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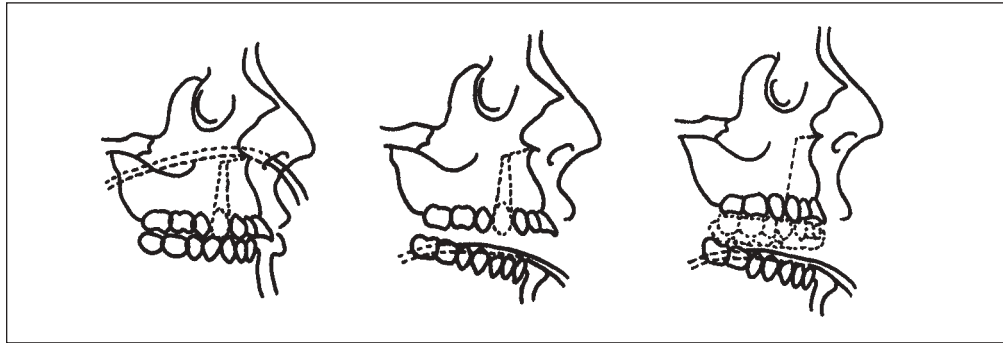
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## Three cases of anterior maxillary osteotomy under orotracheal intubation

*Anterior maxillary osteotomy is frequently applied to skeletal Class II cases with maxillary protrusion. In addition to the anteroposterior problem, these cases are often accompanied with a long midfacial appearance and display of incisors and gingiva during smiling. In the application of anterior maxillary osteotomy to such patients, it is necessary to move the anterior maxillary segments upward as well as backward. Since the upward movement occasionally interferes with the intranasal endotracheal tube, orotracheal intubation is recommended for the operation. Recently, the use of a resin replica of the mandibular dental arch was introduced to place the anterior maxillary segment correctly in the planned position and to obtain the correct occlusion. This article reports on 3 maxillary protrusive skeletal Class II patients with deep overbites and vertical esthetic problems treated by this method. The treatment results show that all 3 patients exhibited large upward and backward movements of the anterior maxillary segments and desirable facial profiles, with a reduction of the deep overbites after the treatment. This case report demonstrates that the anterior maxillary osteotomy under orotracheal intubation with the use of a resin replica is a useful method to treat maxillary protrusive skeletal Class II patients with a large alveolar height. (Int J Adult Orthod Orthognath Surg 2002;17:273-282)*

Anterior maxillary osteotomy is frequently applied to cases of maxillary excess.<sup>1,2</sup> Most of them exhibit skeletal Class II malocclusion with maxillary protrusion and proclined maxillary incisors. In addition to these anteroposterior problems, these cases are often accompanied by excessive vertical growth of the maxilla. This vertical excess causes a long midfacial appearance and the display of incisors and gingiva during smiling. To treat these patients, it is necessary to move the anterior maxillary segments upward as well as backward by anterior maxillary osteotomy. Since the upward movement occasionally interferes with an intranasal endotracheal tube, orotracheal intubation is recom-

mended (Figs 1a and 1b). However, the critical problem of orotracheal intubation is the difficulty in examining the occlusion between the maxillary and mandibular teeth and in placing the anterior maxillary segment correctly in the arranged position during the operation. To solve this problem, application of a resin replica of the mandibular dental arch has been reported (Fig 1c).<sup>3</sup> This method enables examination of the occlusion and helps to place the anterior maxillary segment correctly into the arranged position. This article reports on 3 maxillary protrusive skeletal Class II patients with deep overbites and vertical esthetic problems who were treated by this method.



**Figs 1a to 1c** Schematic drawing of (*left*) an intranasal endotracheal intubation and (*center and right*) an orotracheal intubation. Note that the upward movement of the anterior maxillary segment is occasionally interfered with by the intranasal endotracheal tube. (*Right*) The resin replica of the mandibular dental arch (*dotted line*) is fixed to the maxillary arch after the osteotomy and extraction of the maxillary first premolars.

## Case reports

### Patient 1

A 19-year-old male patient presented for treatment with the chief complaint of maxillary protrusion. His profile demonstrated a marked protrusion of the maxilla and upper lip before treatment (Figs 2a to 2c). The frontal facial appearance showed a large vertical height and display of an entire incisor crown with a few millimeters of gingiva on smile. Intraoral photographs showed significantly proclined maxillary incisors and +15.0 mm of anterior overjet with +5.5 mm of overbite (Figs 2d to 2f). A lateral cephalogram also demonstrated protrusion of the maxilla and maxillary incisors (Fig 2g). The ANB angle was +4.5 degrees. The panoramic radiograph showed that the mandibular premolars and molars were inclined mesially (Fig 2h).

The most significant problems were the protrusion and excessive vertical height of the maxilla. Therefore, the treatment plan was to move the anterior maxillary segment upward and backward by anterior maxillary osteotomy using a resin replica of the mandibular dental arch under orotracheal intubation. Before presurgical orthodontic treatment, the maxillary left and right third molars and the mandibular right second premolar and third molar were extracted. Due to apical periodontitis, the mandibular left second molar was also extracted. An edgewise multibracket appliance was placed, and presurgical orthodontics was

carried out for 2 years, 11 months, to level and align both arches. The sectional archwires were set to the maxillary arch immediately before the operation (Figs 2i to 2k).

The anterior maxillary osteotomy was carried out as previously reported.<sup>3</sup> In brief, the patient underwent surgery under general anesthesia with orotracheal intubation. To preserve the blood supply to the anterior maxillary segment from both the palatal and labiobuccal soft tissue pedicles, 3 vertical labiobuccal incisions and 1 sagittal midpalatal mucosal incision were performed. The maxillary first premolars were extracted, and the osteotomy and osteotomy were carried out based on methods of Wassmund<sup>4</sup> and Wunderer.<sup>5</sup> After these were accomplished, a resin replica of the mandibular dental arch was temporarily fixed to the molar region of the maxillary arch. The anterior teeth in the replica helped to place the mobilized anterior maxillary segment in the arranged position (Fig 1c). The anterior maxillary segment was moved backward by 8.0 mm and upward by 4.0 mm and was fixed with miniplates. Vertical steps were made between the maxillary canines and second premolars immediately after the operation (Figs 2l and 2m). The edges of the sectional archwires were connected to each other with self-curing resin to reinforce the intersegmental fixation. Postsurgical orthodontic treatment was initiated to level these vertical steps gently using titanium-nickel superelastic wire. The appliance was removed 17 months after surgery.

The patient was seen 6 months after postsurgical orthodontics and showed good facial harmony and a satisfactory occlusion with a normal overbite and overjet (Figs 2n to 2r). As shown in Fig 3, subnasale (Sn),<sup>6</sup> an intersection of the lower border of the nose and upper lip, was projected on a line perpendicular to Frankfort horizontal (FH) plane as Sn'. The distance between Sn' and incision superius (Is) was measured and used to evaluate the vertical position of Is. The vertical position of Is and the nasolabial angle were improved after treatment (Tables 1 and 2). The posttreatment lateral cephalogram and superimposed cephalometric tracings are shown in Figs 2s and 2u. Both backward and upward movements of the anterior maxillary segment were apparently observed. The ANB angle at this stage was  $-4.1$  degrees. The teeth were aligned parallel, as shown in the posttreatment panoramic radiograph (Fig 2t).

#### *Patient 2*

Patient 2 was a 19-year-old man who presented for treatment with the chief complaint of maxillary protrusion. The pretreatment facial photographs demonstrated a marked protrusion of the maxilla and upper lip with a long vertical height (Figs 4a and 4b). The ANB angle was  $+9.5$  degrees. Intraoral photographs showed an anterior overjet of  $+10.0$  mm and an overbite of  $+7.5$  mm (Figs 4c to 4e). Spaced arch and proclined maxillary incisors were also seen. A scissors bite was observed in the right molar region.

The excessive vertical height and maxillary protrusion were the most significant problems. After the mandibular left and right third molars were extracted, an edgewise multibracket appliance was placed and presurgical orthodontics was carried out for 3 years, 1 month. Anterior maxillary osteotomy was performed, as in patient 1, under orotracheal intubation using a resin replica, and the maxillary first premolars were extracted. The anterior maxillary segment was moved backward by  $6.0$  mm and upward by  $4.0$  mm. After 16 months of postsurgical orthodontics, the multibracket appliance was removed. The pro-

trusive midfacial appearance was significantly improved, and a stable occlusion with a marked reduction in overjet and overbite was obtained after treatment (Figs 4f to 4j). The vertical position of Is moved upward, and the nasolabial angle increased significantly (Tables 1 and 2). The posttreatment lateral cephalogram and superimposed cephalometric tracings showed backward and upward movements of the anterior maxillary segment with the retroclined incisors (Figs 4k to 4m). The ANB angle had improved to  $+5.0$  degrees at this stage.

#### *Patient 3*

Patient 3 was a 31-year-old man who presented for treatment with the chief complaint of maxillary protrusion. Significant protrusion and excessive vertical height of the maxilla were noted before treatment (Figs 5a and 5b). The ANB angle was  $+12.3$  degrees. Intraoral photographs showed an anterior overjet of  $+8.0$  mm with an overbite of  $+7.5$  mm (Figs 5c to 5e). The mandibular left and right third molars and second premolars were extracted before presurgical orthodontics. An edgewise multibracket appliance was placed and presurgical orthodontics was carried out for 2 years, 9 months. The anterior maxillary osteotomy was performed using a resin replica under orotracheal intubation, and the maxillary first premolars were extracted. The anterior maxillary segment was moved backward by  $6.0$  mm and upward by  $6.0$  mm, and postsurgical orthodontics was carried out for 11 months. The profile and the midfacial vertical height were significantly improved after the treatment (Figs 5f and 5g). A stable occlusion with Class I molar relationships and a normal overjet and overbite were obtained (Figs 5h to 5j). The vertical position of Is moved significantly upward and the nasolabial angle increased slightly (Tables 1 and 2). The posttreatment lateral cephalogram and superimposed cephalometric tracings showed a large movement of the anterior maxillary segment in the upward and backward directions (Figs 5k to 5m). The ANB angle had improved to  $+6.3$  degrees at this stage.

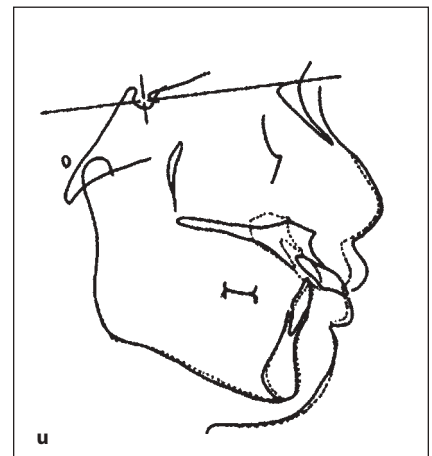
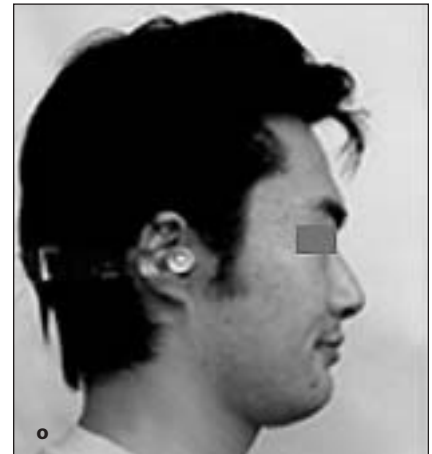
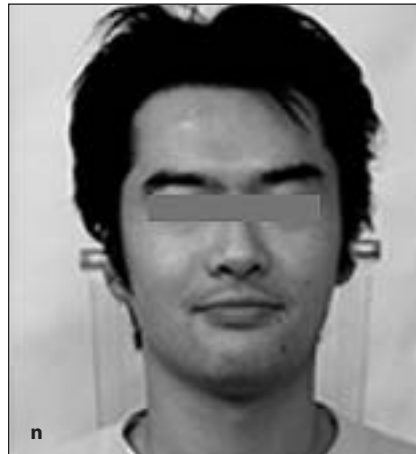
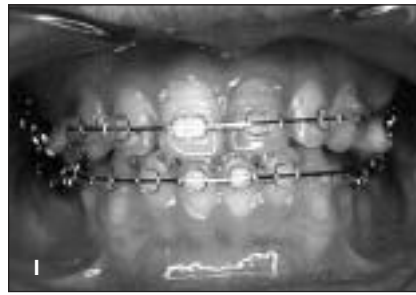


**Figs 2a to 2h** Pretreatment facial and intraoral photographs and radiographs of patient 1.

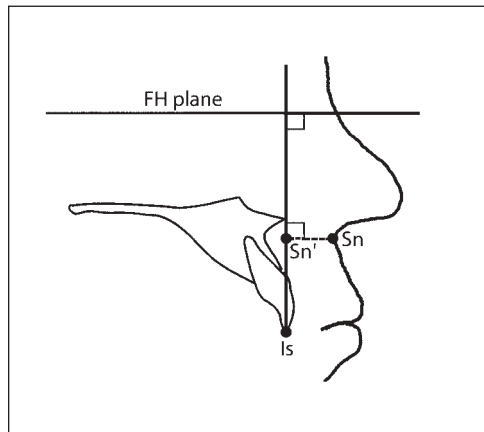


**Figs 2i to 2k** Frontal and lateral intraoral photographs of patient 1 immediately before the anterior maxillary osteotomy. Note that the sectional archwires were set to the maxillary arch.

**Figs 2l and 2m** Frontal and lateral intraoral photographs of patient 1 immediately after surgery. The edges of the sectional archwires were connected to each other with self-curing resin to reinforce the intersegmental fixation.



**Figs 2n to 2u** Posttreatment facial and intraoral photographs, radiographs, and superimposed tracings of case 1. Solid lines represent pretreatment and dotted lines posttreatment.



**Fig 3** Subnasale (Sn), the intersection of the lower border of the nose and the upper lip, was projected backward to a line perpendicular to Frankfort horizontal plane, and the distance between Is and the projected point (Sn') was measured.

Table 1 Vertical position of incisor superius			
Time	Sn'-Is (mm)		
	Case 1	Case 2	Case 3
Pretreatment	22.1	31.9	29.4
Posttreatment	19.4	29.8	23.7
Difference	-2.7	-2.1	-5.7

Table 2 Change in nasolabial angle (deg)			
Time	Case 1	Case 2	Case 3
	Pretreatment	86.5	98.5
Posttreatment	93.0	109.5	90.5
Difference	6.5	11.0	3.5



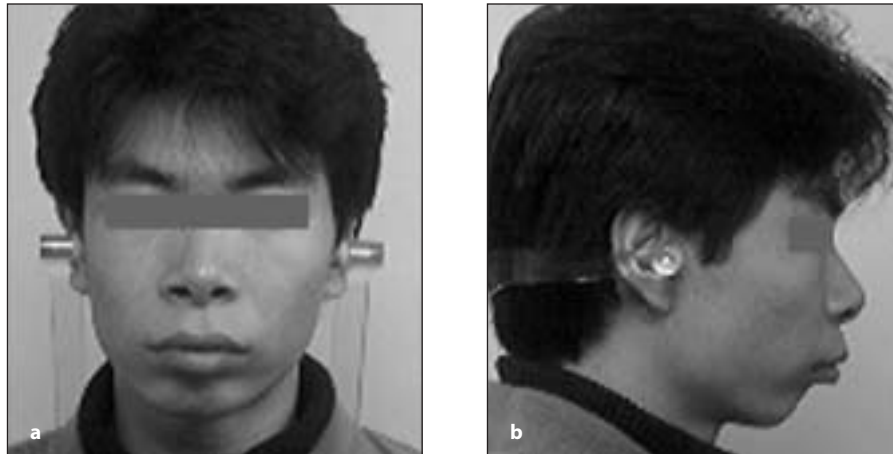
**Figs 4a to 4e** Pretreatment facial and intraoral photographs of patient 2.



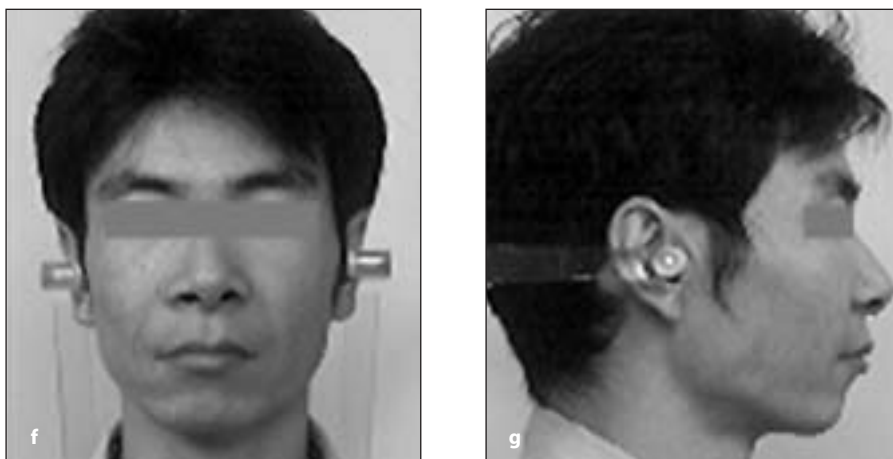
**Figs 4f to 4j** Posttreatment facial and intraoral photographs of patient 2.



**Figs 4k to 4m** (Left) Pretreatment and (center) posttreatment radiographs and (right) superimposed tracings of patient 2. Solid lines represent pretreatment and dotted lines posttreatment.



**Figs 5a to 5e** Pretreatment facial and intraoral photographs of patient 3.



**Figs 5f to 5j** Posttreatment facial and intraoral photographs of patient 3.



**Figs 5k to 5m** (Left) Pretreatment and (center) posttreatment radiographs and (right) superimposed tracings of patient 3. Solid lines represent pretreatment and dotted lines posttreatment.

## Discussion

In all the cases presented, backward and upward movements of the anterior maxillary segments were performed by surgery. The moved segments were correctly placed in the planned position with the aid of a resin replica of the mandibular dental arch. The upward movement was 4.0 mm in patients 1 and 2 and 6.0 mm in patient 3. Since the intranasal endotracheal tube was expected to interfere with these upward movements, the operations were performed under orotracheal intubation. As shown in Figs 2l and 2m, the edges of sectional archwires were connected to each other with self-curing resin. This is an intelligent way to reinforce the intersegmental fixation, since it is difficult to adjust and set a new continuous rectangular archwire to the operated maxilla during and immediately after the surgery.

Patient 1 showed the most severe maxillary protrusion and convexity in profile, and the backward movement of the maxillary anterior segment was the largest (8.0 mm) among the 3 cases. The ANB angle decreased significantly, from +4.5 degrees to -4.1 degrees after treatment. The anterior maxillary segment also moved upward by 4.0 mm, and the vertical position of *I*s improved after the treatment. This bidirectional movement would contribute to the

marked improvement of the posttreatment profile in patient 1. However, if the anterior maxillary segment could be rotated lingually by the surgery, it would help to decrease the amount of backward movement, with the same treatment result in the profile.

Patient 2 had a spaced arch in the maxilla before treatment, and the maxillary incisors appeared to tip lingually with the descent of their edges after presurgical orthodontics. Thus, even after the treatment, the reduction in the distance of *Sn'*-*I*s was only 2.1 mm (Table 1). If the upward movement of the anterior maxillary segment had not been performed, the treatment result of the maxillary height and the position of *I*s would be worse.

In patient 3, the upward movement of the maxillary anterior segment (6.0 mm) and the reduction in the distance of *Sn'*-*I*s (-5.7 mm) were the largest among the 3 cases. The significant improvement in the maxillary height can be seen from the radiographs and superimposed cephalometric tracings (Figs 5k to 5m).

In summary, the use of a resin replica of the mandibular dental arch is a reliable and useful method to place the anterior maxilla into the planned position during an anterior maxillary osteotomy. This method enables a large movement of the anterior maxillary segment in the upward

as well as backward directions, and provides a desirable facial profile and a large reduction of the deep overbite in maxillary protrusive skeletal Class II patients with a large alveolar height.

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