the first premolar to the second molar on the right side of mandibular arch. In the left region of mandible, only the first premolar and the second molar were included, between which an open-coil spring was placed to move the second molar distally on an 0.018 × 0.025-in stainless steel wire.

After 2 months of treatment, the mandibular left second molar was distalized by 2 mm but still required further movement. At the same time, distal movement of the mandibular posterior teeth was severely hindered by the maxillary left second molar because of its buccal malposition and overeruption. The patient agreed with the plan to extract the maxillary left second molar. A multiloop edgewise archwire of 0.019 × 0.025-in stainless steel was then placed in the maxillary arch with continuous use of the short Class III elastics.

After 5 months of Class III elastics, the anterior crossbite was corrected. There was a space of 4 mm between
the mandibular left first and second molars (Fig 4). Distalization of the mandibular left first molar was started with an open-coil spring between the first premolar and the first molar.

At the seventh month of treatment, the mandibular left first molar moved to the mesial surface of the second molar, and there was distal drift of the second premolar. Subsequently, the brackets were bonded on the remaining teeth in the mandibular arch. Serial archwires were placed, from a 0.014-in nickel-titanium archwire to an 0.018 × 0.025-in stainless steel wire to level and align the maxillary and mandibular dentitions.

During these phases, sequential distal movements of the mandibular left second premolar, first premolar, and canine were performed with elastomeric chains. To correct the mild mesial molar relationship, a multiloop edgewise archwire of 0.019 × 0.025-in stainless steel was placed in the mandibular arch with short Class III elastics in the anterior region (Fig 5). The lingual crown torque and labial crown torque were accentuated for the maxillary and mandibular incisors, respectively, against the elastic forces.

After correction of the anterior edge-to-edge occlusion and creation of a Class I molar and canine occlusion, detailing and finishing were undertaken. The total active treatment time was 26 months. Patient compliance was good throughout treatment. After treatment, maxillary and mandibular circumferential retainers were made and used full time for 1 year and then at night only.

**TREATMENT RESULTS**

The patient was pleased with the treatment results. The posttreatment extraoral photographs (Fig 6) showed that her facial profile remained straight, and her protrusive chin had been retracted slightly. The posttreatment intraoral photographs (Fig 6) and dental casts (Fig 7) demonstrated satisfactory dental alignment, Class I canine and molar relationships, and normal overjet and overbite. The dental midline was corrected and brought to coincide with the facial midline. The mandibular dentition was notably distalized by 5 mm on the left and 2 mm on the right (Fig 7). The maxillary left third molar was moved parallel to the second molar extraction space and had good occlusion with the mandibular molar.

The superimposed pretreatment and posttreatment cephalometric tracings (Figs 8 and 9; Table) according to the anterior cranial base showed that the ANB angle increased from –3.4° to –0.9°. The maxillary incisors showed a slight labial proclination, and the mandibular incisors were uprighted and retracted. The mandibular plane angle changed little in spite of the significant
mandibular molar distalization. Mild extrusion of the maxillary molars resulted in counterclockwise rotation of the occlusal plane but caused little backward rotation of the mandible and no remarkable negative changes in the facial height or the soft-tissue profile.

The patient was asked to wear the removable retainer all day for the first year. One year later, the follow-up examination (Fig 10) showed a well-proportioned soft-tissue profile. The occlusion remained stable, with normal overjet and overbite. There were no signs or symptoms of any temporomandibular disorder during the treatment and retention periods. The retainer was worn at night only for another year.

**DISCUSSION**

Whether to treat an adult with a skeletal Class III malocclusion by orthognathic surgery or orthodontic camouflage treatment is still controversial. Treatment approaches depend on different patterns of growth, severity of the skeletal discrepancy, facial profile, and patient requirements. For borderline cases, the soft-tissue profile plays an important part in treatment planning. With mild crowding and an acceptable straight profile, our patient chose camouflage treatment. After treatment, her facial profile was still straight, and her protrusive chin had been retracted slightly as expected, producing a more balanced and harmonious facial profile.

The orthodontic camouflage options for adults with a skeletal Class III malocclusion include various extraction patterns. Mandibular incisor extraction is sometimes indicated in moderate Class III malocclusions with an anterior crossbite or an edge-to-edge incisor relationship. It depends on the severity of anterior crowding, Bolton analysis, and amounts of overbite and overjet. In this patient, it would have caused a mandibular midline deviation and an excessive overjet of the anterior dentition. Another treatment alternative of extracting the mandibular left first premolar without moving the mandibular molars distally might have provided a normal anterior relationship, but the maxillary left second molar would not have occlusal contact with the opposing tooth.

It has been reported that anteroposterior intermaxillary elastics can produce significant adverse vertical effects. However, these can be prevented by proper design and manipulation. In this patient, throughout the distalization phase, the entire maxillary dentition was supported with an 0.018 × 0.025-in stainless wire as integrated anchorage against the Class III elastic
forces. In the maxillary arch, a coordinated archwire was placed with stop loops to maintain the transverse dimension. Short Class III elastics were used from boot loops between the maxillary first and second premolars to the hooks mesial to the mandibular first premolars, to counteract the adverse labial inclination forces on the mandibular incisors from the open-coil spring. Compared with long Class III elastics, the force is closer to the center of resistance of both the maxilla and the maxillary arch, partly preventing forward movement of the maxillary dentition.

In previous studies, distalization of the entire mandibular dentition was accompanied by a slight mandibular posterior tooth extrusion and an increase in the mandibular plane angle; these movements are not suitable for patients with long faces.12 The multiloop edgewise archwire technique for Class III malocclusions has many loops to provide second-order control of the posterior teeth, permit individual tooth movement, and transmit the force generated by the intermaxillary elastics throughout the entire arch.13 In this patient, the multiloop edgewise archwires (0.019 × 0.025-in stainless steel) were placed in the maxillary and mandibular arches with tip-back mechanics, so that efficient uprighting and intrusion of the mandibular molars, correction of the midline deviation, and relief of anterior crowding could be achieved. With the coordination of the maxillary and mandibular arches, the patient had only counterclockwise rotation of the occlusal plane instead of significant backward and downward mandibular rotation. As a result, the mandibular plane angle changed little, as expected; this was appropriate for a patient with a vertical growth pattern.

The satisfactory occlusion and harmonious appearance are due to appropriate dentoalveolar compensation accompanied by maxillary incisor proclination and bodily retraction of the mandibular incisor. It was believed that the incisor movement was partly controlled...
by the bracket system and mechanics. As we know, Class III elastics have a labial proclination tendency for the maxillary incisors and a lingual retroclination tendency for the mandibular incisors. To counteract the adverse forces of Class III elastics, resistant torques are needed. Therefore, the lingual crown torque and the labial crown torque were accentuated for the maxillary and mandibular incisors, respectively, to counteract the excessive elastic forces.

Microimplant anchorage has some advantages. It can be placed either between the first and second molars or between the second premolar and the first molar in the mandibular arch. With intra-arch elastics, the entire mandibular dentition would be distalized with no movement of the maxillary dentition. However, because of the high cost and complications of surgery, including inflammation and infection around the implant site, injury to adjacent structures, failure, and fracture, some patients do not accept this invasive approach. For these patients, the maxillary coordinated archwire can be combined with various anchorage alternatives, including a palatal bar or headgear, to maintain the transverse and vertical relationships and prevent the adverse effects of Class III elastics. No matter which anchorage pattern is used, the magnitude, direction, and point of application of the force should be carefully monitored.

The relationship between intermaxillary elastics and temporomandibular disorders still lacks a clear consensus. Etiologic factors that might cause upward and backward pressures on the mandible should be minimized as much as possible. Some authors believe that a posterior force on the condyle will induce anterior disc displacement. Others have demonstrated that temporomandibular disorder signs and symptoms are changing, inconsistent, and ephemeral in many orthodontic patients, regardless of the different treatment mechanics including headgear, Class II or Class III elastics, extraction, and nonextraction. Further studies are indicated to document that traditional orthodontic treatments do not increase the prevalence of temporomandibular disorders. In this patient, we used short Class III elastics as a supplementary means to correct the Class III malocclusion and to prevent an undesirable labial inclination of the mandibular anterior teeth. With light and continuous forces, the patient showed no discomfort of the temporomandibular joint and no pain on palpation throughout the treatment and retention periods.

CONCLUSIONS

This case report demonstrates that fixed orthodontic appliances with intermaxillary elastics, open-coil springs, and multiloop edgewise archwires can be an effective method to move the mandibular dentition distally to correct a Class III malocclusion and a midline deviation for an adult.

REFERENCES