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CASE REPORT

Dental & Craniofacial Research

Horseshoe Le Fort I osteotomy for gummy smile and facial asymmetry: Two cases

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Abstract

Introduction: *In cases with gummy smile or asymmetry of the maxilla, superior repositioning of the maxilla is required. If superior repositioning by a Le Fort I osteotomy alone is difficult, a horseshoe Le Fort I osteotomy can be used.*

Presentation of cases: *Case 1: A 24-year-old Japanese woman patient presented with a gummy smile and an open bite. After we performed a horseshoe Le Fort I osteotomy, the maxillary segment was repositioned superiorly 3.0 mm at upper tooth number 1 (U1) and 5.0 mm at upper tooth number 6 (U6). Case 2: A 21-year-old Japanese man presented with severe facial asymmetry. After we performed a unilateral modified horseshoe Le Fort I osteotomy, the maxillary segment was superiorly repositioned 6.0 mm at the right U6.*

Discussion: *This procedure eliminated the risk of intraoperative bleeding because it was unnecessary to remove bones around the descending palatine artery, and it was possible to maintain the chamber size of the nasal cavities.*

Conclusion: *The horseshoe Le Fort I osteotomy is a reliable technique for cases with severe gummy smile or asymmetry of the maxilla.*

Keywords: *Horseshoe Le Fort I osteotomy; gummy smile; severe asymmetry*

Introduction

Superior repositioning of the maxilla is required in cases of vertical excess of gummy smile and asymmetry of the maxilla. However, the single segment created by Le Fort I osteotomy is often difficult to reposition superiorly because of the posterior maxillary bone around the descending palatine artery and the anterior part of the pterygoid plates. As the span of the superior repositioning of the maxilla increases, there is a risk of damaging the descending palatine artery or the pterygoid venous plexus, which can cause intraoperative bleeding and avascular necrosis of the maxilla [1,2]. Horseshoe Le Fort I osteotomy is useful for cases in which a Le Fort I osteotomy alone cannot easily move the bone fragment upward.

Bell and McBride were the first to introduce the horseshoe palatal osteotomy: namely, a total alveolar osteotomy in combination with Le Fort I osteotomy [3]. In Japan, the horseshoe Le Fort I osteotomy was first reported by Harada [4]; then Yoshioka et al. [5] reported paramedian palatal osteotomies for reliable superior repositioning by further dividing the palatal portion into three pieces. They also reported the procedure of reducing the maxillary tuberosity for posterior repositioning [6] and the postoperative skeletal stability of the procedure [7].

In the present case report, two patients obtained sound occlusion and a good profile after the operation. In case 1, we performed horseshoe Le Fort I osteotomy for gummy smile with open mouth; in case 2, we performed a unilateral modified horseshoe Le Fort I osteotomy for a severely asymmetric case.

Presentation of cases

Case 1: A 24-year-old Japanese woman.

Clinical diagnosis: Gummy smile and skeletal open bite.

Surgical procedure: After pre-surgical orthodontic treatment, orthognathic surgery was performed under general anesthesia. Following a Le Fort I osteotomy and down fracture, a horseshoe osteotomy was performed from the superior surface of the down-fractured maxilla as shown by the green line in Figure 1A. The amount of maxillary impaction is shown in between the double green line in this figure, which also shows how the maxillary cant was corrected. A horseshoe osteotomy was performed according

to the preoperative computed tomography (CT) image (Figure 1A, red line), dividing the maxilla into dentoalveolar and palatal components using the ultrasonic cutting device Osada Surgery Falcon® to avoid damage to the palatal mucosa (Figure 1B, dotted line). It was not necessary to remove the bone around the descending palatine artery (Figure 2B, arrow). After the dentoalveolar and the palatal bone fragments were completely separated, the burrs and undercuts of the truncated end portion of the bone that interfered with the lifting of the dentoalveolar fragments were ablated. The palatal mucosa and periosteum needed to be preserved in order to reduce the loss of blood supply to the palatal bone fragment, so a sufficient-sized portion of the periosteum on the side of dentoalveolar bone was peeled off. Interposing the positioning plate allowed us to confirm that the dentoalveolar segment was repositioned superiorly 3.0 mm at upper tooth number 1 (U1) and 5.0 mm at upper tooth number 6 (U6). The mandible was advanced by a bilateral sagittal split ramus osteotomy. Figure 1C and D shows frontal view pictures of the patient's preoperative and postoperative full smile. The gummy smile and maxillary cant were improved, and postoperative stability was good.

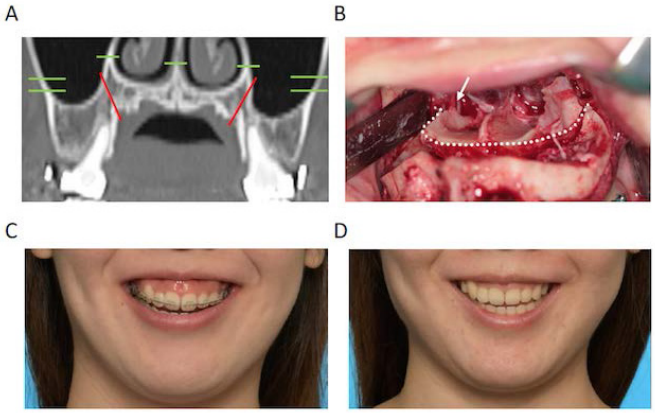

Figure 1. Case 1. Gummy smile with open bite. A, CT image at the molar region. Osteotomy lines shows Le Fort I (green) and horseshoe (red). B: perioperative photograph of horseshoe osteotomy. C and D: frontal view pictures of preoperative and postoperative full smile. Dotted line, osteotomy line; arrow, descending palatine artery.

Case 2: A 21-year-old Japanese man.

Clinical diagnosis: Facial asymmetry.

*Surgical procedure: Und*er general anesthesia, we performed a unilateral modified horseshoe osteotomy after a Le Fort I osteotomy and down fracture. Figure 2A shows a perioperative picture of the horseshoe osteotomy line, which was on the left side of the nasal floor (Figure 2A, dotted line). The maxillary dentoalveolar segment was superiorly repositioned 6.0 mm at the right U6, and the left upper jaw was not raised. The postoperative CT image clearly shows the site of the horseshoe osteotomy (Figure 2B arrow), and demonstrates that the right dentoalveolar fragment was successfully impacted (Figure 2B). A comparison of the preoperative (Figure 2C, red line) and postoperative (Figure 2D, red line) cants of the maxilla by frontal cephalometric X-ray

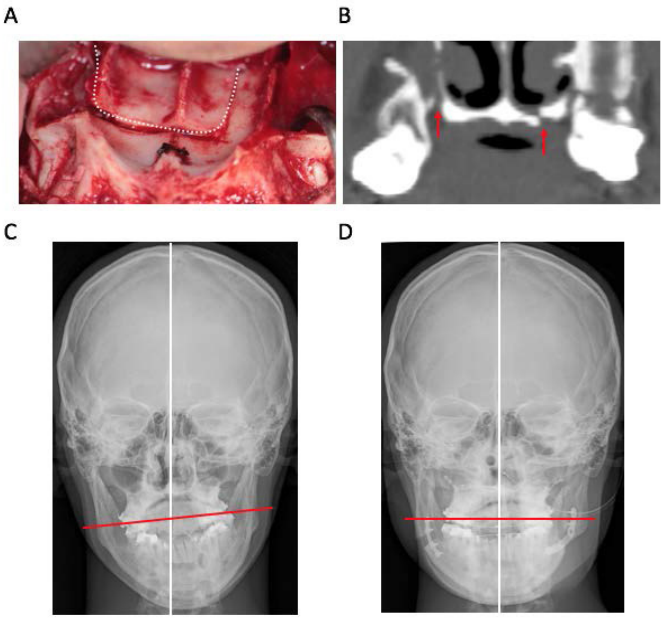

Figure 2. Case 2. Severe asymmetry. A: unilateral modified horseshoe Le Fort I osteotomy. Horseshoe osteotomy line is shown by the dotted line. B: postoperative CT image arrows show the osteotomy line. C and D: preoperative (C) and postoperative (D) frontal cephalometric X-ray view. The cant of the maxilla is shown by the red line.

view demonstrated improvement of the cant of the maxilla as a result of the operation.

Discussion

In the case of vertical maxillary excess with gummy smile or open bite, the surrounding bone of the descending palatine artery or inferior turbinate can be a barrier to achieving the planned superior repositioning using a Le Fort I osteotomy. Bone trimming around the descending palatine artery with superior repositioning carries the risk of bleeding from the maxilla and the artery. Although dissection of the lower nasal concha or turbinectomy has been reported when the required superior repositioning exceeds 8 mm [3,8,9], dissection of the inferior nasal concha can cause atrophic rhinitis [10]. In our experience, the postoperative cephalometric analysis sometimes shows that a superiorly repositioned maxilla is not actually raised to the planned position with a Le Fort I osteotomy alone, even if the bone around the descending palatine artery is removed. The effectiveness of the horseshoe Le Fort I osteotomy lies not only in the reliability and stability of the maxillary impaction but also in eliminating the risk of damage to the descending palatine artery and nasal cavity function by preventing narrowing of the nasal cavity. We have used horseshoe osteotomy in cases of severe gummy smile requiring elevation of 4 mm or more at the posterior portion of the maxilla.

In case 1, it was necessary to reposition the maxilla by 3 mm at the maxillary anterior tooth region (U1), 5 mm at the first maxillary molar part (U6), and 7 mm at the posterior part of the maxilla. In performing a conventional horseshoe Le Fort I osteotomy as we did here, it is important to check the positional relationship between the

palatal root apex of the maxillary molars and the maxillary sinus and nasal floor by preoperative CT to avoid the risk of damaging the palatal root apex. On the other hand, in the case of the unilateral impaction of the maxilla, a unilateral modified horseshoe Le Fort I osteotomy was effective. The advantage of this technique is that the horseshoe line is placed in the left nasal floor on the side without impaction, thus reducing the risk of damage to the palatal root apex of the maxillary molars. In case 2, an ultrasonic cutting device was used to avoid the risk of palate mucosal damage. A key advantage of the horseshoe Le Fort I osteotomy is its ability to maintain the chamber size of the nasal cavity. In a traditional Le Fort I ostomy, cases of maxillary impaction with forward movement experience nasal cavity expansion but cases requiring backward movement suffer from narrowing of the nasal cavity [11]. In case 1, the maxillary segment was repositioned superiorly, but there are cases in which a gummy smile requires superior and posterior repositioning of the maxilla. As the horseshoe Le Fort I osteotomy superiorly repositioned only the dentoalveolar fragments instead of the entire maxilla including the palatal bone fragment, it is presumed that stenosis of the nasal cavity was less likely to occur.

One limitation of this paper is that 3D morphological evaluation of the nasal cavities using CT was not used to calculate the volume change of the nasal cavities after superior repositioning of the maxilla in our gummy smile case. In such a postoperative evaluation of a horseshoe Le Fort I osteotomy described in a previous report, the maxilla was superiorly repositioned near their planned positions and the postoperative stability was also good [5,7]. The immediate postoperative course in these cases has been good; long-term postoperative stability including conventional nose function in conventional horseshoe Le Fort I osteotomy and unilateral modified horseshoe Le Fort I osteotomy should also be examined.

In this report, a case with a gummy smile and a case with severe asymmetry were addressed using a horseshoe Le Fort I osteotomy, which is a useful technique for reliable superior repositioning of the maxilla.

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