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Journal
Bulletin of Tokyo Dental College, 52(1): 39-46

URL
http://hdl.handle.net/10130/2330
A Case Report of Bilateral Brodie Bite in Early Mixed Dentition Using Bonded Constriction Quad-helix Appliance

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Received 26 July, 2010/Accepted for publication 6 October, 2010

Abstract

Brodie bite is a comparatively rare type of malocclusion found in primary and mixed dentition. It not only adversely affects chewing and muscle functions, but also impairs normal growth and development of the mandible. This report describes the therapeutic results of a patient with bilateral Brodie bite in early mixed dentition after using a bonded constriction quad-helix appliance. The patient, a boy aged 9 years and 2 months, first visited our hospital after occlusal abnormality in the molar region was detected at a local dental clinic. Case analysis resulted in a diagnosis of bilateral Brodie bite with slight mandibular retrognathism. Treatment objectives were to reduce the arch width of the maxillary dentition and expand the mandibular arch in order to establish and stabilize molar occlusion and to achieve a Class I molar relation and appropriate overbite and overjet. Treatment comprised covering the occlusal surface of the maxillary molars with resin and attaching a bonded constriction quad-helix appliance joined with a 0.040-inch quad-helix wire. A bi-helix appliance was also fixed to the mandibular dentition. Brodie bite visibly improved after 5 months. Cervical headgear was then fitted and the patient observed until eruption of the permanent dentition was complete. Class I molar relation was achieved after 2 years and 6 months, although spacing remained in the maxillary and mandibular dentitions. Treatment of bilateral Brodie bite in mixed dentition by means of a bonded constriction quad-helix appliance attached to the maxillary dentition enabled effective bite opening and reduction in the width of maxillary arch independent of the patient's cooperation, providing good therapeutic outcome in a short time period.

Key words: Brodie bite—Early treatment—Angle Class II malocclusion—Bonded constriction quad-helix appliance—Bi-helix appliance

Introduction

In 1943, Brodie first described a type of occlusion in which the mandibular dental arch was telescoped within the maxillary dental arch, known as the Brodie syndrome. This type of occlusion, also called “scissors crossbite” or “buccal crossbite”, refers to molar
crossbite resulting from incorrect horizontal positioning of the maxillary and mandibular dental arches, in which all the mandibular molar buccal cusps are telescoped within the lingual side of the maxillary molars, so that there is no intercuspation of the maxillary and mandibular molars. In mixed dentition, the prevalence of this syndrome is 1–2%, making it a comparatively rare form of malocclusion. As it does not affect aesthetics, both patients and their parents or guardians may be unaware of the malocclusion. Therefore, fewer patients present with Brodie bite as a primary complaint compared with patients
exhibiting other types of malocclusion. For this reason, there have been few case reports of the treatment of Brodie bite in primary or mixed dentition.

Nevertheless, this occlusal abnormality is unlikely simply to resolve spontaneously. It not only adversely affects chewing function and muscle function but also impairs the normal growth and development of the mandible if left untreated, with the possibility of jaw deformities such as facial asymmetry and mandibular retrognathism. Therefore, early correction of this occlusion is essential.

We obtained good therapeutic results in a patient with bilateral Brodie bite within a short time period by fitting a bonded constriction quad-helix appliance to reduce the width of the maxillary arch and raise the bite, as well as a bi-helix appliance to expand the mandibular arch.

Case

A boy, aged 9 years and 2 months, first came to our hospital after occlusal abnormality in the molar region had been identified at a local dental clinic. He was healthy with no contributing medical history. The patient’s family history did not reveal any relevant information. The facial features were symmetric from the frontal view, and the profile was convex from the lateral view (Fig. 1). Intraoral examination revealed a dental age of IIIA with +5 mm overbite and +8 mm overjet, spacing in the maxillary anterior teeth, bilateral Brodie bite, and Class II molar relation (Fig. 2). Model analysis showed an excessive coronal arch width of 57.2 mm (Mean 50.98 ± 1.86 mm) and basal arch width of 71.0 mm (Mean 63.72 ± 2.39 mm) in the maxillary molar region, with narrow mandibular dental arch width at the molars of 35.9 mm (Mean 44.65 ± 1.72 mm) and alveolar base width of 55.6 mm (Mean 62.01 ± 2.24 mm) (Table 1). A panoramic radiograph revealed that the entire permanent dentition was present (Fig. 3). Cephalometric analysis indicated slight skeletal mandibular retrognathism with SNA 79.0°, SNB 75.0°, and ANB 4.0°, and labial inclination of the maxillary and mandibular anterior teeth with U1 to FH 126.0°, L1 to FH 54°, and interincisal angle 108° (Fig. 4). From these findings, bilateral

### Table 1 Model analysis

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Maxillary arch</th>
<th>Mandibular arch</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± S.D.</td>
<td>Pre. treat</td>
</tr>
<tr>
<td>Coronal arch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anterior width</td>
<td>39.10 ± 1.43</td>
<td>41.2</td>
</tr>
<tr>
<td>Posterior width</td>
<td>50.98 ± 1.86</td>
<td>57.2</td>
</tr>
<tr>
<td>Anterior length</td>
<td>14.00 ± 1.18</td>
<td>15.6</td>
</tr>
<tr>
<td>Posterior length</td>
<td>32.18 ± 2.08</td>
<td>37.5</td>
</tr>
<tr>
<td>Basal arch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anterior width</td>
<td>45.10 ± 3.01</td>
<td>45.9</td>
</tr>
<tr>
<td>Posterior width</td>
<td>65.72 ± 2.39</td>
<td>71.0</td>
</tr>
<tr>
<td>Anterior length</td>
<td>7.90 ± 2.06</td>
<td>12.0</td>
</tr>
<tr>
<td>Posterior length</td>
<td>25.35 ± 2.25</td>
<td>33.5</td>
</tr>
</tbody>
</table>
Brodie bite with slight mandibular retrognathism was diagnosed.

Treatment objectives were to reduce the arch width of the maxillary dentition and expand the mandibular arch in order to establish and stabilize molar occlusion and to achieve a Class I molar relation, as well as appropriate overbite and overjet until eruption of the permanent dentition was complete. The treatment plan consisted of reducing the width of the maxillary arch by covering the occlusal surfaces of the maxillary first primary
molar, second primary molar, and first permanent molar on both sides with resin to raise the bite and support and activate a bonded constriction quad-helix appliance, which was joined by a 0.040-inch quad-helix wire in 5-mm sections on either side and attached with a light-cured adhesive (Fig. 5). In addition, a bi-helix appliance was fitted to the mandibular first molars to expand the mandibular arch. After 5 months, the Brodie bite showed improvement. Cervical headgear was then fitted in order to correct the Class II molar relation, and the patient was observed regularly until eruption of the permanent dentition was complete. A Class I molar relation was achieved after 2 years and 6 months, although spacing remained in the maxillary and mandibular dentition (Figs. 6–8).

Cephalometric superimposition before and after treatment showed that in the skeletal pattern, anterior growth of the maxilla had been controlled, while the mandible had grown markedly in the anteroinferior direction with no clockwise rotation (Fig. 9). As a result, major skeletal improvement was achieved, with ANB decreasing from 4° to 1.5°
In the denture pattern, no anteroposterior or vertical movement occurred in either the maxillary anterior teeth or molars. The mandibular anterior teeth and molars had shifted slightly in a mesial direction, with almost no vertical change. Eruption of both upper and lower molars was controlled (Fig. 9). In addition, a comparative model analysis showed that the width of the dental arch at the maxillary molars had decreased by 4 mm to 53.2 mm and the alveolar base width had decreased by 2.9 mm to 68.1 mm, whereas the width of the dental arch at the mandibular molars had expanded by 8.7 mm to 44.6 mm and the alveolar base width had expanded by 6.0 mm to 61.6 mm (Table 1).

**Discussion**

Possible causes of Brodie bite include microglossia and hypoglossia, the involvement of neurological and muscular mechanisms causing oral habits, skeletal Class II factors, and abnormal tooth germ position or eruption direction. In the present case, no functional or organic causes were observed, and as the patient not only had an excessively wide maxillary arch and narrow mandibular arch but also a deep bite and mandibular retrognathism, it is probable that the condition was the result of multiple skeletal factors caused by excessive growth of the maxilla and insufficient growth of the mandible.

With respect to treatment planning, Brodie bite frequently involves not only horizontal problems but also anteroposterior and vertical issues, as in the present case. The treatment sequence basically comprises prioritizing horizontal improvement, after which vertical and anteroposterior problems should be corrected. In cases of molar deep bite such as the present case, however, molar interference while horizontal problems are being improved can result in clockwise rotation of the mandible. As Class II molar relation may deteriorate as a result, attention must be paid to the treatment mechanism.

In adult patients, major skeletal abnormalities have been reported, and orthodontic treatment by means of complex treatment mechanisms, orthognathic surgery, and mandibular widening by distraction osteogenesis had to be performed for correction. These treatment procedures require much patient cooperation, and impose a major physical and psychological burden on the patient. Therefore, correction of Brodie bite at an early stage is recommended.

In most reports of patients with primary and mixed dentition, treatment of unilateral Brodie bite involved bite opening using a bite opening.
plate combined with lateral expansion of the mandibular arch by means of a lingual arch or removable lower lateral expansion plate\textsuperscript{7,10}. A bite plate is used to separate the molar occlusion and eliminate occlusal interference in order to improve therapeutic results. However, this method was not recommended in the present case, as the excessive width of the maxillary arch meant that active constriction of the maxillary dentition was necessary. This would also cause molar extrusion in patients with mandibular retrognathism, potentially worsening the mesiodistal occlusal relation. To reduce maxillary arch width, some researchers have used modified removable-type appliances\textsuperscript{4,9} and modified fixed-type appliances for constriction\textsuperscript{2,4,13}. However, correction would take longer with this approach in patients with molar deep bite, such as in the present case. As these methods can also cause molar interference, they were considered inappropriate for the reasons described above. We were unable to locate any case reports on the treatment of bilateral Brodie bite that actively incorporated reduction of the maxillary arch width in the treatment mechanism while taking the vertical relationship into account.

To reduce maxillary arch width in this case, the occlusal surfaces of the first and second primary molars and the permanent first molar were coated with resin, and a bonded constriction quad-helix appliance consisting of four constriction helices joined with 0.040 stainless steel wire was used. In recent years, bonded-type orthodontic appliances such as the Herbst appliance have been used for rapid maxillary expansion. McNamara\textsuperscript{8} has reported the use of a bonded expansion appliance that inhibited the eruption of posterior teeth in patients with increased facial height; slight tipping was observed during expansion due to the rigid framework of the appliance and bonding of the appliance to the posterior teeth. In this study, use of a similar type of resin cover was intended to improve the retention of the appliance and maximize its effect on the skeleton, while minimizing clockwise rotation of the mandible and raising the bite. The patient did not complain of any discomfort or problems with mastication or articulation during the treatment period. Cephalometric superimposition in the present case showed that occlusion had been unlocked by improvement in the Brodie bite and deep bite, with anterior growth promoted by the catch-up growth of the mandible. In addition, the inhibition of anterior growth of the maxilla as an effect of the headgear was effective for skeletal Class II treatment and achieving a Class I molar relation. Vertically, eruption of upper and lower molars was controlled by the bonded constriction quad-helix appliance, and clockwise rotation of the mandible was inhibited, despite the fact that the patient had long face-type mandibular retrognathism. Model analysis showed that reduction of the arch width in the molar region was achieved in both the coronal and basal arches of the maxilla, and in the mandible both the coronal and basal arches were expanded in the molar region as a result of the bi-helix appliance treatment. Correction of bilateral Brodie bite was thought to be achieved as a result of improvement in the buccolingual tooth axis of the molars and lateral skeletal improvement. Some reports concerning treatment period have stated that around 5–8 months are required for primary dentition\textsuperscript{9,15}, with several years required for correction of the first molar\textsuperscript{7}. In the present case, despite the difficulty of correction, effective improvement was seen in a short period of 5 months. Later, although labial inclination of the maxillary and mandibular anterior teeth occurred after eruption of the mandibular second molar, the patient had a spaced arch, and we intend to proceed with corrective orthodontic treatment without tooth extraction to maintain the lateral molar occlusal relation.

Treatment of bilateral Brodie bite in mixed dentition by fitting a bonded constriction quad-helix appliance achieved effective bite opening and reduction in the width of the maxillary arch, providing good results in a short time period independent of the patient’s cooperation.
References


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