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Case Report

Multidisciplinary Treatment of Mandibular Prognathism with Multiple Congenitally Missing Teeth

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Abstract

Surgical orthodontic treatment and dental implant therapy were performed on a man (aged 18 years 8 months) with mandibular prognathism and seven congenitally missing teeth: upper canines, first and second premolars and lower right second premolar. After 17 months of preoperative orthodontic treatment at age 20 years 1 month, sagittal split ramus osteotomy was performed using the remaining upper deciduous teeth as an anchor for intermaxillary fixation. In postoperative orthodontic treatment, the remaining deciduous teeth were extracted, and fixture installation was performed. The entire therapy required 4 years to complete (age 22 years 8 months). After completion of orthodontic treatment, superstructures were put in place. This patient had many dental problems, so multidisciplinary care was performed in conjunction with other departments to improve oral function and facial esthetics.

Key words: Multidisciplinary treatment—Surgical orthodontic treatment—Mandibular prognathism—Multiple congenitally missing teeth—Dental implant

Introduction

Multiple missing teeth not only cause malocclusion, but also make orthodontic treatment difficult due to poor occlusal support and stability1,3,4,9. Furthermore, Sato and Mitani7,8 suggested that multiple missing upper teeth tend to cause mandibular protrusion requiring orthognathic surgery due to retrusion of the maxilla and anti-clockwise rotation of the mandible12. Therefore, in order to improve oral function and facial esthetics, multidisciplinary treatment involving orthodontists, prosthodontists and oral surgeons is important. In some surgical orthodontic treatment cases, a removable surgical splint has been used where the patient has had multiple missing teeth and severe maxillofacial deformity31,40.
However, it is believed that, with this method, it is difficult to achieve the required level of occlusal stability, secure an anchor for intermaxillary fixation, and regain occlusal vertical dimension during surgery. In addition, this method assumes that removable denture and bridgework are insufficient in younger patients where it is necessary to reconstruct the permanent occlusal function and proper dental esthetics.

In this study, we performed surgical orthodontic treatment in conjunction with dental implant therapy in a patient with mandibular prognathism and missing upper canines, premolars and lower right second premolar in order to achieve favorable occlusion and proper facial proportion by effectively using the remaining deciduous teeth prior to orthognathic surgery.

Case Report

The patient was a man (aged 18 years 4 months) who visited our department with anterior crossbite caused by mandibular prognathism. The patient’s family history did not reveal any relevant information. In the past, the patient had childhood asthma and fever seizure. As regards his dental history, none of the permanent teeth had been extracted. From the frontal view, the facial features were symmetric, and from the lateral view, the profile was concave, and mandibular protrusion was obvious (Fig. 1). Intraorally, prolonged retention of the upper bilateral deciduous canines, deciduous molars and lower right deciduous second molar was observed. There was an overjet and overbite of \(-3\) mm and \(3\) mm, respectively and the molar relation was Angle class III. In relation to the midline, the mandible deviated \(3\) mm to the right. A diastema was seen between the upper central incisors, between the lower lateral incisor and canine (both left and right) and between the lower right canine and first premolar (Fig. 2). A panoramic radiograph revealed that the upper canines, premolars and lower right second premolar were missing (Fig. 3). A lateral cephalogram showed the following skeletal pattern: ANB angle \(-3^\circ\), facial angle \(92^\circ\), Y-axis \(58^\circ\), and mandibular plane angle \(18^\circ\). These findings indicated anti-clockwise rotation and anterior overgrowth of the mandible. The U-1 to FH was \(118^\circ\), and L-1 to mandibular plane was \(92^\circ\), suggesting dental compensation of the anterior teeth (Fig. 4). Therefore, the patient was diagnosed with mandibular prognathism accompanied by multiple congenitally missing teeth.

Sagittal split ramus osteotomy was performed, and seven dental implants were placed in place of the seven missing teeth: upper left and right canines, upper left and right premolars and lower right second premolar. The retained deciduous teeth were
During orthodontic treatment, 0.022-slot preadjusted edgewise appliances were used. Starting with a 0.016 NiTi wire, the wire size was increased up to a 0.019×0.025 NiTi wire for alignment and leveling. Six months after the start of preoperative orthodontic treatment, a 0.018×0.025 SS wire was used for the upper and lower dentitions. Furthermore, an edgewise bracket was attached to the remaining deciduous teeth (the left and right canines, first molars and second molars) using an about 2-mm thick self-curing resin at the occlusal surface (Fig. 5). After 17 months of preoperative orthodontic treatment (at age 20 years 1 month), sagittal split ramus osteotomy was performed. The mandible was rotated 2 mm to the left and set back approximately 7 mm. Nine months later (at age 20 years 10 months), when the screws used in orthognathic surgery were removed, a fixture was placed in the

extracted at appropriate time points. The lower right deciduous second molar was extracted at the start of orthodontic treatment, while the other remaining deciduous teeth were extracted after orthognathic surgery.
Fig. 4 Tracing and measurements on pretreatment cephalometric radiograph

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Mean ± S.D.</th>
<th>Pre. Treat.</th>
<th>Post. Treat.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facial angle (deg.)</td>
<td>86.1 ± 3.3</td>
<td>92</td>
<td>89</td>
</tr>
<tr>
<td>Convexity (deg.)</td>
<td>6.4 ± 3.0</td>
<td>−7</td>
<td>2</td>
</tr>
<tr>
<td>A-B plane (deg.)</td>
<td>−5.2 ± 2.5</td>
<td>−3</td>
<td>−1</td>
</tr>
<tr>
<td>Mandibular plane (deg.)</td>
<td>24.8 ± 5.9</td>
<td>18</td>
<td>22</td>
</tr>
<tr>
<td>Y-axis (deg.)</td>
<td>64.0 ± 3.1</td>
<td>58</td>
<td>60</td>
</tr>
<tr>
<td>Occlusal plane (deg.)</td>
<td>8.4 ± 4.2</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Interincisal (deg.)</td>
<td>131.6 ± 5.6</td>
<td>130</td>
<td>117</td>
</tr>
<tr>
<td>L-1 to Occlusal (deg.)</td>
<td>21.3 ± 5.3</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>L-1 to Mandibular (deg.)</td>
<td>97.1 ± 4.9</td>
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<td>91</td>
</tr>
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<td>U-1 to A-P plane (mm)</td>
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<td>6</td>
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<tr>
<td>FH to SN plane (deg.)</td>
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<td>7</td>
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<td>SNA (deg.)</td>
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<td>81</td>
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<tr>
<td>SNB (deg.)</td>
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<tr>
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<td>130</td>
</tr>
<tr>
<td>L-1 to FH plane (deg.)</td>
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<tr>
<td>Gonial angle (deg.)</td>
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<td>118</td>
<td>126</td>
</tr>
<tr>
<td>Ramus angle (deg.)</td>
<td>88.5 ± 4.5</td>
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<td>76</td>
</tr>
</tbody>
</table>

Fig. 5 Introral occlusal view of 2-mm thick self-curing resin at occlusal surface

upper left and right canines, upper left and right first premolars and second premolars and lower right second premolar. The appliance was removed after four years (at age 22 years 8 months) of treatment because satisfactory improvements in occlusion and facial feature were obtained. Four months later (at age 23 years 0 month), the superstructures were put in place (Figs. 6, 7, 8). At present, the patient is in the retention period and is being monitored. A wrap-around type retainer was placed in the upper and lower arches, and a fixed type retainer was used between the upper lateral incisors and between upper canines.

As for changes during active treatment, orthognathic surgery moved the mandible 9 mm in the posterior direction, SNB was decreased by 2° and facial angle was decreased by 3°. With maxillary superimposition, the upper first molar moved 1 mm in the mesial direction, and the U-1 to FH of the upper central incisors changed from 118° to 130°, and these teeth were labially inclined by 1 mm. With mandibular superimposition, the lower right first molar became upright and moved 2 mm in the mesial direction. The L-1 to FH of the lower central incisors changed from 70° to 67°, and these teeth were labially inclined by 0.5 mm. In relation to the E-line, deviation of the lower lip decreased from 4 to 1 mm, and the facial features became proportionate (Fig. 9).

**Discussion**

The incidence of malocclusion accompanied by congenitally missing teeth is relatively
high, but that accompanied by multiple congenitally missing teeth is rare. Oka et al.\textsuperscript{5} studied 215 patients with congenitally missing teeth and reported that the majority (92\%) had four or less missing teeth, while 8.0\% had five or more missing teeth. They also documented that the incidence of congenitally missing first and second premolars was high. Brekhus et al.\textsuperscript{7} studied 202 patients with congenitally missing teeth and reported that only
nine patients (4.4%) had four or more missing teeth. The patient in the present study was lacking six upper teeth that were vital in determining occlusal function and vertical dimension. Therefore, congenital lack of teeth as a functional matrix caused maxillary deficiency, and the collapse of occlusal vertical dimension caused anti-clockwise rotation of the mandible, thus leading to skeletal mandibular protrusion.

As for the timing of retained deciduous tooth extraction, the lower right deciduous second molar was extracted at the start of treatment so that the lower right first molar could be moved 2 mm in the mesial direction to ensure the appropriate width for the lower right second premolar. However, the remaining deciduous teeth were extracted after orthognathic surgery as they were used as anchors for intermaxillary fixation during orthodontic treatment and orthognathic surgery and were also helpful in the regaining of occlusal vertical dimension. Until postoperative orthodontic treatment, the left and right retained deciduous teeth were bound as a single mass using self-curing resin.

For subsequent prosthesis placement, dental implant therapy was considered appropriate because the width of the maxilla and bone mass were sufficient. In young patients, implant therapy must be planned after taking into account growth and development, but the present patient was over the age of 20 years when the implants were put in place. Hence, the effects of growth and development were considered minimal, and we focused on mechanical conditions, using an implant-supported bridge to treat the upper missing teeth.

We used the remaining deciduous teeth in a patient with mandibular prognathism accom-
panied by congenitally missing teeth in order to achieve occlusal stability, secure anchors for intermaxillary fixation, and regain occlusal vertical dimension prior to orthognathic surgery. In postoperative orthodontic treatment, these deciduous teeth were extracted, and fixtures were placed in the extracted regions. The results showed that oral function and facial esthetics were improved in this patient with many dental problems through multidisciplinary care involving close collaboration with other departments.

References


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