Orthodontic Treatment in a Cleft Lip and Palate Patient with Skeletal Class III Malocclusion: A Case Report

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This case report describes the orthodontic treatment of a 12 years and 1 months old boy with right cleft lip and palate, who had received primary lip repair and palatoplasty at 4 and 12 months of age, respectively. The patient had Angle’s Class III malocclusion, combined anterior and posterior crossbite, and a concave profile. Growth modification treatment with removable expansion plate followed by camouflaged treatment with fixed appliance yielded successful results. The teeth alignment and occlusion improved; however, secondary bone graft was not performed. The patient was satisfied with the treatment outcome and could function normally.

Key words: cleft lip, cleft palate, crossbite, Angle’s class III malocclusion, concave profile


Introduction

A skeletal Class III malocclusion has been acknowledged to be the most challenging problem confronting orthodontics, especially when it is associated with cleft lip and palate.(1) Primarily because of the unpredictable and potentially abnormal growth in patients with this skeletal pattern, treatment planning for most young patients with Class III malocclusion has been directed at growth modification,(2) lip and palate is generally considered to be a congenital birth defect.(1) It is the most prevalent craniofacial anomalies, affecting one in every 700 births(2) and affects the quality of life of more than 7 million people around the world.(3) Skeletal Class III malocclusion associated with cleft lip and palate is the most challenging problem that orthodontists encounter. (4) This is primarily because of the unpredictable and potentially abnormal growth in patients with this skeletal pattern. Thus, the treatment planning for most of the young patients with Class III malocclusion has been directed towards growth modification.(5) Patients with cleft lip and palate can also have other abnormal features, such as deficient midface development resulting in Class III tendency, severe maxillary transverse deficiency, alveolar cleft, and dental abnormalities. (6-7) In cleft patients, dental abnormalities such as hypodontia, malformation, and abnormal eruption patterns occur frequently.(8-12)
The timing and sequencing of orthodontic care for cleft patients can be divided into developmental periods. These developmental periods are defined by patient’s age and dental development, and should be considered as time frames in which specific objectives should be accomplished. The stages of cleft lip and palate reconstruction first starts with the repair of the cleft lip and primary nasal reconstruction, which can begin as early as 10-12 weeks. The cleft palate repair can then start at 9-18 weeks, but it is still a subject of controversy and may depend on the child’s speech-language age. Although early closure helps in speech development, some protocols suggest to delay the procedure as long as possible to prevent maxillary growth retardation that may occur due to surgical scarring. Following palatal surgery, Phase I orthodontic therapy can be initiated as deemed necessary to optimize the position of the dentoalveolar structures and to encourage the growth in the appropriate dimensions. This can be attained by using appliances such as a Hyrax palatal expander. Bone graft reconstruction can be performed at 6-9 years to close any remaining cleft at the maxilla or the alveolus. Then, phase II orthodontic therapy can be started as soon as the permanent canine and premolars erupt using fixed appliances to align the dentition. In complex cases, this phase of therapy can be combined with orthognatic surgery and is typically performed 16-18 years for boys and 14-16 for girls. Any prosthodontic therapy with dental implants, if required, can be performed at 16-18 years, followed by revisions of the lip and nose. It is also possible to modify the growth of maxilla or the mandible during the growth spurts to the desired position such that the need for orthognatic surgery is minimized.

Therefore, the purpose of this article is to report the orthodontic treatment of Class III malocclusion with a unilateral cleft lip and palate in a growing patient without orthognatic surgery.

**Diagnosis and etiology**

A Thai boy, aged 12 years and 1 month, was born with a complete right cleft lip and cleft palate with no other associated syndromes. His chief complaint was the unesthetic appearance of his maxillary anterior teeth, which were behind his mandibular anterior teeth. He had received primary lip repair and palatoplasty when he was 4 months and 13 months of age, respectively. The patient had a mesiofacial and concave profile with retrusive upper lip and maxilla. His frontal facial photographs showed a flat alar base, a deviated nasal septum, and lips canting with mild facial asymmetry. The maxillary arch constriction was due to the unilateral cleft lip and palate. In addition, he had severe crowding in the maxillary arch with anterior and posterior crossbite, and mild crowding in the mandibular arch with a moderate curve of Spee. He had Class III canine and Class I molar relationships on both sides with an overjet of −10 mm and an overbite of 80%. The maxillary right lateral incisor was trapped palatally in the alveolar cleft area, while the maxillary central incisors, left lateral incisor, and left canine were all shifted to the right resulting in a 5 mm midline shift to the right. The maxillary right canine was partially erupted and located palatal to the maxillary right central incisor (Fig 1).

Cephalometric analysis indicated a skeletal Class III relationship (SNA, 79.1°; SNB, 84°; ANB, -4.9°; Wits appraisal, -11 mm ) with normal vertical growth pattern (SN-PP, 8.9°; SN-MP, 31°; PP-MP, 23° ). The maxillary incisors showed retroclination and retrusion (U1-NA, 18°, 1.8 mm), and the mandibular incisors showed normal inclination and position (L1-NB, 28°, 7 mm). The maxillary incisor retroclination resulted in buccally positioned roots, thus influencing the contour of the anterior maxillary vestibule; this slightly masked the retrusive maxillary position. (Fig 2 ; Table 1).
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Fig 1  Pre-treatment facial and intraoral photographs.

Fig 2  Pre-treatment cephalogram and tracing.
The panoramic radiograph showed presence of all permanent teeth, and maxillary right lateral incisor malposition was adjacent to the cleft. (Fig 3)

Treatment objective and alternatives
The treatment objectives were to obtain normal overjet and overbite, establish asymmetric occlusion Class I canine relationship on the right side, maintain the Class III molar relationship on both sides, relocate the upper midline to the left side, and to relieve crowding of both arches and level the curve of Spee.

<table>
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<tr>
<th>Table 1</th>
<th>Cephalometric analysis</th>
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<tr>
<td>Assessment</td>
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<td></td>
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<td>SNA (degree)</td>
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<td>Co-A (mm.)</td>
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<td>WiTs</td>
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<td>Facial height index</td>
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* Steiner Analysis (14-16)

Treatment plan
For this case, the treatment plan was divided into two stages. Firstly, growth modification with an expansion plate was carried out, followed by camouflaged treatment with lower first premolars extraction. Fissural tooth, i.e. upper right lateral incisor, was extracted without secondary alveolar bone grafting. It was presumed that the labial and lateral expansions would enlarge the maxillary right alveolar cleft, therefore the secondary bone graft was considered to close these clefts at an appropriate stage, however the patient declined the procedure.
Treatment progress

The removable appliance with a three way expansion screw and posterior bite plane was placed to stimulate forward movement of the premaxilla, followed by lateral expansion of the maxillary arch (Fig 4). One month after starting orthodontic treatment, the mandibular right and left first premolars were extracted. A full fixed appliance was placed on the mandibular arch. Five months following the expansion, it was found that the premaxilla had successfully moved forward providing enough space for the maxillary left canine to enter correct alignment. Although the right and left segments of the maxillary bone had moved buccally, the maxillary right canine had erupted juxtapositionally to the maxillary right central incisor. After careful observation of the response of the maxilla, a full fixed appliance was placed on the maxillary arch. To intrude the mandibular anterior teeth and extrude the posterior teeth, a 0.016 x 0.022 utility arch was placed on the mandibular arch (Fig 5). Before treatment, the midline had a 5 mm shift to the right. This was caused by the maxillary right lateral incisor being trapped in the cleft area which resulted in the incisors shift to the right. After analysis for the final treatment plan, the maxillary right lateral incisor was extracted at 13 years old and 5 months. All spaces were closed, the crossbite corrected, and the midline relocated to the maxillary left central incisor and the maxillary left lateral incisor. During the finishing stage, multi-loop archwires and Class III diagonal and up-and-down elastic were used to correct the Class III canine relationship on the right side and to balance the occlusion (Fig 6).

Active treatment time took a total of 39 months. After its completion, the patient was instructed to use an orthodontic retainer (24 hours per day except when eating) for 2 years because he had declined the alveolar bone graft procedure. During the first year after debond, retainer check appointments were performed at first, second, third and sixth months.
**Fig 4** Intraoral photographs of the removable appliance with the three way expansion and posterior rest bite

**Fig 5** Treatment progress: twist flex for leveling on the maxillary arch and utility arch on the mandibular arch

**Fig 6** Progress intraoral photographs
Treatment results

The overall treatment objectives were successfully achieved (Fig. 7). The facial photographs showed improved profile esthetics. Dental findings demonstrated Class I canine relationship on the right side, Class II canine relationship on the left side, Class I molar relationship on the left side, and Class III molar relationship on the right side. The upper dental midline was relocated to the left side with ideal overbite and overjet, and a flat curve of Spee.

According to Figure 9 and Table 1, the post-treatment lateral cephalometric analysis and superimposition showed significant skeletal changes with forward and downward movement of the maxilla difference values and an increase in the mandibular plane angle. Moreover, the growth of mandible is in a forward and downward direction and the extrusion of the mandibular posteriors was performed along with intrusion of the mandibular anteriors, which related to the increase in the mandibular plane angle. Proclination of the incisors was also observed primarily in the maxillary incisors; this helped correct the anterior crossbite. The mandibular incisors were retroclined and there was an overall improvement in the patient’s profile (Figs. 8-9).

The treatment plan was a camouflaged alternative. Functional and esthetic occlusal relationships were established. Although correction of the malocclusion and improvement of his facial profile were satisfactorily accomplished with both dentoalveolar and skeletal changes, (Fig. 10) the upper midline was compromised and the final occlusion was asymmetric.

Fig 7  Post-treatment facial and intraoral photographs
**Fig 8**  Post-treatment cephalogram and tracing

**Fig 9**  Superimposition of the pre-treatment and post-treatment cephalometric tracings
Midface retrusion and malocclusion are concerns for patients with operated cleft lip and palate. Because of the possible influence of cleft severity on the growth of the maxilla, cleft lip and palate patients can have a relatively retruded maxillary position with a tendency for Class III malocclusion, even after palatoplasty.\(^4,\ 14-15\) In this case, the patient came with completed initial lip and palate reparative surgery. He had an anterior and posterior crossbite, and Angle’s Class III malocclusion. Patient and parent consent was obtained before orthodontic treatment, allowing the use of all necessary orthodontic resources. The age of the skull is an essential element that affects the mechanical property of the skeletal suture.\(^16\) Therefore, timing is crucial for successful orthodontic treatment. Beginning treatment at the correct time in a patient with growth potential has significant influence in correcting discrepancies in the sagittal, vertical, and transverse planes. It is recommended that treatment directed at promoting or inhibiting maxillary or mandibular growth be performed before the puberty growth spurt.\(^17\) For this case, the patient came for treatment at an early age; therefore, maxillary bone growth stimulation by maxillary expansion was selected.
This palatal and midface suture expansion would result in forward and downward growth of the maxilla and dentoalveolar. This treatment modality could be used effectively in both non-cleft cases \(^{(18-20)}\) and in cleft lip and palate cases.\(^{(21)}\) Moreover, it easily corrects crossbite with less relapse compared to tooth tipping only.\(^{(22)}\) The posterior raise bite would allow the maxilla to move freely by eliminating interarch locking and further prevent rotation and supraeruption of the posterior teeth which would result in posterior rotation of mandible from extrusion of posterior teeth.\(^{(23)}\)

Patients with cleft lip and palate can have an abnormal number, shape, or size of teeth. This causes a greater challenge in obtaining an ideal occlusion and esthetic restorative result. In this patient, the maxillary right lateral incisor was extracted because of its small shape, and lack of bone and gingiva support. After completed maxillary arch expansion, the maxillary right canine was slowly moved to the desired position. The upper dental midline was changed to enhance the esthetic results.

The deep mandibular curve of Spee was leveled by intruding the anterior teeth, and uprighting and tipping the posterior teeth using a cantilever archwire followed by a multi-loop edgewise archwire with Class III elastics.\(^{(24, 25)}\) The extrusion of the premolars and molars resulted in an increased mandibular plane, a compatible cant of the maxillary and mandibular occlusal planes, and downward and backward rotation of the mandible\(^{(24, 25)}\), which helped to correct the Class III skeletal relationship. Our patient was cooperative, and the treatment results demonstrated normal overjet and overbite with asymmetric molar and canine relationships. Adequate dental alignment and leveling were established.

**Conclusion**

This patient’s treatment was unconventional, but it was successful in significantly improving his dental and facial results. Although the appearance of the maxillary midline was not ideal, his generalized esthetics and function were significantly improved without orthognatic surgery.

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