

# Orthodontic Treatment of a Bilateral Cleft Lip and Palate Patient with Bilateral Tooth Transpositions and Congenitally Missing Teeth

Kiyoshi Tai \* / Jae Hyun Park \*\* / Masahiro Tanino \*\*\* / Yasumori Sato \*\*\*\*

*Treatment of patients with a cleft lip and palate can be challenging. A boy, 15 years 11 months old, with a bilateral cleft lip and palate and a convex profile, transposed teeth and congenitally missing teeth was treated by orthodontic treatment. 3 year posttreatment records showed excellent results with good occlusion, facial balance and harmony, and long-term stability.*

**Keywords:** cleft lip and palate, transposed teeth, Tip-Edge appliances

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Cleft lip and palate is a common congenital craniofacial malformation.<sup>1</sup> In Asian people the frequency of clefting is higher than in other races.<sup>2,3</sup> The failure of fusion between the medial nasal process and the maxillary process, or between the palatal processes causes orofacial clefts. These failures are the result of genetic and environmental factors.<sup>2,4</sup> More often, one or more teeth are missing<sup>2,5,6</sup> or the size of the teeth is significantly reduced.<sup>7,8</sup> The incidence of morphologic irregularities is higher for all teeth. Teeth on both sides of the cleft are often affected by enamel hypoplasia.<sup>2,7,8</sup>

In those patients, a congenitally missing permanent maxillary lateral incisor on the cleft side is the most common finding.<sup>2,9,10</sup> The second most common anomaly is a supernumerary tooth in the cleft region.<sup>8</sup> Several of other anomalies including peg-shaped maxillary lateral incisors, palatally displaced canines, and transpositions of various teeth have

been more frequently in patients with clefting.<sup>11,12</sup> In the cleft area, the patterns of dental anomalies are important for timely, accurate and effective orthodontic treatment planning.

This case report presents orthodontic treatment of a male patient showing bilateral cleft lip and palate with bilateral tooth transpositions and congenitally missing teeth.

## CASE REPORT

A 15 year 11 month old Japanese male was referred for orthodontic treatment. His chief complaint was the unesthetic appearance of his upper anterior teeth. He presented bilateral cleft lip and palate. He had received primary lip repair when he was 3 months old and palatoplasty when he was 1 year 10 months old respectively. He also had a history of rhinoplasty when he was 7 years 10 months old. Lip and nose revisions were also performed and he had a secondary bone graft when he was 11 years 9 months old. A secondary lip repair was done at 15 years 9 months old.

The patient presented a mesofacial and a convex profile with a protrusive maxilla and upper lip. His posteroanterior cephalogram showed a deviated nasal septum without facial asymmetry (Figures 1-3).



Figure 1. Pretreatment facial photographs.

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**Figure 2.** Pretreatment intraoral photographs.

According to serial panoramic radiographs, he was congenitally missing his maxillary permanent canines on both sides and a mandibular left central incisor. In the right cleft site a supernumerary tooth was developing (Figure 4). The maxillary left lateral incisor was transposed with the maxillary left primary canine, and the supernumerary tooth was transposed with the maxillary right first premolar. The maxillary right central and lateral incisors were malformed. The maxillary right central incisor and the maxillary right first premolar were rotated 90° mesially. The maxillary right primary lateral incisor and the maxillary left second primary molar were retained and the maxillary left second premolar was palatally displaced. Deep caries was present in the maxillary right primary lateral incisor (Figure 2).

There was maxillary arch constriction due to a bilateral cleft lip and palate. He also showed moderate crowding on the maxillary arch and mild spacing issues on the mandibular arch with retroclined mandibular incisors. He had a Class I molar relationship on both sides with 2 mm overjet and 50% overbite. The maxillary left primary canine was erupted in crossbite position. Cephalometric analysis indicated a skeletal Class I (ANB: 7.9°, Wits: 4.2 mm) with normovergent growth pattern (SN-MP: 41.9°). The maxillary incisors were retroclined (U1 to SN: 86.1°) and the mandibular

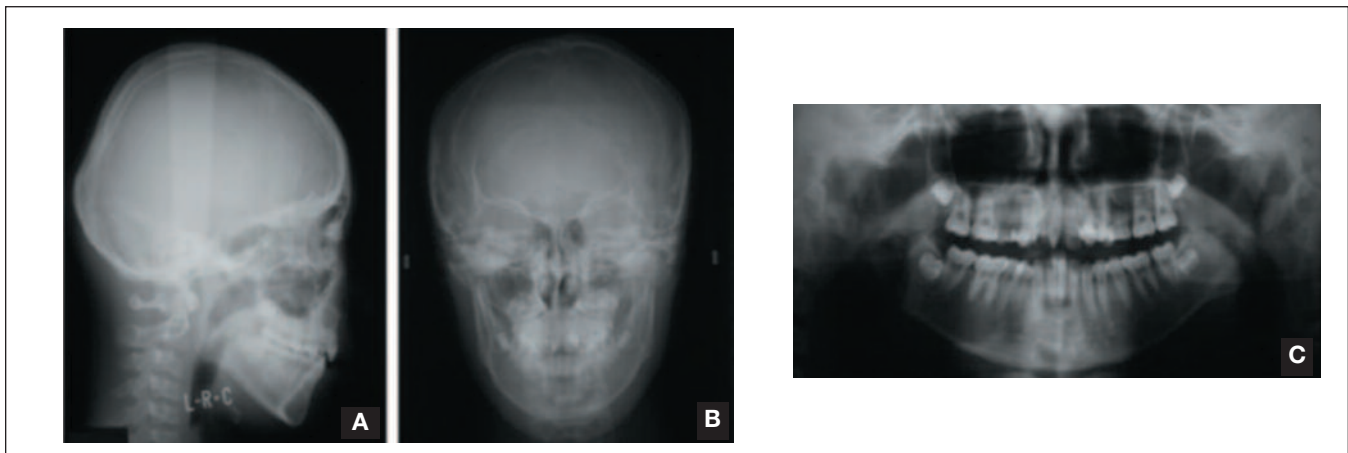
incisors showed retroclination (IMPA: 75.3°) (Figure 3, A and Table).

A panoramic radiograph demonstrated that the crowns of third molars were developing (Figure 3, C).

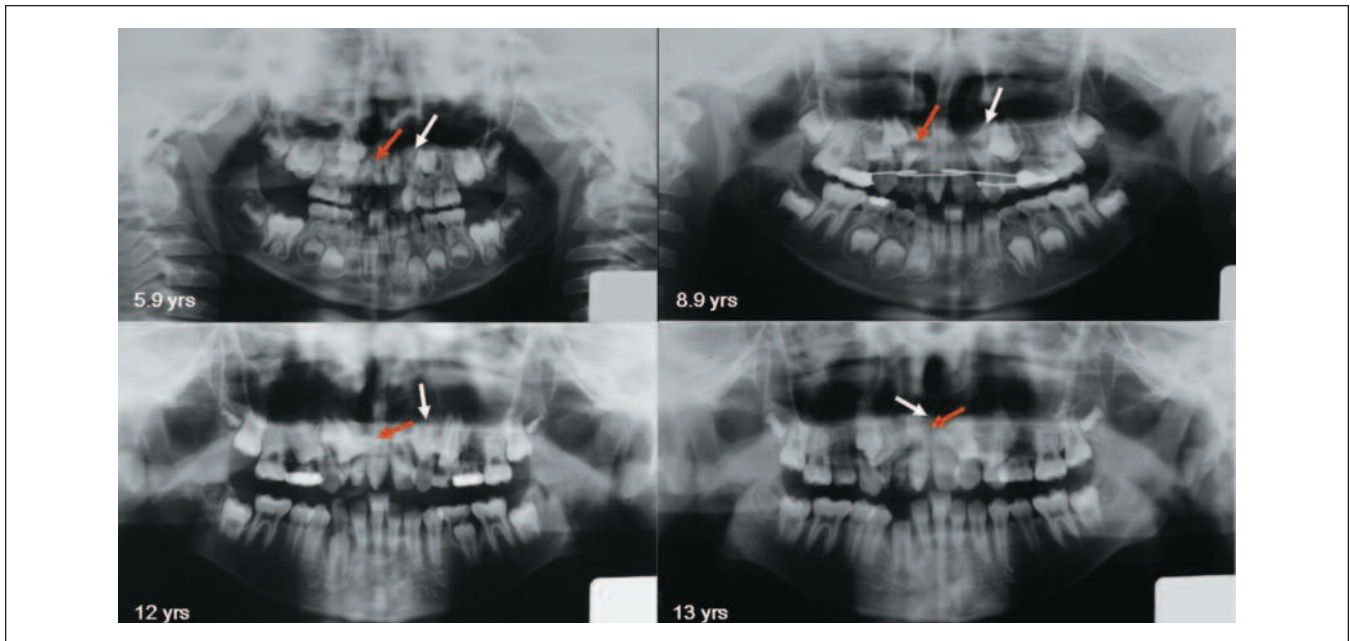
The treatment objectives were to obtain a normal overjet and overbite, maintain a Class I molar relationship, relieve the crowding on the maxillary arch, and close the spacing on the mandibular arch. However, the dental midline would be

**Table.** Cephalometric measurements.

Measurement	Japanese Norm	Pre-treatment	Post-treatment	3 y Post-treatment
SNA (°)	82.3	85.7	85.0	85.5
SNB (°)	78.9	77.8	78.7	79.0
ANB (°)	3.4	7.9	6.3	6.5
Wits (mm)	0	4.2	3.5	3.6
SN-MP	40.2	41.9	42.0	42.5
FH-MP	28.8	34.5	35.0	35.5
LFH (ANS-Me/N-Me) (%)	55.0	47.2	49.3	50.7
U1 to SN (°)	104.5	86.1	91.1	92.0
U1 to NA (°)	22.0	-1.4	4.9	5.4
IMPA (°)	96.3	75.3	72.0	72.5
L1 to NB (°)	25.0	15.7	11.5	12.1
U1/L1 (°)	124.1	157.5	152.1	151.6
Upper lip (mm)	1.2	7.3	0.7	0.9
Lower lip (mm)	2.0	6.5	-0.8	1.5



**Figure 3.** Pretreatment radiographs; A, lateral cephalogram; B, posteroanterior cephalogram; C, panoramic radiograph.



**Figure 4.** Serial panoramic radiographs showing changes in the eruption direction of the transposed teeth.

compromised due to the missing mandibular left central incisor. In addition to better occlusion, improvement of his profile was also crucial. Careful observation of the maxilla was required during treatment because of the surgical lip repair and palatal closure he had had.

It was expected that his facial profile would be improved after these treatments, especially by performing cleft lip repair along with derotating the maxillary right central incisor. There was a plan to add veneers to the maxillary anterior teeth after the orthodontic treatment.

Before orthodontic treatment began, treatment plans were discussed with a specialist for restorative dentistry including advice regarding how to treat the maxillary incisors. Also, he consulted with a specialist for an evaluation of existing peri-

odontal conditions which included an alveolar cleft area and an unesthetic gingival contour of the maxillary right lateral incisor. The general dentist extracted the maxillary left second primary molar before orthodontic treatment. However, for esthetic reasons, the patient and his parents wished to postpone the extraction of the retained maxillary right primary lateral incisor for as long as possible.

In order to obtain the acceptable overbite and overjet and considering that there was one missing mandibular anterior tooth and small sized teeth on the maxillary anterior segment, the Bolton anterior tooth size discrepancies were measured. The .022" Tip-Edge (TP Orthodontics, Inc., LaPorte, IN) appliances were initially placed in the maxillary arch. After leveling for 2 months by Ni-Ti arch wires,



**Figure 5.** Intraoral maxillary occlusal photographs during treatment. The transposed teeth moved successfully to the proper position.

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0.016-inch arch wire with omega loops mesial of the maxillary first molars was engaged to expand slightly. After correcting the rotation of the maxillary right central incisor and maxillary right first premolar, and moving the palatally displaced the left maxillary second premolar into the arch, two palatally transposed teeth were started to be moved mesially. The two transposed teeth moved forward slowly to the normal position using light force with elastic thread while carefully observing the response of the maxilla on the cleft areas. After placing the transposed teeth in the right position, the .022" Tip-Edge appliances were placed in the mandibular arch. Nine arch wires were used in the maxillary arch and three arch wires were used in the mandibular arch during the treatment. The maxillary left lateral incisor moved anteriorly approximately 15 mm (Figure 5).

During the finishing stage, up-and-down elastics were used for two months to settle the occlusion. At the end of orthodontic treatment, the patient was referred to specialists for the restorative treatment and to address gingival margin discrepancies. The active treatment period was 28 months. Due to a significant amount of movement of the maxillary

right supernumerary tooth, a fixed retainer was bonded from the maxillary left lateral incisor to the maxillary right supernumerary tooth, and a fixed canine-to-canine retainer was bonded to the mandibular arch.

Posttreatment records revealed that the treatment objectives were achieved. Facial photographs showed improved profile esthetics (Figure 6). An acceptable overbite and over-

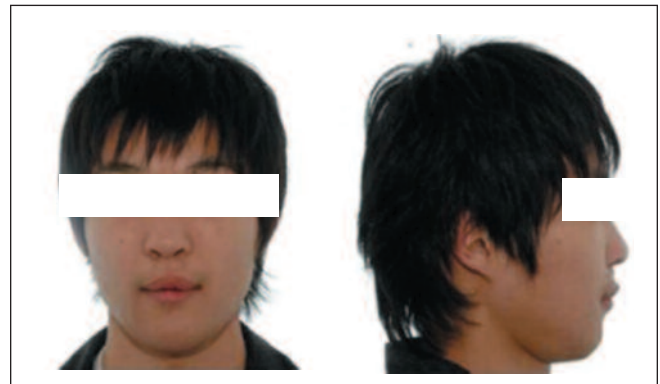


Figure 6. Posttreatment facial photographs.



Figure 7. Posttreatment intraoral photographs.

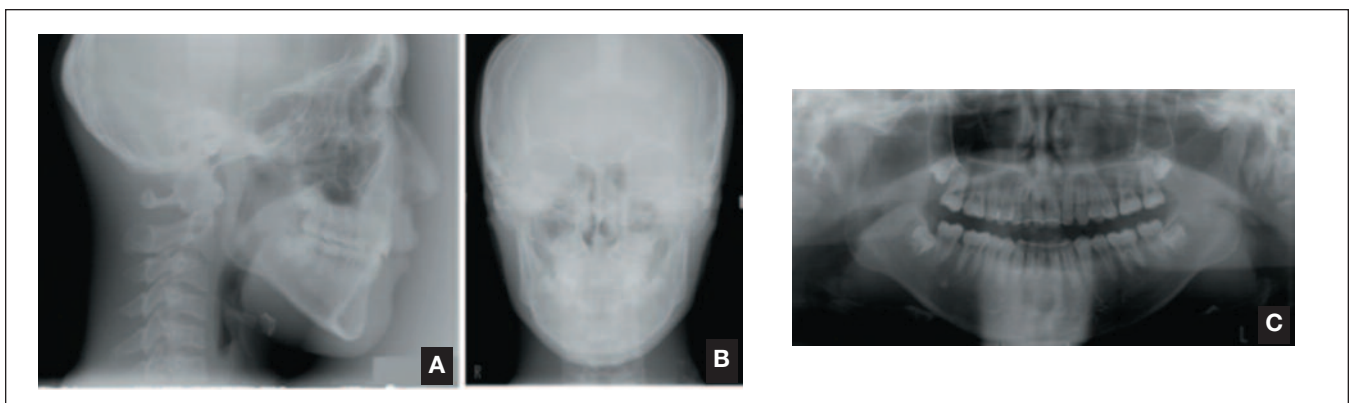
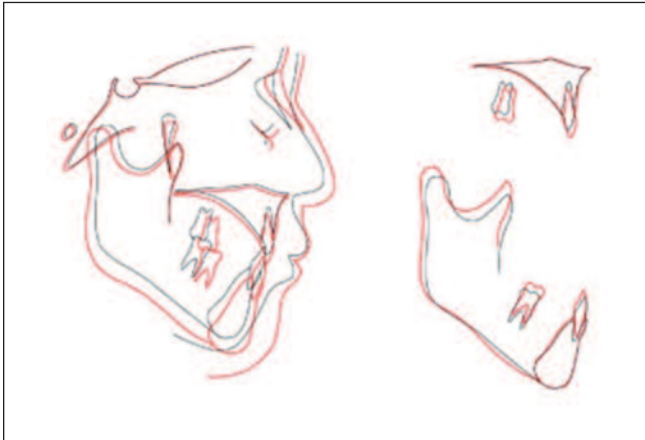


Figure 8. Posttreatment radiographs; A, lateral cephalogram; B, posteroanterior cephalogram; C, panoramic radiograph.

jet were achieved. The maxillary left lateral incisor needed more labial root torque after treatment, but since it was in the cleft area, it could not be expressed fully (Figure 7).

Posttreatment lateral cephalometric analysis and superimposition revealed slight skeletal changes (ANB= 6.3°,

Wits= 3.5 mm) and a stable mandibular plane angle (SN-MP: 42.0°). The maxillary incisors proclined (U1 to SN: 91.1°) and mandibular incisors were retroclined (IMPA: 72.0°) compared with pretreatment (Figure 8, A and Table). A posttreatment panoramic radiograph showed acceptable



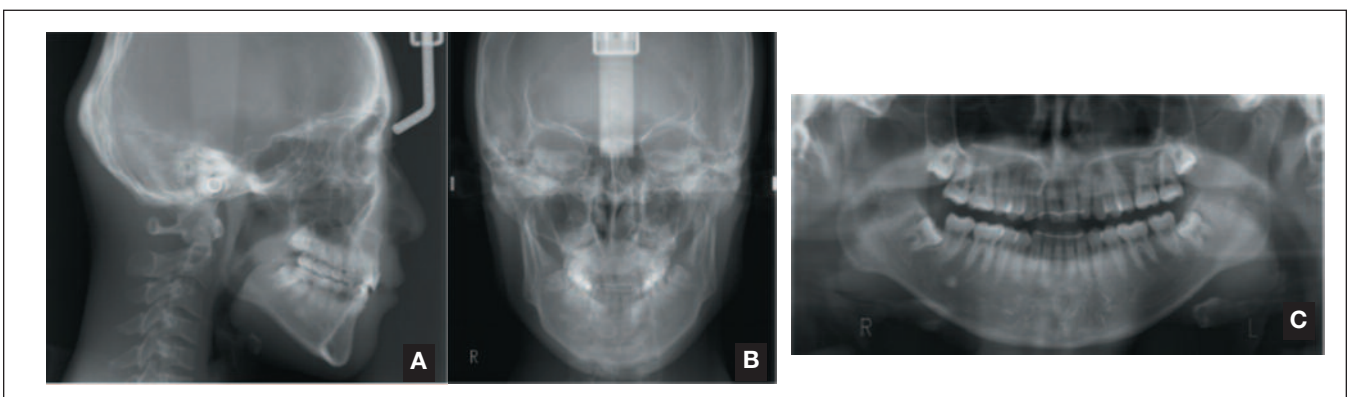
**Figure 9.** Cephalometric superimposition. Black line, pretreatment; red line, posttreatment.



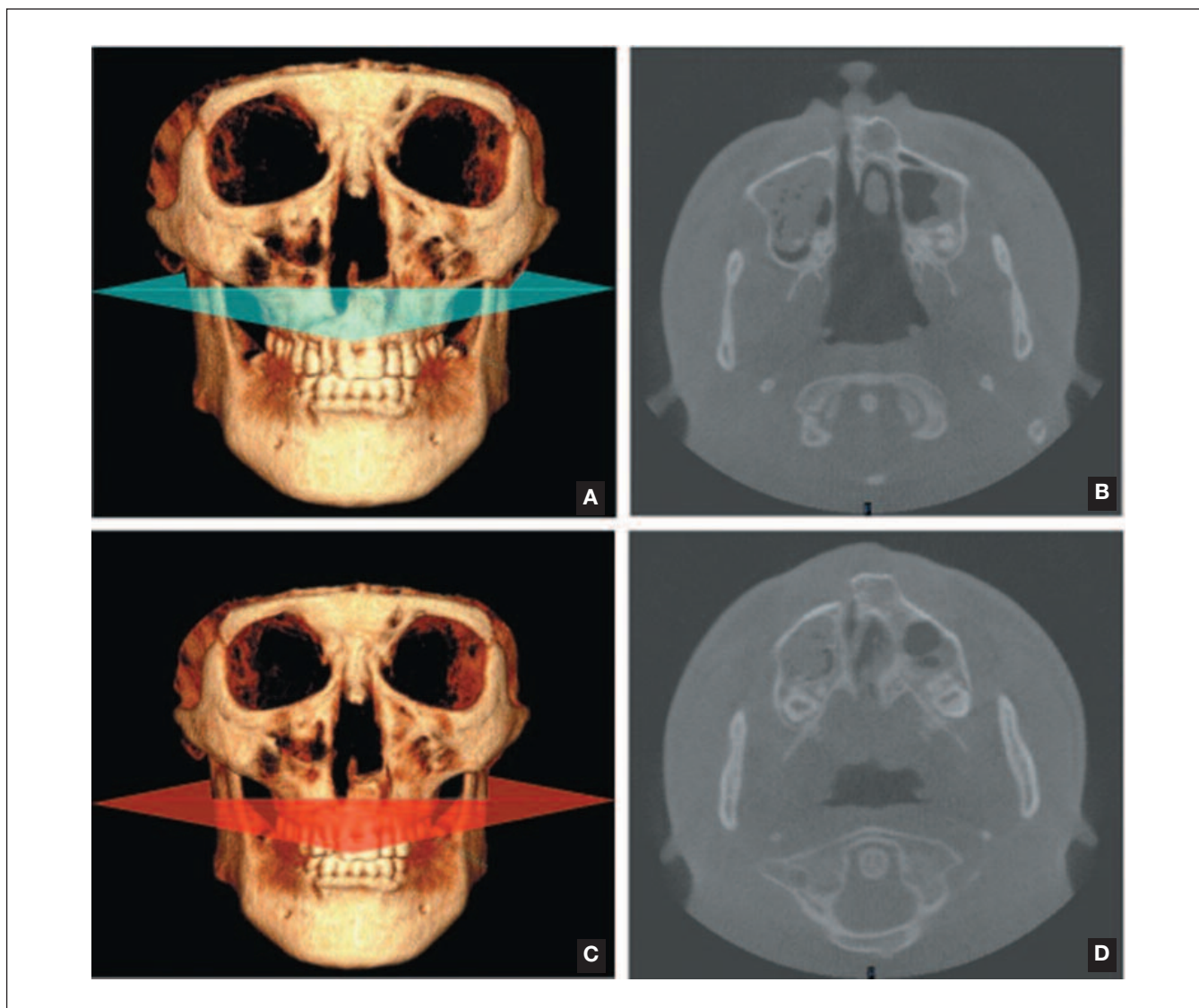
**Figure 10.** Three-year posttreatment facial photographs.



**Figure 11.** Three-year posttreatment intraoral photographs.



**Figure 12.** Three-year posttreatment radiographs; A, lateral cephalogram; B, posteroanterior cephalogram; C, panoramic radiograph.



**Figure 13.** Three-year posttreatment CBCT images showing different areas of clefting; A, C, A volume-rendering 3-dimensional computed tomography; B, D, multiplanar reconstruction (MPR) image.

root parallelism with slight root resorption on the maxillary left primary canine (Figure 8, C). The patient's facial profile, especially the upper and lower lips, was improved. Furthermore, the esthetic plane was improved primarily by increasing the nasolabial angle (Figures 6 and 9, Table) This was mainly corrected by cheiloplasties, which were performed when he was 16 years 9 months old and 17 years 9 months old. At the 3 year follow-up, the patient had a stable occlusion, and the orthodontic improvements were maintained (Figures 10 and 11). However, his maxillary anterior teeth were still not restored. Radiographic examination showed fairly stable results (Figures 12 and 13).

#### DISCUSSION

Clefts of the lip and palate can be caused by many etiologic factors but it has been demonstrated that the great majority is caused by the interaction of genetic and environmental factors.<sup>13,14</sup> It has been proposed that cleft lip and palate

patients present with more dental anomalies than do individuals without clefts due to the cleft itself or the early surgery.<sup>15,16</sup> It has been hypothesized that the absence of fusion between the maxillary and medial processes that resulted in the clefting is a contributing factor for the various anomalies that affect the lateral incisor.<sup>2,4</sup> This could explain the frequent absence of lateral incisors, or their distal or mesial location with respect to the cleft as well as the presence of supernumerary teeth in the same region.<sup>8</sup> Knowledge of dental anomalies occurring in cleft lip and palate patients is fundamental for treatment planning since some of these anomalies may lead to edentulous spaces in the maxillary arch that must be closed by orthodontic movement, prostheses, or implants.

The permanent maxillary canine has the deepest and highest area of development under the orbit. It has the longest period of development and the longest way to travel from its point of origin to full occlusion. Due to these

circumstances, eruption disturbances are more common with maxillary canines than with other teeth, except for third molars.<sup>17</sup> During eruption, the canine moves down along the distal aspect of the lateral incisor root in very close contact with it. As the canine crown passes the midportion of the lateral incisor root and erupts more coronally, these teeth spontaneously upright.<sup>18,19</sup> In this case, the permanent maxillary canines were missing and instead a supernumerary tooth was developing in the right cleft area.

The dental transposition represents a multifactorial condition.<sup>20,21</sup> Both genetic and environmental factors seem to be involved in the etiology of transposition and the relationships are complex. In the maxilla the canine is transposed most frequently with the first premolar, less often with the lateral incisor, and rarely with the central incisor or second premolar.<sup>20</sup> Transposed canine and premolar teeth appear to possess anatomically normal crowns and roots.<sup>21</sup> Transposition may be incomplete when the crowns overlap each other but the root apices are in their relative normal positions, or complete when both the crowns and roots are parallel in their transposed malpositions.<sup>20</sup> In this case, even though the transposed teeth moved a substantial distance from their original position, treatment was performed without great difficulty because the transposed teeth were in incomplete transposition. Orthodontists are intimately involved in the therapeutic management of individuals affected by cleft lip and palate and it is important that they keep abreast of current knowledge of the etiology behind these conditions.

This case shows the benefits of treatment with the Tip-Edge brackets. These brackets encourage free tipping of the tooth crowns toward their final positions in the dental arch. The subsequent use of axillaries makes it a relatively simple matter to upright the teeth to their final desired torque and tip angles.<sup>22,23</sup> The orthodontist skilled solely in bodily movement techniques will need education in the diagnosis, treatment planning, and appliance manipulation associated with the Tip-Edge bracket and differential tooth movement. Although it may appear very much like an ordinary bracket, the treatment concept and tooth movements are considerably different. If used properly, this is a technique that offers a heightened level of treatment efficiency and simplicity for both orthodontists and their patients.

## CONCLUSION

This case presents how the transposed teeth moved successfully to their normal location even though the site was involved with cleft palate. With careful observation combined with a gentle and continuous force using Tip-Edge brackets, treatment provided relocation of the transposed teeth successfully to the cleft sites.

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