

# Interdisciplinary treatment of an adult with complete bilateral cleft lip and palate

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Interdisciplinary treatment was used for an adult patient born with complete bilateral cleft lip and palate. He had a severe maxillary deficiency with a wide cleft involving the alveolar and maxillary bone and palate. Reconstruction of the arches and occlusion in patients who missed the optimal treatment time is a difficult task for orthodontists. The clinical examination showed severe hypogenesis of the maxillary bone with a total crossbite. The maxillary dental arch was extremely narrow, and the maxillary incisors showed extensive caries caused by improper oral hygiene. Fixed and removable expansion appliances were used to improve the lateral crossbite. Alveolar bone grafting and unilateral LeFort I maxillary osteotomy were performed on the right side for alignment of the maxillary arch. Mandibular setback with bilateral sagittal split ramus osteotomy was also performed to correct the anteroposterior skeletal discrepancy. After postsurgical orthodontic treatment, prosthetic treatment was carried out for final reconstruction of esthetics and orthognathic function. Interdisciplinary treatment was necessary for this patient to achieve a proper occlusion and better esthetics. (*Am J Orthod Dentofacial Orthop* 2012;141:S149-58)

Cleft lip and palate (CLP) is generally considered to be a congenital birth defect.<sup>1</sup> Miyazaki et al<sup>2</sup> reported that the prevalence of CLP in the Japanese population is 0.18%. The prevalence of patients with complete bilateral CLP is relatively low, and the results of treatment in these patients are less favorable than those achieved in patients with unilateral CLP.<sup>3</sup> The long-term treatment protocol for patients with CLP is well established and includes palatal closure, alveolar bone grafting, and orthognathic surgeries such as maxillary distraction osteogenesis.<sup>4-15</sup>

In Japan, few patients with bilateral CLP fail to take advantage of this long-term treatment protocol. In this report, we present a young adult patient with severe maxillary retrusion and collapse of the maxillary arch resulting from bilateral CLP; interdisciplinary treatment

was provided to correct the functional problems and improve facial esthetics.

## DIAGNOSIS AND ETIOLOGY

The patient was a 21-year-old Japanese man. He was born with complete bilateral CLP with no other associated syndromes. He was not examined by an oral surgeon or an orthodontist until he was 21 years old. He complained of difficulty in speech and mastication as well as an unesthetic facial appearance.

Frontal facial photographs before treatment showed that the upper lip was extensively scarred because of the closure of the bilateral cleft lip. He showed no asymmetry in the frontal view. The lateral-view photograph showed a slightly concave facial profile with a protruded lower lip (Fig 1). The maxillary dental arch was severely collapsed. The posterior segments were severely constricted because of scarring in the palatal area; consequently, the premaxillary segment was pushed out. The maxillary and mandibular dental arches showed a total crossbite in which the buccal segments, except for the molars, had nonocclusion (Fig 2). The maxillary incisors and some posterior teeth in both arches showed extensive caries from poor oral hygiene. Overbite and overjet were -3.5 and -3.0 mm, respectively, measured from the maxillary right incisor root stump to the mandibular incisors. The mandibular left first and second premolars were submerged relative to

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**Fig 1.** Pretreatment facial and intraoral photographs. Extensive scarring from the previous repair is seen in the upper lip.

the occlusal plane. The dental cast analysis showed that the maxillary basal arch width was extremely narrow (16.0 mm) compared with the Japanese mean value (49.48 mm).<sup>16</sup>

A panoramic radiograph showed the severely decayed teeth in both the maxillary and mandibular arches. The crowns of the maxillary central incisors and left second molar, and the mandibular right second premolar and second molar were severely broken down. Both maxillary lateral incisors were missing, with only the central incisor retaining roots in the premaxillary area. The occlusal radiograph showed a considerable defect in the palatal bone and a small amount of osseous tissue remaining in the premaxillary segment (Fig 3).

The cephalometric analysis showed that the SNA angle was 76.0°, and the ANB angle was -1.2°, indicating a moderate sagittal skeletal discrepancy (Fig 4, Table).

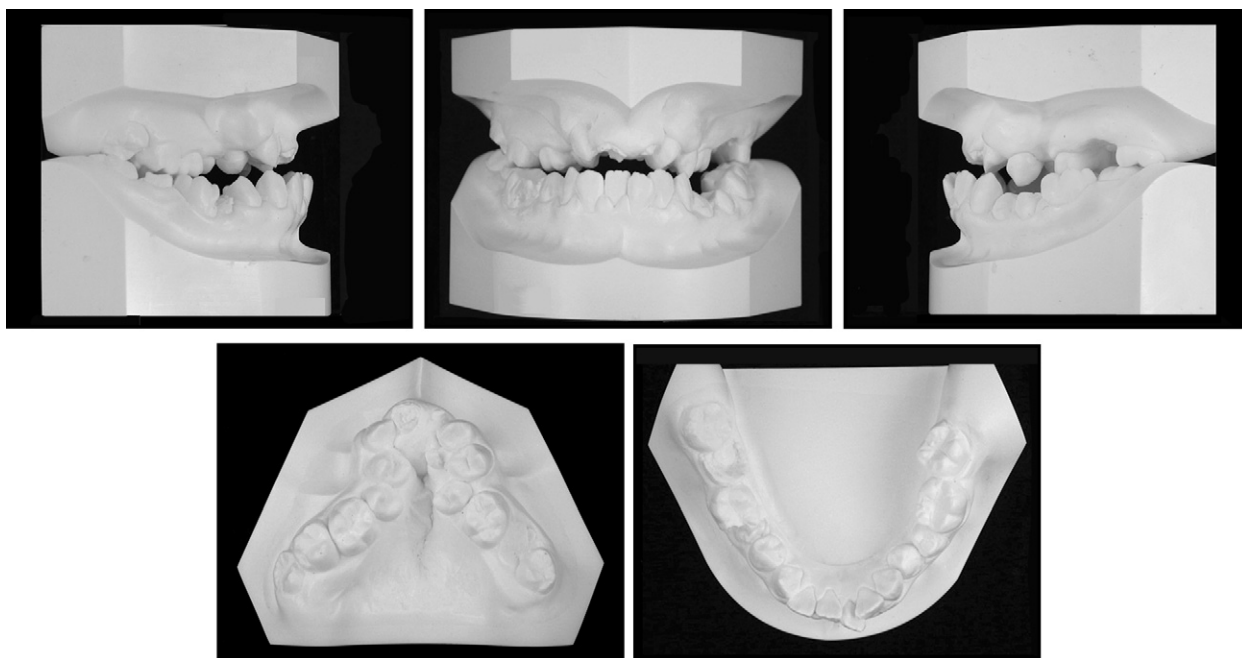
Other values of skeletal and dental parameters were almost normal compared with the Japanese norms.<sup>16</sup> There were no signs or symptoms of temporomandibular joint disorder during mandibular movement.

#### TREATMENT OBJECTIVES

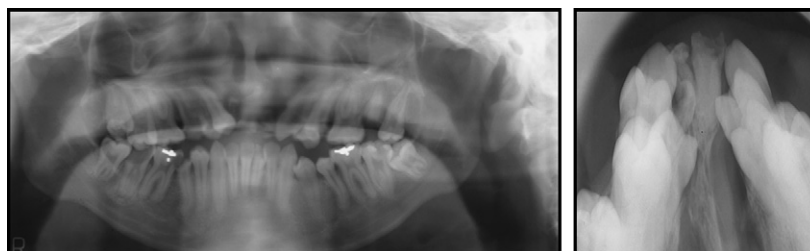
The treatment objectives were to (1) expand the extremely collapsed maxillary arch, (2) surgically correct the sagittal skeletal discrepancy between the maxillary and mandibular dental arches, (3) rehabilitate the maxillary incisor area with a prosthetic device, and (4) surgically improve the upper lip and the nose.

#### TREATMENT ALTERNATIVES

Treatment options for patients with bilateral cleft palate vary depending on the patient's age and the



**Fig 2.** Pretreatment dental casts.



**Fig 3.** Pretreatment panoramic and occlusal radiographs of the maxilla.

severity of the skeletal and dental conditions. For this patient, 2 main problems had to be solved: the extremely collapsed maxillary dental arch and the functional and esthetic disturbances because of the residual roots in the premaxillary area that affected mastication and speech.

The extremely collapsed maxillary dental arch had to be expanded initially. Generally, the 2 main treatment options are rapid palatal expansion and slow expansion. It was difficult to apply a rapid palatal expansion appliance to the extremely collapsed maxillary arch and also difficult for the patient to adapt to the heavy intermittent force because of his age. Therefore, slow expansion was chosen. A fixed slow expansion appliance would be used initially to expand the maxillary arch. When adequate space was gained, a removable expansion appliance with artificial teeth could be placed; this appliance would improve both function and esthetics.

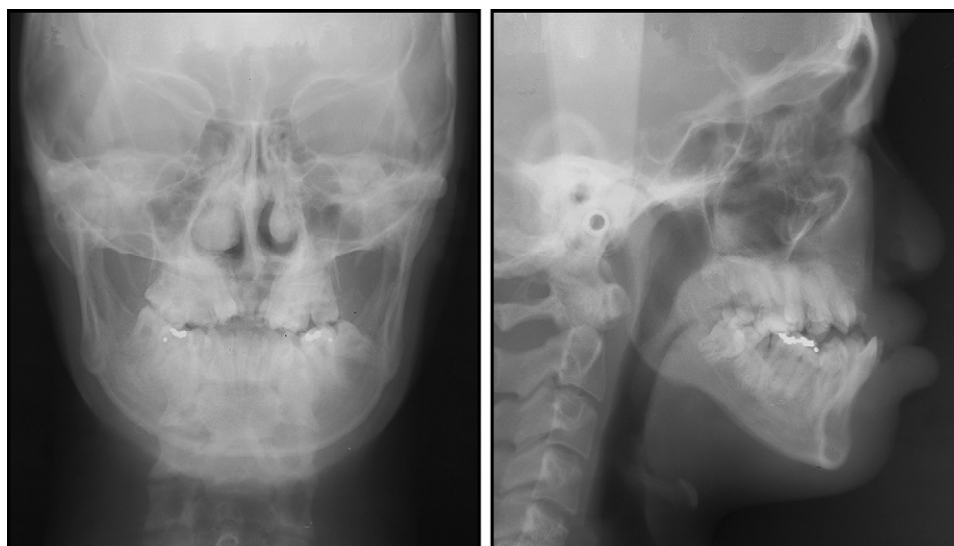
#### **TREATMENT PLAN**

The patient was told that the treatment would be performed in several stages, as follows: (1) extraction of the residual root tips of the maxillary incisors, followed by expansion of the collapsed maxillary dental arch with a quad-helix and denture-type expansion appliances; (2) secondary alveolar bone grafting in the cleft space on both sides after expansion in both arches with a multi-bracketed appliance; (3) mandibular setback by bilateral sagittal split ramus osteotomy; (4) correction of the soft tissues of the lip and nose by plastic surgery and restoration of the maxillary anterior area with a denture; and (5) retention.

#### **TREATMENT PROGRESS**

After extraction of the maxillary incisors, the collapsed maxillary dental arch was expanded with



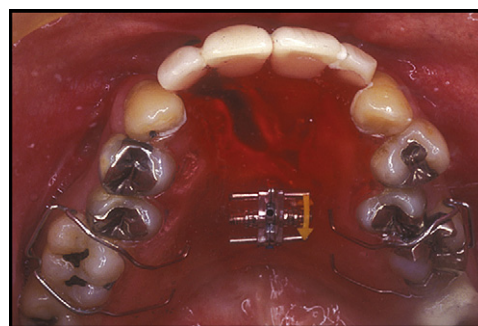


**Fig 4.** Pretreatment anteroposterior and lateral cephalometric radiographs.

**Table.** Summary of dental cast and cephalometric analyses

	Mean	SD	Pretreatment	Posttreatment
Intercanine width				
Maxillary arch (mm)	37.92	2.68	16.0	36.7
Mandibular arch (mm)	28.82	2.99	26.3	29.5
Basal arch width				
Maxillary arch (mm)	49.48	3.89	35.3	45.0
Mandibular arch (mm)	41.78	2.92	39.9	39.1
Skeletal pattern				
Facial angle (°)	87.37	2.81	85.8	85.7
SNA (°)	81.42	3.64	76.0	76.0
SNB (°)	79.61	3.93	77.2	74.0
ANB (°)	1.81	1.57	-1.2	+2.0
FMA (°)	25.62	5.56	29.4	28.3
Gonial angle (°)	112.36	6.01	122.1	117.7
Denture pattern				
L-1 to MP (°)	94.71	6.89	94.2	89.2
FMIA (°)	58.01	6.00	56.4	62.5

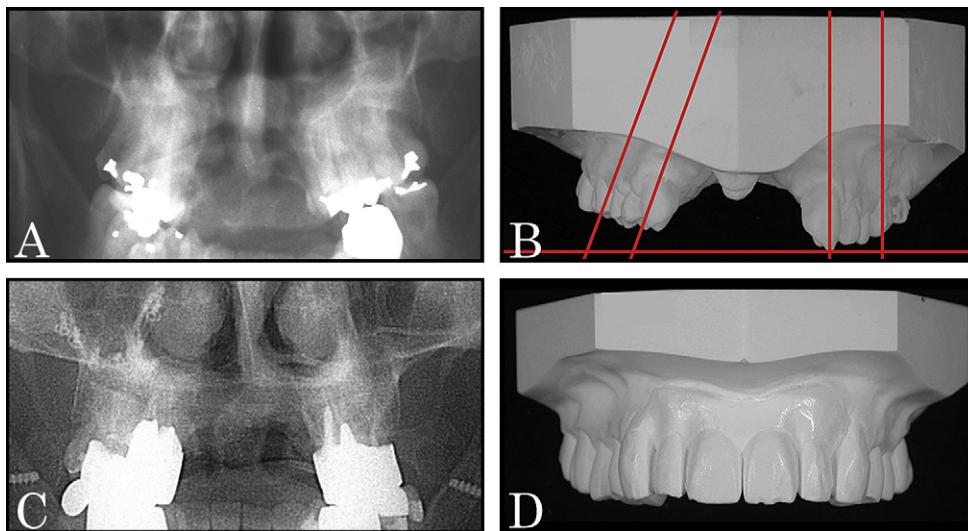
a quad-helix for 6 months to adjust the arch form for transient esthetic recovery in the anterior area with a denture. Then, a denture-type appliance with an expansion screw was placed to further expand the maxillary arch (Fig 5). After the expansion, the results in the right segment of the maxillary bone were unexpected. Although the left segment of the maxillary bone had moved buccally, the right segment could not be expanded sufficiently. The alveolar bone on



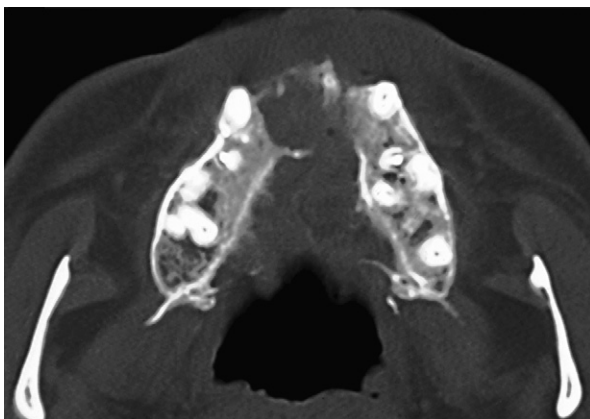
**Fig 5.** Intraoral photograph of the partial denture with the expansion screw.

the right segment was acutely tipped buccally compared with the left segment. Furthermore, the right segment had unexpectedly moved upward, causing changes in the occlusal plane (Fig 6, A and B). Therefore, a LeFort I osteotomy was performed in the right segment of the maxillary bone to correct the tipped alveolar bone and to pull down the maxillary bone to fix the occlusal plane of the maxillary right dental arch (Fig 6, C and D).

Bilateral alveolar bone grafting (Fig 7), vestibular extension, and recheiloplasty were also performed apical to the maxillary area simultaneously. The decayed mandibular right second premolar was extracted. The occlusal relationship between both dental arches was corrected with a multi-bracket appliance before the bilateral sagittal split ramus osteotomy (Fig 8). The mandibular bone was set back 4 mm on the right side and 6 mm on the left side.



**Fig 6.** Comparison of radiographs and dental casts: **A** and **B**, before the LeFort I surgery; **C** and **D**, after the LeFort I surgery.



**Fig 7.** Computed tomography scan after the alveolar bone grafting.

The total treatment period was 4 years, including the presurgical and postsurgical orthodontic treatments. After the postsurgical orthodontic treatment, a new prosthetic appliance covering the premaxillary area was placed in the maxillary arch for retention (Fig 9). Finally, a conical crown telescopic denture was placed to restore the anterior occlusion and to resist maxillary arch width contraction. An ordinary plate-type retainer was used for the mandibular arch. The patient was instructed to use an orthodontic retainer at night.

#### TREATMENT RESULTS

The overall treatment objectives were achieved. Esthetic improvement of the frontal and lateral profiles

was evident, especially in the profile of the upper and lower lips (Fig 9).

Overbite and overjet were both +2.0 mm as measured from the maxillary incisors of the conical crown telescopic denture to the mandibular incisors. Whereas the canine relationship was edge to edge on the right side, the left posterior teeth showed almost a Class I relationship. The achieved occlusion was within the acceptable range, considering the occlusion at the initial examination. The intercanine width of the maxillary arch had increased from 16.0 to 36.7 mm. The basal arch width of the maxilla had also expanded from 35.3 to 45.0 mm (Table). The width of the mandibular arch was stable. Esthetic recovery and reconstruction of the occlusion at the premaxillary area were performed with prosthetic treatment (Fig 9).

The posttreatment panoramic radiograph showed a slight root resorption of the mandibular incisors (Fig 10), and the bone grafted in the palatal area had disappeared. The ANB angle improved from  $-1.2^\circ$  to  $+2.0^\circ$ . The labial inclination of the mandibular incisors was slightly reduced (Fig 11, Table). The FMA angle was almost stable. The cephalometric superimposition showed that the amount of surgical setback was 4 mm in the midsagittal plane (Fig 12).

The functional movement of the mandible was normal, and no signs or symptoms of temporomandibular joint disorder were found. The patient is wearing a conical crown telescopic denture during the day (Fig 13, A-F) and a plate-type retainer at night (Fig 13, G and H). He has also been instructed to wear a plate-type





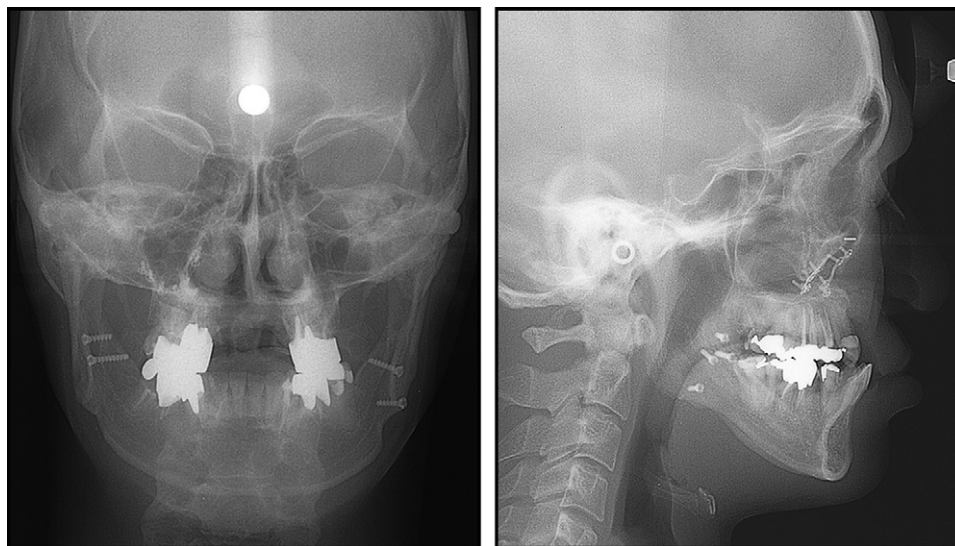
**Fig 8.** Intraoral photographs before the bilateral sagittal split ramus osteotomy.



**Fig 9.** Facial and intraoral photographs after treatment.



**Fig 10.** Posttreatment panoramic and occlusal radiographs of the maxillary arch.



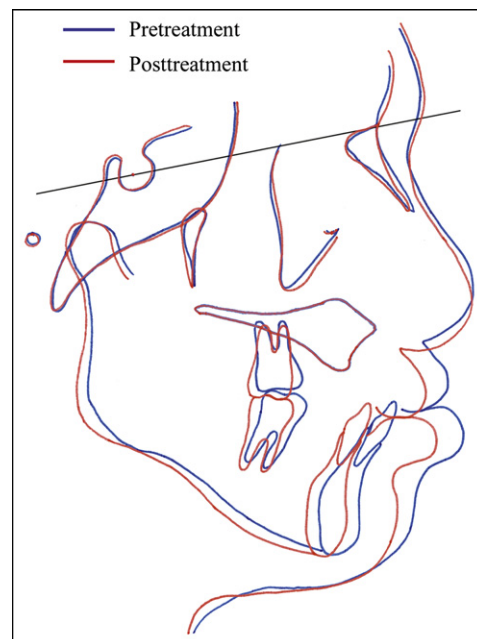
**Fig 11.** Posttreatment anteroposterior and lateral cephalometric radiographs.

retainer in the mandibular arch all day. The occlusion has been maintained for 3 years (Fig 14).

## DISCUSSION

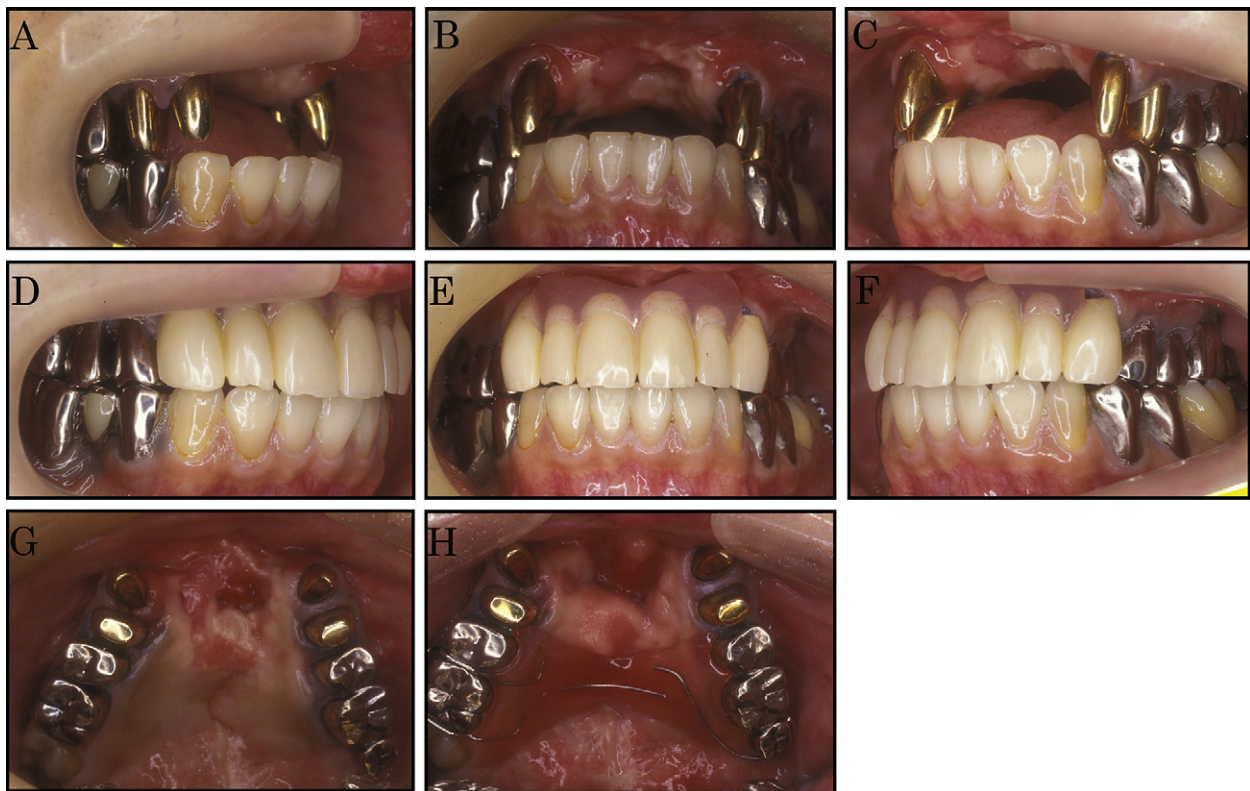
This patient had a severe horizontal skeletal discrepancy and an extremely narrow dental arch. The maxillary bone and arch showed severe collapse and nonocclusion except for the molars on both sides. Therefore, reconstruction of the occlusion for more efficient mastication was the most urgent objective of the treatment, even though the recovery was insufficient. Therefore, the maxillary arch had to be expanded for reconstruction of the occlusion.<sup>17-19</sup> First, a quad-helix appliance was used to expand the maxillary arch for 6 months. Then, after creating enough space with the appliance, a partial denture with an expansion screw was used to improve the posterior occlusion and restore the anterior occlusion and the esthetics.

However, expansion resulted in unexpected changes in the right bone segment of the maxilla. The right segment could not be expanded sufficiently. The alveolar bone on the right segment was acutely tipped buccally, compared

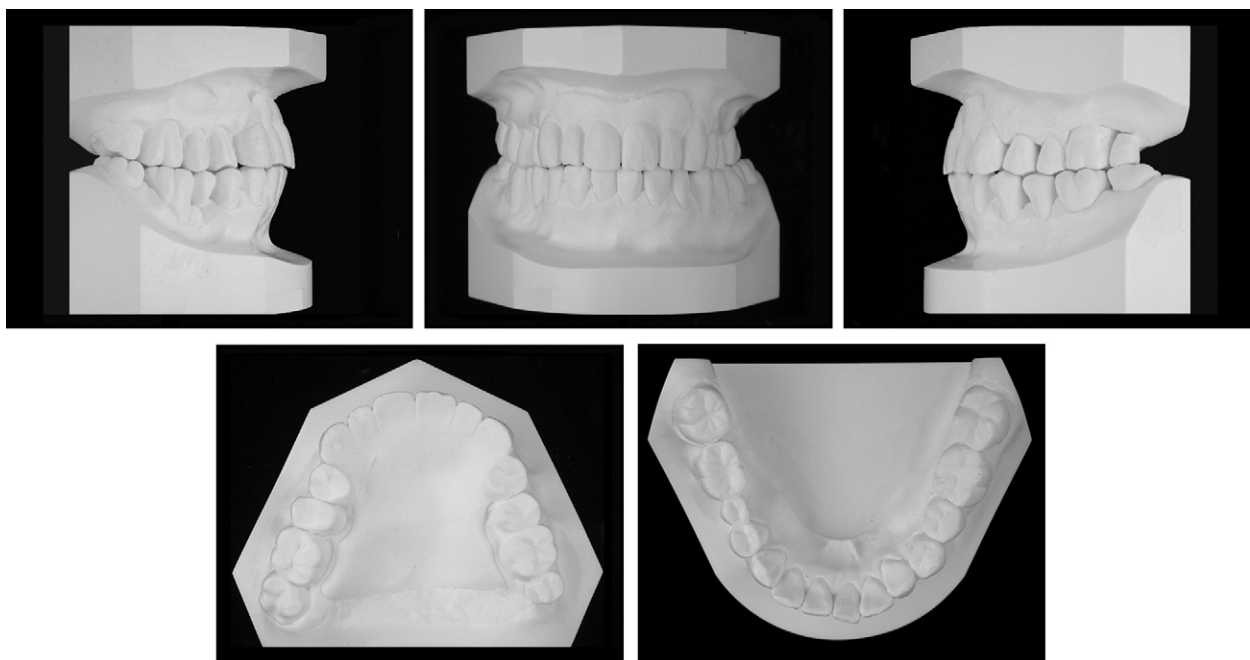


**Fig 12.** Superimposed cephalometric tracings.





**Fig 13.** Intraoral photographs during the retention period: **A-F**, conical crown telescopic denture worn during the day; **G** and **H**, retainer worn at night.



**Fig 14.** Dental casts during the retention period.



with the left side. Furthermore, the right segment had unexpectedly moved upward, causing changes in the occlusal plane; this made the mandibular setback difficult. Thus, we were forced to modify the treatment plan.

We performed a LeFort I osteotomy of the right segment to correct the labial tipping of the alveolar bone and also moved the segment downward to correct the maxillary occlusal plane.<sup>20-24</sup> It is difficult to select the ideal treatment procedure for a patient with severe CLP, mainly because the movement of the maxillary bone during expansion might not be uniform. As a result, the treatment caused considerable increases in arch widths; intercanine width increased by 20.7 mm (16.0 to 36.7 mm) and basal arch width by 9.7 mm (35.3 to 45.0 mm). The discrepancy in the widths of the maxillary and mandibular dental arches was obliterated. This made it easier to reconstruct the occlusion with a bilateral sagittal split ramus osteotomy.

However, the secondary alveolar bone grafts on both sides applied after expansion of the maxillary arch had disappeared. An occlusal x-ray at the 4-year follow-up showed almost complete loss of the grafted bone, indicating that it had been resorbed during the treatment. It is widely accepted that grafted bone contributes to the eruption of adjacent teeth and is maintained by the teeth.<sup>25</sup> The presence of teeth is necessary to maintain the grafted bone. In this case, the central and lateral incisors had been lost before grafting; this might explain the resorption of the grafted bone. This might be a kind of disuse atrophy.

In this patient, the maxilla would have to be moved forward to correct the sagittal skeletal discrepancy. However, a bilateral CLP makes the surgical procedure difficult. Furthermore, the cephalometric analysis showed a slight undergrowth of the maxillary bone; this made the lateral facial profile less concave. Thus, a mandibular setback was performed, and the facial profile consequently improved.

After orthodontic treatment, a conical crown telescopic denture was selected as the retainer as well as the denture in the maxillary arch to rehabilitate the anterior occlusion. It was easier to maintain oral hygiene with the conical crown telescopic denture than with a fixed prosthesis. Accordingly, this prosthesis could improve the esthetics and also prevent relapse of the expanded maxillary arch. Consequently, this technique contributed to the long-term stability of the occlusion.

## CONCLUSIONS

This case report suggests that interdisciplinary treatment is necessary for adult patients with severe CLP to achieve the proper occlusion.

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