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INTRODUCTION

Tooth ankyloses is the pathological merging of root surface to the alveolar bone. Infraocclusion with marginal ridge discrepancies between ankylosed and adjacent teeth is one of the main characteristics. This often accompanies with tilting of adjacent teeth and midline deviation to the affected side. Physiologically, due to the shedding of deciduous molars, leeway space is created and first permanent molar shifts mesially. Since ankylosed tooth lacks normal process of mesial drift on the affected side, it will draw the midline to that side. An ankylosed tooth also permits elongation of the opposing tooth and occlusal plane canting. The distance from occlusal heights of the teeth adjacent to the inferior border of the mandible will be shorter compared with that of the contralateral side.

Case Report

This case report describes the treatment of a 24-year-old woman with chief complaints of anterior open bite and long lower jaw. She had a skeletal Class III with concave facial profile, hyperdivergent facial pattern, long lower facial height, and excessive anterior open bite. Intraoral examination revealed 26 tooth ankyloses and 32, 42 congenital missing teeth. The 26 was highly-locked, showing root penetrating into the sinus floor. Treatment was performed with a modified surgery-first approach, which included 5 months of presurgical alignment phase to upright the 27 mesially-tilted tooth and to correct upper dental midline by 14 extraction. The surgeries included 3-pieces LeFort I impaction by using 14 and 26 extraction spaces as well as bilateral sagittal split ramus osteotomies setback with closing rotation and genioplasty. Upper and lower arches coordinated well soon after surgery. The posterior open bite settled well during postsurgical orthodontic phase. Appropriate vertical facial proportion and solid interdigitation were achieved after treatment. The treatment had successfully corrected the anterior open bite and long face problems, concomitantly solved her difficult molar ankyloses issue during the time of surgery, no further prostheses were required. Pleasing esthetic outcomes were achieved, contributing to patient’s psychosocial satisfaction. (Taiwanese Journal of Orthodontics. 30(4): 218-227, 2018)

Keywords: surgical orthodontics; skeletal Class III; anterior open bite; Class III malocclusion; ankylosed maxillary molar.

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With a misdiagnosis, it can lead to several unexpected complications. Because an ankylosed tooth lacks mobility, it does not respond to orthodontics force and can cause significant intrusion of the surrounding teeth when tied into the main arch wire, commonly seen as an open-bite.\(^5\)

Another concern of ankyloses is the deficiency of bony tissue. Retained ankylosed during growth will interrupt the development of the alveolar ridge.\(^6\) As the adjacent teeth continue to erupt, the ankylosed vertical development becomes arrested, forming vertical steps.

Obviously, it causes occlusal disturbance. Attempts to move the tooth is complicated. Removal of the tooth will create a huge bony defect, requiring bone augmentation for prostheses or orthodontic closure. This case report illustrates a treatment option for correcting this difficult ankyloses problem.

**CASE REPORT**

A 24-year-old woman complained about her anterior open bite and long lower jaw. The patient denied any major systemic disease. She had no trauma history and no temporomandibular disorder signs and symptom. Her past dental history was routine dental care with previous 17 and 38 extractions.

**Diagnosis**

The patient had concave facial profile with long face. The facial asymmetry was acceptable with chin deviation to the right side by 1 mm. Left-sided upward eye, lip, and occlusal plane canting was observed. Her lip incompetence and muscle strain were presented. The upper incisor display at rest was 1 mm. When she smiled, the upper incisor show is 80% (8 mm) and the smile arc was not consonant. Paranasal depression and shallow mentolabial fold were also noticeable.

Intraorally, Class III canine and molar relationship with anterior open bite of 5 mm and anterior crossbite of 4 mm were obviously demonstrated. According to her facial midline, lower dental midline was 0.5 mm shift to the right side, while upper dental midline was 3.5 mm shift to the left due to 26 ankylosed tooth, showing infraocclusion and buccoversion. The 17 was missing due to previous extraction from extensive proximal caries, while 32, 42

![Figure 1. Pre-treatment facial and intraoral photographs showing skeletal Class III and dental Class III with anterior open bite, missing 32,42 lower incisors and 26 highly-locked in the sinus.](image-url)
were congenitally missing. There was also lingual cross bite at 13, 14. The maxillary arch was asymmetric ovoid-shaped, whereas the mandibular arch was symmetric taper-shaped. The curve of Spee was 1 mm on both sides. The Bolton’s analysis could not be calculated due to 32, 42 missing teeth (Figure 1).

The lateral cephalometric analysis revealed that mandible was protractive with ANB angle of -2.5°. The mandible protrusion was confirmed by Pg-Nv. The facial pattern was hyperdivergent, as SN-MP angle represented 45°. The UFH/LFH ratio of 43/57 showed increased lower facial height. All parameters in dental part were within normal limits, except lower incisors were retroclined (Table 1). The postero-anterior cephalometric examination showed left-sided upward of occlusal plane canting. Panoramic film demonstrated no pathologic finding on bilateral condyles and maxillary sinus. There were 18, 28, 38 impacted teeth. From cone-beam computed tomography (CBCT) image, the 26 was highly-locked with root penetrating into the maxillary sinus (Figure 2).

**Table 1. The comparison of cephalometric analysis between initiation and completion of treatment.**

<table>
<thead>
<tr>
<th></th>
<th>Norm</th>
<th>Before treatment</th>
<th>After treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNA (°)</td>
<td>79.8 ~ 83.2</td>
<td>82.0</td>
<td>83.0</td>
</tr>
<tr>
<td>SNB (°)</td>
<td>75.7 ~ 78.7</td>
<td>84.5</td>
<td>82.0</td>
</tr>
<tr>
<td>ANB (°)</td>
<td>3.2 ~ 5.0</td>
<td>-2.5</td>
<td>1.0</td>
</tr>
<tr>
<td>SN-MP (°)</td>
<td>33.8 ~ 38.4</td>
<td>45.0</td>
<td>38.0</td>
</tr>
<tr>
<td>UFH/LFH (%)</td>
<td>45/55</td>
<td>47/53</td>
<td>45/55</td>
</tr>
<tr>
<td>U1-NA (mm)</td>
<td>4.3 ~ 6.1</td>
<td>8.0</td>
<td>5.5</td>
</tr>
<tr>
<td>U1-SN (°)</td>
<td>103.85 ~ 108.75</td>
<td>106.5</td>
<td>103.0</td>
</tr>
<tr>
<td>L1-NB (mm)</td>
<td>5.4 ~ 10.2</td>
<td>6.0</td>
<td>4.0</td>
</tr>
<tr>
<td>L1-MP (°)</td>
<td>93.4 ~ 99.2</td>
<td>75.0</td>
<td>78.0</td>
</tr>
<tr>
<td>E-LINE: Upper</td>
<td>0.7 ~ 3.1</td>
<td>-2.0</td>
<td>-1.0</td>
</tr>
<tr>
<td>E-LINE: Lower</td>
<td>0.2 ~ 3.4</td>
<td>3.5</td>
<td>-0.5</td>
</tr>
</tbody>
</table>

**Figure 2.** Radiographs and CBCT showing 26 ankylosed tooth was highly-locked with the root penetrating into the maxillary sinus.
Taken all the findings and analysis into consideration, the patient had a skeletal Class III relationship with mandibular prognathism and hyperdivergent facial type, and Angle’s Classification III malocclusion with anterior cross bite, anterior open bite, 32, 42, 17 missing teeth and 26 ankyloses.

**Treatment objectives**

The treatment goals for this patient were to: (1) correct the open bites as well as improve vertical facial proportion; (2) solve the ankylosed maxillary molar problem; (3) obtain functional and healthy dental occlusion.

**Treatment plan**

In order to correct the all the problem lists, orthodontic treatment combined with two-jaw orthognathic surgery was offered to this patient. The presurgical orthodontic treatment consisted of correction of dental midline by 14 extraction and uprighting 27 mesially-tilted tooth. The surgeries included 3-pieces LeFort I impaction by using 14 and 26 extraction spaces (26 extracted during surgery) as well as bilateral sagittal split ramus osteotomies with closing rotation and genioplasty. The following treatment option were considered and well explained to the patient.

**Treatment progress**

The treatment started with pre-operative orthodontic treatment with full mouth bonding of .022 x .028-in brackets. By using .016 NiTi wire, upper and lower dentition was leveled and aligned. After 27 mesially-tilted tooth had been uprighted, 14 was then extracted and the wire was changed to .018 stainless steel. The 8-mm extraction space was partially utilized to correct the upper dental midline, leaving the remaining space for segmental osteotomy. After 5 months of retraction, the upper dental midline coordinated well with facial midline (Figure 3).

*Figure 3. Pre-operative facial and intraoral photographs showing midline had been corrected.*
Pre-operative records, comprising clinical evaluation, 2D, 3D photos, X-ray and dental casts with bite registration, were collected. Surgical treatment objective (STO) was tentatively planned from paper surgery. Surgical planning was later simulated in 3D software (Simplant O&O) to achieve precise roll, pitch and yaw movement (Figure 4). The surgical stent was double stent technique.

Due to difficulty of 26 extraction and risk of an oroantral communication, the ankyloses tooth was decided to be surgically removed during the time of surgery. For the maxilla, the surgery was LeFort I posterior impaction including segmental osteotomy (3-pieces) by using 14 and 26 extraction spaces to level the occlusal plane canting, transverse correction, and to close extraction space during surgery (Figure 5). The mandible was done by bilateral sagittal split ramus osteotomies setback with counterclockwise rotation of the distal segment to close the bite and reduce the lower facial height as well as advancement genioplasty. For the surgical occlusion, the bite was setup open at molars, while slightly deep overbite at incisor region. Rigid internal fixation was used for better stability. Upper and lower arches coordinated well and the posterior open bite had been settled down soon after surgery.

Figure 4. 3D surgical planning (After LeFort I, BSSO and genioplasty).

Figure 5. 3D surgical planning, occlusal view (before and after).
In terms of dentition, Class I canine with lower canine substitution, right side Class I molar, and left side Class III molar were achieved with solid interdigitation occlusion, optimal overbite, overjet, and well-coordination arches. The ankylosed tooth with vertical bone deficiency problem was totally eliminated without any complications. The panoramic radiograph showed good roots parallelism (Figure 7).

Postoperative orthodontic phase was aimed for closing remaining spaces, coordinating dental midlines, correcting residual canting and residual buccal crossbite. It turned out that, although the extraction of 14 and 17 with space closure had already provided some space for upper right third molar to erupt, it is still impacted. With the aid of gingivectomy and surgical eruption, it was successfully brought into the oral cavity. After finishing and detailing, the retention was done by fixed and removable retainers.

**Treatment results**

In terms of soft tissue and facial appearance, straight facial profile with appropriate vertical facial proportion, including correlation of facial and dental midlines were achieved.

The patient was back for one-month post-operative follow up. Despite mild swelling and the maintained lip canting when smiled, excellent improvement in facial esthetics and midline correlation was achieved. The overjet was +2 mm and overbite was +3 mm (Figure 6).

In terms of dentition, Class I canine with lower canine substitution, right side Class I molar, and left side Class III molar were achieved with solid interdigitation occlusion, optimal overbite, overjet, and well-coordination arches. The ankylosed tooth with vertical bone deficiency problem was totally eliminated without any complications. The panoramic radiograph showed good roots parallelism (Figure 7).

The 3D superimposition and superimposed cephalometric tracing between pre-treatment and debonding X-rays demonstrated significant improvement in the skeletal measurements with posterior impaction of maxilla and great amount of mandibular setback with closing rotation. The vertical dimension of lower facial height was remarkably reduced with the upward movement of pogonion by 8 mm (Figure 8).

The case report was approved by the Institutional Review Board of Chang Gung Memorial Hospital (No. 201900036B0).
Figure 7. Post-treatment photographs and radiographs at debonding visit.
DISCUSSIONS

Management of an adult permanent ankylosed tooth is challenging, requiring interdisciplinary comprehensive approach. It depends on the tooth position, degree of ankylosis, treatment goals as well as patient’s motivation and patient’s choice. Orthodontic and surgical decisions could range from maintaining the same position then build up with composite, moving orthodontically or surgically, to extraction then close space or open space for prosthesis.

If the option is to save the tooth, build up with composite was not recommended in this case because the tooth was too infra-occluded with buccally tilt. To move the tooth by subluxation followed by heavy continuous orthodontic force may have some limitations if it was true ankylosed. Complication like crown fracture, root fracture, root resorption, necrosis of pulp and possibility of reankylosis must be informed in advance. For surgical repositioning by dentoalveolar segmental osteotomy, sufficient proximal spaces were required for fine cut and the roots of adjacent teeth must be taken care of. Distraction osteogenesis of the segment was not a good option in posterior region because it can cause sinus perforation.

Alternative treatment option includes extraction. However, it occasionally results in a large bony defect, which will increase difficulty in orthodontic space closure. Moreover, extraction of a highly-locked ankylosed tooth could lead to a high risk of root penetration into sinus with an oroantral fistula. It also causes further negative effect on the adjacent teeth periodontal status. Bone augmentation from ramus or iliac crest is often needed for prosthetic replacement in the definitive restoration stage.

According to patient’s chief complaint, extraction and elimination of the space by posterior segmental maxillary osteotomy (PSMO) in conjunction with LeFort I and bilateral sagittal split osteotomies seemed to be the optimum solution. The extraction site can be utilized for cutting line of PSMO and the posterior segment would be moved forward. With this advancement, it eliminates the need for bony reconstruction and prostheses restoration.

Figure 8. Superimposition of lateral cephalometric tracings. (Transparency view of pre-op 3D skull).
In 1954, Schuchardt introduced the PSMO for vertical dimension correction in open bite cases. It was later modified for horizontal and transverse problems. Moloney et al provided more extensive review for PSMO applications, especially for edentulous space closure. Using a PSMO to reposition the teeth can be implemented for dentofacial deformities in all three dimensions.

- Vertical dimension - to extrude posterior segment for lateral open bite correction, to intrude for vertical reduction for prosthetic restoration.
- Sagittal dimension - to close edentulous space or cleft defect, to gain space for impacted canine or premolar.
- Transverse dimension - to expand or constrict the arches for unilateral or bilateral crossbite and arches coordination.

Presurgical orthodontics treatment was aimed to upright 27 mesially-tilted tooth and to correct upper dental midline by 14 extraction. The benefits of upper right premolar extraction were not only for midline correction but also for shortening the arch length, providing space for impacted tooth eruption. Brezulier et al reported in a systematic review that extraction of premolars contributes to improving the prognosis of third molars eruption after space closure. In our case, with the extractions of 17 extensive proximal caries and 14, 18 automatically moved mesially. With 18 gingivectomy by uncoverage the thickened mucosa, it could erupt successfully within a few months.

This patient had Skeletal Class III with severe open bite. Simultaneous removal of ankylosed tooth with surgical space closure during segmental LeFort I osteotomy will reduce the risk of complications, shorten the treatment time as well as harmonize the skeletal discrepancy in sagittal, vertical and transverse dimensions.

**CONCLUSION**

If orthognathic surgery is required to correct a dentofacial deformity and the patient has ankylosed tooth problem, segmental osteotomy could be the treatment of choice by removing the ankylosed tooth and eliminating the extraction space by performing a vertical osteotomy in conjunction with a posterior segmental maxillary osteotomy and advance the segment forward. This eliminates the need for reconstruction and prosthetic replacement. The treatment had successfully corrected the anterior open bite and long face problems, concomitantly solved her difficult molar ankyloses issue during the time of surgery. Pleasing esthetic outcomes were achieved, contributing to patient’s psychosocial satisfaction.

**REFERENCES**


10. Cohenca N, Stabholz A. Decoronation - a conservative method to treat ankylosed teeth for preservation of alveolar ridge prior to permanent prosthetic reconstruction: literature review and case presentation. Dental traumatology: official publication of International Association for Dental Traumatology. 2007;23(2):87-94.


