Nonsurgical treatment of an adult patient with bilateral posterior crossbite

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A woman with an Angle Class III malocclusion and bilateral posterior crossbites complaining of difficulty in chewing was treated orthodontically without surgery. The treatment comprised asymmetric extractions, a removable mandibular lingual arch constriction appliance to narrow the mandibular arch, and a standard edgewise appliance to align the teeth. Pretreatment, posttreatment, and 1-year follow-up records are shown. With this treatment strategy of constricting the mandibular arch by using a combination of removable and fixed orthodontic appliances, we achieved a good result with optimal occlusion. (Am J Orthod Dentofacial Orthop 2011;140:106-14)

Posterior crossbite is a common problem in orthodontic practice and has been reported to occur in 8% to 22% of orthodontic patients.1-3 Posterior crossbite occurs when the buccal cusps of the maxillary posterior teeth occlude lingually to the buccal cusps of the corresponding mandibular teeth. The origin and basic mechanisms of posterior crossbite remain unclear, but various combinations of dental, skeletal, and neuromuscular functional components are known to be etiologic factors.4 The most common cause, however, is a posterior transverse discrepancy due to reduced maxillary dental arch width alone or combined with increased mandibular arch width.5

The management of a posterior crossbite is based on the cause of the discrepancy between the maxillary and mandibular arch widths. Treatment usually involves the use of a maxillary expansion appliance, which can take many forms. The recommended treatment for younger patients is expansion of the maxillary arch with a removable expansion plate or a quad-helix appliance after grinding the occlusal interferences.6-9 If, however, the posterior transverse discrepancy is caused by increased mandibular arch width only or combined with reduced maxillary arch width, it is difficult to achieve the desired effect with fixed appliances and a maxillary expansion appliance. Orthodontists have tried to reduce maxillary arch width, but the reduction of mandibular arch width rarely has been reported.

The purpose of this article was to present an adult with bilateral posterior crossbites and an excessively wide mandibular arch treated orthodontically by using a removable mandibular lingual arch constriction appliance and fixed orthodontic appliances to reduce the mandibular arch width and correct the posterior transverse discrepancy.

DIAGNOSIS AND ETIOLOGY

A 24-year-old woman was referred for orthodontic consultation. Her chief complaint was inability to chew well because her posterior teeth were not in contact properly when eating. This was a longstanding problem. The extraoral examination showed that she had a straight profile with a symmetric face and competent lips (Fig 1). Functional examination showed no abnormal features. Intraorally, she had Class III molar and Class I canine relationships bilaterally, an anterior crossbite involving the maxillary lateral incisors, and a bilateral posterior crossbite involving the premolars and molars (Fig 2).

Both arches were U-shaped with mild crowding in the posterior segments. The posterior crossbite was due to an absolute maxillary to mandibular arch width discrepancy. The maxillary intermolar width between the central fossae of the right and left first molars was 54 mm, and the mandibular intermolar width between the mesiobuccal cusps of the left and right first molars was 58 mm. The maxillary molars were inclined buccally,
and the mandibular molars were tipped linguually. The mandibular arch had a moderate curve of Spee. The maxillary midline was coincident with the facial midline, but the mandibular midline was deviated 1 mm to the left. Both maxillary lateral incisors were small.

The panoramic radiograph showed all teeth present except the mandibular right third molar, which was impacted. The patient had a large amalgam restoration in the mandibular left second molar, 2 ceramic restorations in the maxillary right molars, and mild generalized periodontal bone loss, but no active periodontal disease (Fig 3). The cephalometric tracing showed a skeletal Class I jaw relationship (Fig 4, Table I). The patient was in good general health with no history of major systemic diseases.

**TREATMENT OBJECTIVES**

The treatment objectives were to correct the anterior crossbite, eliminate the bilateral posterior crossbite by reducing mandibular arch width, resolve the crowding in the maxillary and mandibular arches, correct the mandibular midline deviation, and achieve a normal occlusion with ideal overjet and overbite while maintaining the straight pretreatment facial profile.

**TREATMENT ALTERNATIVES**

We considered that extraction of some mandibular teeth would be required to allow constriction of the mandibular arch to correct the bilateral posterior crossbite and to allow correction of the anterior crossbite. Two alternatives were considered and presented to the patient.

1. Extraction of the mandibular second premolars. This would facilitate easier correction of the posterior crossbites and the anterior crowding but would involve extraction of a healthy tooth on the left side and leave behind a poorly restored second molar.
2. Extraction of the mandibular right second premolar and left second molar. This extraction pattern would
provide enough room to retract the posterior teeth, correct the crossbites, and avoid extracting a healthy tooth in the mandibular left quadrant where there was a poorly restored tooth.

The impacted maxillary right molar was to be surgically removed with both options. The patient chose the second plan comprising extraction of the mandibular right second premolar and left second molar, and surgical removal of the impacted molar.

**TREATMENT PROGRESS**

The proposed orthodontic treatment involved the use of fixed appliances in both arches and a removable mandibular lingual arch constriction appliance. Patient cooperation was required for the removable appliance. Banding and bonding were done from second molar to second molar in the maxillary arch and from first molar to first molar in the mandibular arch. A 0.22 × 0.28-in standard edgewise appliance was used. The maxillary and mandibular arches were leveled and aligned starting with a 0.014-in nickel-titanium wire and a 0.017 × 0.025-in beta-titanium wire. During this time, a removable lingual arch constriction appliance was used to narrow the mandibular dental arch (Fig 5). Meanwhile, an asymmetric arm fabricated in 0.9-mm stainless steel
wire was placed to distalize the maxillary left second molar.

Eight months later, a 0.019 \times 0.025\text{-in} stainless steel wire was placed. Intra-arch elastics were used for space closure, and Class III elastics were used judiciously to obtain an ideal occlusal relationship. The posterior transverse discrepancy was fully corrected during the last 4 months of active treatment. The entire treatment took 2 years 10 months, after which all fixed appliances were removed. A Hawley retainer was used in the maxillary arch, and a removable cast splint wraparound retainer was placed in the mandibular arch (Fig 6). The patient was instructed to use the retainers full time indefinitely. The maxillary left second molar was restored after the treatment.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Pretreatment</th>
<th>Posttreatment</th>
<th>Normal mean ± SD (Chinese adult)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNA (°)</td>
<td>85.5</td>
<td>85.5</td>
<td>81.69 ± 2.54</td>
</tr>
<tr>
<td>SNB (°)</td>
<td>84.5</td>
<td>84.1</td>
<td>78.94 ± 2.19</td>
</tr>
<tr>
<td>ANB (°)</td>
<td>1</td>
<td>1.4</td>
<td>2.75 ± 1.16</td>
</tr>
<tr>
<td>U1 to NA (mm)</td>
<td>6.6</td>
<td>7.1</td>
<td>5.56 ± 3.6</td>
</tr>
<tr>
<td>L1 to NB (mm)</td>
<td>7.3</td>
<td>5.8</td>
<td>5.76 ± 2.29</td>
</tr>
<tr>
<td>Interincisal angle (°)</td>
<td>125.7</td>
<td>125.5</td>
<td>123.22 ± 6.18</td>
</tr>
<tr>
<td>MP:SN (°)</td>
<td>33.6</td>
<td>33.5</td>
<td>32.85 ± 4.21</td>
</tr>
<tr>
<td>FMIA (°)</td>
<td>66.8</td>
<td>63</td>
<td>54.6 ± 6.5</td>
</tr>
</tbody>
</table>

S, Sella; \(N\), nasion; \(A\), A-point; \(B\), B-point; \(MP\), mandibular plane; \(U1\), maxillary central incisor; \(L1\), mandibular central incisor; \(SN\), sella-nasion plane; \(FMIA\), Frankfort-mandibular incisor angle.

Fig 4. Pretreatment cephalometric tracing.

Fig 5. The removable mandibular lingual arch constriction appliance.

Fig 6. The removable casting splint retainer.
TREATMENT RESULTS

Normal functional occlusion was established with normal overbite and overjet (Figs 7 and 8). The posterior crossbites were corrected, and the final molar relationship was acceptable. The midlines were coincident with each other and with the facial midline. The straight facial profile was largely maintained, and the resulting profile was satisfactory.

The constriction of the mandibular dental arch was quite remarkable. On the dental casts, the maxillary intermolar width between the central fossa of the right and left first molars decreased by 5.0 mm, and the mandibular intermolar width between the mesiobuccal cusps of the left and right first molars decreased by 11.0 mm after treatment (Table II). The posttreatment radiographs showed no evidence of root resorption (Fig 9). The superimposed pretreatment and posttreatment cephalometric tracings showed no skeletal changes in the maxilla or the mandible (Fig 10, Table I). The patient was happy with the results achieved and still satisfied at the 1-year retention appointment (Figs 11 and 12).

DISCUSSION

Posterior crossbites are common problems in orthodontic practice. In most cases, posterior transverse discrepancies are due to insufficient maxillary arch width; therefore, expanding the maxillary arch is a major goal of posterior crossbite treatment. Numerous treatment modalities have been recommended to expand the maxillary arch.6-9 Orthodontic effects include tooth tipping and bodily movement of the maxillary posterior teeth and the canines. Midpalatal suture opening is the skeletal response to maxillary expansion, particularly in young patients.7,10 However, if applied to adult patients, the possibility of successful palatal expansion is decreased, because the sutures have a more interdigitated form and greater resistance to mechanical forces.11 In patients, especially adults, when a broad mandibular arch is a factor...
in the etiology of posterior crossbites, the treatment approach should be focused on both arches and not be limited to constricting the maxillary arch. Reduction of the mandibular arch width has, however, been rarely reported. So we tried to design a removable mandibular lingual arch constriction appliance to reduce the mandibular arch width.

This appliance was fabricated from 0.8-mm stainless steel round wire. This wire size was required to generate the necessary force because of the relatively long free span of wire. The wire was bent to conform to the shape of mandibular lingual arch to reduce the patient’s discomfort. Two helices were incorporated to increase the length of the wire and reduce its load around the curvature for better force delivery. Activation was done by compressing the helices so that the force was delivered by spring action as it opened.

Treatment with a constriction mandibular lingual arch appliance can be used primarily in the permanent dentition to correct a posterior crossbite. The mandibular arch width is reduced by decreasing the width of the removable mandibular lingual arch moving the molars lingually. To allow this movement, space is required in the arch, and this can be obtained by any space-gaining method. In this patient, reduction of the dental arch was quite remarkable, and the tooth axes returned to normal, which was conducive for periodontal health.

Table II. Changes in arch width dimensions

<table>
<thead>
<tr>
<th>Measurement (mm)</th>
<th>Pretreatment</th>
<th>Posttreatment</th>
<th>One-year follow-up</th>
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<tbody>
<tr>
<td>Maxillary intermolar width</td>
<td>54</td>
<td>49</td>
<td>50</td>
</tr>
<tr>
<td>Maxillary interpremolar width</td>
<td>45</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Mandibular intermolar width</td>
<td>55</td>
<td>44</td>
<td>44</td>
</tr>
<tr>
<td>Mandibular interpremolar width</td>
<td>45</td>
<td>38</td>
<td>38</td>
</tr>
</tbody>
</table>

Maxillary intermolar width, between the central fossae of the right and left first molars.
Maxillary interpremolar width, between the central fossae of the right and left first premolars.
Mandibular intermolar width, between the mesiobuccal cusps of the right and left first molars.
Mandibular interpremolar width, between the mesiobuccal cusps of the right and left first premolars.
can be camouflaged by orthodontic treatment alone. The constriction mandibular lingual arch can also be used in patients with a mild skeletal malocclusion.

Patients with a broad mandibular arch might have a hypertrophic tongue. Schwenzer et al\textsuperscript{13} concluded that the incidence of relapse was less when reduction of tongue size was combined with orthodontic treatment. The size of the tongue might, therefore, be an essential factor in treatment stability.\textsuperscript{14} We used a removable cast splint wraparound retainer, which controls tongue function and position similar to a tongue crib appliance, and restored the mandibular left second molar.\textsuperscript{15} Muscle balance can play a decisive role in final tooth positions, and mandibular arch retention should be long term. Comparison of the posttreatment dental casts and the 1-year posttreatment dental casts showed little difference.

**CONCLUSIONS**

This case demonstrates that a removable mandibular constriction lingual arch appliance can be an effective method to reduce the width of a wide mandibular arch in the permanent dentition.

**REFERENCES**


Fig 11. One-year posttreatment photographs.
Fig 12. One-year posttreatment dental casts.