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Orthodontic Treatment Combined with Maxillary Posterior Subapical Osteotomy in Severe Anterior Open Bite

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INTRODUCTION

Skeletal anterior open bite is one of the most difficult cases to treat in orthodontics. It can result from lack of eruption of anterior teeth, but it is most often caused by rotation of the jaws or excessive eruption of posterior teeth. The morphological pattern is characterized by a longer vertical dimension, an increase in development of the maxillary posterior dentoalveolar structure, and a steep mandibular plane. In cephalometric analysis, skeletal anterior open bite exhibits a short mandibular ramus and downward rotation of the posterior maxilla; this tends to produce a downward and backward rotation of the mandible that increases anterior facial height and separates the upper and lower anterior teeth.

Successful treatment of skeletal open bite in growing patients requires controlling the downward growth of the maxilla and the eruption of posterior teeth to prevent mandibular rotation. This can be extremely difficult to accomplish.

Case Report

A 29-year-old woman presented with severe anterior open bite (~6 mm). Eight-month presurgical orthodontic treatment involving arch rounding and leveling was performed, with the upper arch treatment from canine to canine only. Bilateral maxillary posterior subapical osteotomy (PSO) for posterior intrusion was performed for 6-week fixation. Postsurgical orthodontic treatment followed, resulting in a total treatment time of 19 months. Cephalometric X-ray superimposition revealed that the anterior overbite was corrected by 9 mm (from -6mm to +3 mm), and the lower mandibular plane angle changed from 38.4° to 35.4°. Therefore, counterclockwise rotation of the mandible improved the facial profile. In conclusion, orthodontic treatment combined with upper posterior intrusion through PSO was useful for correcting severe anterior open bite; it simultaneously achieved a short treatment time and prevented open bite relapse. (Taiwanese Journal of Orthodontics. 30(4): 228-237, 2018)

Keywords: anterior open bite; molar intrusion; posterior subapical osteotomy (PSO).
In adult patients, treatment of severe skeletal anterior open bite consists mainly of surgically repositioning both the maxilla and the mandible. However, some patients fear the surgical risks. Thus, various alternative orthodontic therapies can be used, such as high-pull head gear, tooth extraction, and multiple-loop edgewise arch wire (MEAW). These techniques provide acceptable interincisal relationships and increase overbite; however, skeletal improvements are often minimal because it is difficult to establish an absolute anchorage for molar intrusion through traditional orthodontic mechanics. Therefore, implants and temporary anchorage devices, including miniscrews and miniplates, have been used to attain absolute orthodontic anchorage. These devices can provide absolute anchorage for molar intrusion without active patient participation, but patients must understand the risks and complications associated with 1) miniscrew loosening and fracture, 2) screw–root proximity, and 3) soft tissue impingement and damage. Relapse of the orthodontic molar intrusion is another unavoidable complication, which is a major harassment in an anterior open bite case.

This article reports the successful treatment of severe skeletal anterior open bite through maxillary posterior subapical osteotomy (PSO) surgery combined with orthodontic treatment. Common orthognathic surgery in skeletal anterior open bite treatment is either superior repositioning of the maxilla through LeFort I osteotomy to correct face height or mandibular ramus osteotomy to adjust the anteroposterior positioning of the mandible if it does not rotate into the correct position after the maxilla is impacted. However, PSO is a simpler procedure than these jaw surgery methods. It can correct anterior open bite through maxillary posterior intrusion and autorotation of the mandible.

CASE REPORT

A 29-year-old woman presented with severe anterior open bite (−6 mm). Her chief complaint was extended inability to bite with her anterior teeth. Intraoral examination revealed anterior open bite from the first premolar with a Class II canine relationship. However, the molar relationship was not defined caused by the tooth 25–28 bridge and absence of tooth 26 and 27. On the right side, it was likely a Class II molar relationship. There was angular impaction at tooth 48. Her facial profile was straight with a slightly short mandible, and her upper anterior teeth showed a reverse curve arch when smiling (Figure 1, 2 and 3). The patient hoped to delay change to her existing prosthesis because of concerns with the long duration of endodontic retreatment.
Figure 2. Intraoral photographs before treatment.

Figure 3. Panoramic and lateral cephalometric X-ray before treatment.
Anterior Open bite Corrected with PSO

The patient hoped to simplify her treatment procedures because she lives outside the city (in Kinmen County). Our treatment plan was maxillary posterior tooth intrusion through maxillary PSO from the first premolar to the last molar combined with full-mouth fixed orthodontic treatment, with surgical removal of the tooth 48 impaction before orthodontic treatment and extraction of tooth 18 during surgery.

Treatment procedure

After tooth 48 extraction, full-mouth fixed orthodontic bonding was performed, except for the tooth 25–XX–27 bridges, from tooth 13 to 23 and 14 to 17 to separate and level and leave 24 free. This should achieve simultaneous rounding and leveling of the lower arch.

Cephalometric analysis

The anterior open bite was greater than 6 mm, with a skeletal Class II (\(\angle ANB = 7.0^\circ\)) and a high mandibular angle (\(\angle SN-MP = 38.4^\circ\)). Her facial profile was straight profile with the upper lip retruding 4.8 mm to the E-line and the lower lip protruding 0.6 mm to the E-line (Table 1).

Diagnosis

The diagnosis was skeletal Class II with a high mandibular plane angle. The molar relationship was Class II (right side), and the bilateral canine relationship was also Class II.

Treatment objectives and treatment plan

According to the aforementioned examination, the treatment objective was to close the anterior open bite first. The maxillary posterior teeth must be intruded to allow the mandible to auto rotate to close the anterior open bite. This should simultaneously shorten the lower facial height and decrease the mandibular plane angle while increasing the maxillary anterior dental show and straightening the anterior dental arch to achieve an esthetically pleasing profile.

The patient hoped to simplify her treatment procedures because she lives outside the city (in Kinmen County). Our treatment plan was maxillary posterior tooth intrusion through maxillary PSO from the first premolar to the last molar combined with full-mouth fixed orthodontic treatment, with surgical removal of the tooth 48 impaction before orthodontic treatment and extraction of tooth 18 during surgery.

Table 1. The pre-treatment and post-treatment cephalometric measurements.

<table>
<thead>
<tr>
<th></th>
<th>Norms</th>
<th>Pre-Tx</th>
<th>Post-Tx</th>
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<tbody>
<tr>
<td><strong>SKELETAL</strong></td>
<td></td>
<td></td>
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<tr>
<td>SNA</td>
<td>82 ± 3.5</td>
<td>82.1</td>
<td>82.1</td>
</tr>
<tr>
<td>SNB</td>
<td>80 ± 3.0</td>
<td>75.1</td>
<td>76.4</td>
</tr>
<tr>
<td>ANB</td>
<td>2.0 ± 2.0</td>
<td>7</td>
<td>5.6</td>
</tr>
<tr>
<td>SN-MP</td>
<td>32.9 ± 5.2</td>
<td>38.4</td>
<td>35.4</td>
</tr>
<tr>
<td><strong>DENTAL</strong></td>
<td></td>
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<tr>
<td>U1-SN</td>
<td>103.8 ± 5.5</td>
<td>105.9</td>
<td>97.2</td>
</tr>
<tr>
<td>U1-NA(mm)</td>
<td>4.3 ± 2.7</td>
<td>3.2</td>
<td>2</td>
</tr>
<tr>
<td>L1-MP</td>
<td>90.0 ± 6.0</td>
<td>100</td>
<td>94</td>
</tr>
<tr>
<td>L1-NB(mm)</td>
<td>4.0 ± 1.8</td>
<td>9.1</td>
<td>8.1</td>
</tr>
<tr>
<td><strong>SOFT TISSUE</strong></td>
<td></td>
<td></td>
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<tr>
<td>U lip to E-line</td>
<td>1.0 ± 2.0</td>
<td>-4.8</td>
<td>-4.9</td>
</tr>
<tr>
<td>L lip to E-line</td>
<td>0.5 ± 2.0</td>
<td>0.6</td>
<td>-1.4</td>
</tr>
</tbody>
</table>
Yang JH, Wu YY

She underwent presurgical orthodontic treatment for 8 months (Figure 4 and 5). Afterward, bilateral maxillary PSO for posterior segment intrusion was performed by oral and maxillofacial surgeon, Dr. Wu. His treatment plan was to impact the posterior segment from the first premolar to last molar, 3.5 mm on the right side and 4 mm on the left. After 6 weeks of fixation, the patient underwent postsurgical orthodontic treatment for 19 months (Figure 6 and 7). After orthodontic treatment (Figure 8, 9 and 10), she was referred to a local dentist to change the prosthesis and pursue further endodontic treatment.

Figure 4. Pre-surgical extraoral photographs.

Figure 5. Pre-surgical intraoral photographs.
Figure 6. Postsurgical extraoral photographs.

Figure 7. Postsurgical intraoral photographs.

Figure 8. Extraoral photographs after treatment.

Figure 9. Intraoral photographs after treatment.
Figure 10. Panoramic and lateral cephalometric X-ray after treatment.
Anterior open bite Corrected with PSO

DISCUSSION

Anterior open bite is often caused by downward rotation of the mandible or overeruption of the posterior teeth. On cephalometric analysis, skeletal open bite primarily exhibits a short mandibular ramus and downward rotation of the posterior maxilla. Both conditions tend to produce a downward and backward rotation of the mandible that increases anterior face height and separates the upper and lower anterior teeth.

The potential for attempting to restrict vertical maxillary development in an adolescent, growing patient with vertical maxillary excess has been described in detail elsewhere. Skeletal anterior open bite is one of the most difficult cases to treat in orthodontics. In adult patients, various nonsurgical approaches have been used.

Although MEAW can achieve acceptable overbite and cephalometric evaluation reveals remarkable changes

RESULT

Cephalometric analysis after treatment (Table 1) revealed that the anterior overbite was corrected by 9 mm (from -6mm to +3 mm), the lower mandibular plane angle changed from 38.4° to 35.4°, and \( \angle \text{ANB} \) decreased by 1.4°. Cephalometric X-ray superimposition demonstrated that the mandible auto-rotated to close the anterior open bite and soft tissue pogonion point advance movement (Figure 11). The anterior incisors looked improved on the X-ray superimposition, also exhibiting a frontal pleasing smiling line in photographs.

Counterclockwise rotation of the mandible and improved facial profile were achieved. In summary, orthodontic treatment combined with upper posterior intrusion through PSO was useful in correcting severe anterior open bite, reducing treatment time while simultaneously correcting the open bite.

Figure 11. Superimposition of cephalometric tracing from pretreatment (black) and post-treatment (red): left, sella-nasion plane registered at sella; upper right, palatal plane registered at ANS; lower right, mandibular plane registered at menton.
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in the dentition with this treatment, changes in the skeletal pattern are limited. This is likely the extraction therapy and extrusion of the anterior teeth are often undesirable for treatment of skeletal open bite cases, particularly those with maxillary vertical excess, a long-face tendency, or compensatory eruption of the anterior teeth. Recently, skeletal anchorage has become popular for open bite treatment; it more effectively achieves vertical control and shortens the long face. However, the problems of skeletal anchorage therapy include difficulty in selecting the site of miniscrew placement as well as the loosening and fracturing of screws. Although these nonsurgical combined orthodontic treatments have exhibited therapeutic effects in anterior open bite, treatment remains challenging because of open bite relapse, tooth instability, and long treatment times.

To achieve satisfactory skeletal facial pattern change, a low degree of relapse, and a short treatment time, combined orthognathic surgery is a superior treatment option for adult skeletal open bite. However, there are three principal methods for surgical correction of an anterior open bite of primarily skeletal etiology in adult patients: 1) differential posterior impaction of a Le Fort I osteotomized maxilla, 2) segmental impaction of the posterior maxilla, and 3) isolated mandibular surgery. These three methods have unique indications and risks. Our case had posterior downward rotation of the maxilla and backward rotation of the mandible but normal mandibular body length and ramus height. Her incisal smiling height was normal but exhibited a reverse curve arch. The treatment plan was method 2, but without Le Fort I osteotomy of the maxilla with separate posterior and anterior vertical segments. We used only surgical intrusion through PSO of the maxilla from the first premolar to the second molar for a simple surgical method to reduce the risks associated with the treatment and shorten the treatment time.

The anterior overbite was corrected from −6 mm to +3 mm. The mandibular plane angle decreased from 38.4° to 35.4°. Cephalometric superimposition analysis revealed upper molar intrusion of 3.5 mm and soft tissue pogonion point forward of 3 mm. Total treatment time was 19 months, including surgery and intermaxillary fixation.

Cephalometric superimposition at follow-up 8 months after treatment revealed that a stable treatment result had been achieved.

**CONCLUSION**

This case achieved anterior open bite correction and facial height pattern improvement with a short treatment time and a stable result. Preliminary investigation found that the fixed orthodontic treatment combined with PSO of the maxilla could be used effectively for anterior open bite correction in adult patients. Long-term follow-up should be conducted to assess the stability of the treatment results.

**REFERENCE**