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Treatment of Unilateral Cleft Lip and Palate Patient With Intraoral Tooth Tissue Borne Distractor and Facemask Therapy: A Case Report

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Abstract

This case report demonstrates the successful use of intraoral distractor/hygenic rapid expander (HYRAX) for rapid maxillary expansion in anteroposterior direction with an adjunctive use of face mask therapy for anterior orthopedic traction of maxillary complex in a cleft patient with concave profile. The patient was a 13-year-old girl who reported with a chief complaint of backwardly positioned upper jaw and a severely forward positioned lower jaw. Therefore, a treatment was chosen in which acrylic bonded rapid maxillary expansion was done with tooth tissue borne intraoral distractor/HYRAX having a different activation schedule along with Dr Henri Petit facemask to treat maxillary retrognathism. As a result, crossbite got corrected and attained a positive jet with no bone loss in cleft area over a period of 5 months which was followed by fixed mechanotherapy achieving a well settled occlusion in 1 year. After completion of expansion and fixed mechanotherapy, ANB became +1 post-treatment which was −4 pretreatment. The prognathic profile was markedly improved by expansion and taking advantage of the remaining growth potential, thus minimizing the chances of surgery later in life. This provided a viable alternative to orthognathic surgery with good long-term stability.

Keywords

orthodontics, nonsyndromic clefting, midfacial growth

Introduction

Cleft lip and palate (CLP) are the most prevalent among all craniofacial anomalies, affecting 1 in every 700 births and disturbing the quality of life of more than 7 million people around the world. Patients with CLP have lip, alveolus, and palate repair surgeries during the initial years of their lives. Consequently, the growth and development of the maxillary segments are compromised by scar tissues, thus inducing maxillary constriction, particularly in the anterior region. Rapid maxillary expansion (RME) is commonly used to correct any of the transverse deficiency (Figueiredo et al., 2014). However, correcting the anterior crossbite by bringing the maxillary expansion in anteroposterior direction is the major goal of treatment in cleft patients. Rapid maxillary expansion has been used to enhance the expansion in the anterior region of the maxillary arch as well, but very few case reports have been documented on correcting the anterior crossbite with a combination of intraoral distractor/HYRAX and face mask.

Thus, the aim of this case report is to evaluate the dentoskeletal effect of anteroposterior hyrax and facemask on cleft patient with different activation schedule. The combination of intraoral distractor/HYRAX and Dr Henri Petit facemask is especially designed to promote the anterior expansion and to take advantage of the growth potential to advance the maxilla, thus improving prognathic profile.

Diagnosis and Etiology

A 13-year-old girl reported to the department of orthodontics and dentofacial orthopedics SDM dental college with a chief complaint of backwardly positioned upper jaw and difficulty in biting from the front teeth. Previous history showed surgical closure of her cleft lip which was done when she was 6 months old and surgery of her cleft palate that was done when she was 1-year old.

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Clinical examination showed that she had a prognathic profile with a mid-face deficiency and a cleft lip on the right side (Figure 1A-D). *Intraoral examination* showed mixed dentition state in upper arch, permanent dentition in lower arch, right side unilateral cleft alveolus and palate, retained 52, 53, 55, 65 in the maxillary arch whereas in mandibular dentition 1-7 full complement of dentition was present. Anterior crossbite with a negative jet of 2 mm with class II molar relation on left side and on right side 46 occluding with the retained 55 lower anterior teeth was tipped lingually indicating the compensation of anteroposterior discrepancy (Figure 2A-E).

The Orthopantomogram validated the intraoral clinical findings showing a mixed dentition state (Figure 3). The cephalometric analysis showed a skeletal class III relationship with restricted maxillary growth, maxillary deficiency of 5 mm, and mandible excess of 8.75 mm with hypodivergent growth pattern (Figure 4). *Dentoalveolar analysis* showed retroclined mandibular incisor with lower incisor mandibular plane angle of 90° and proclined maxillary incisors.

Radiographically no major bone deficiency was seen in the cleft area as assessed by the occlusal radiograph (Figure 5).

Figure 1. Pretreatment extraoral photographs of (A) lateral, (B) frontal, (C) oblique smiling, ad (D) frontal smiling.

Treatment Objective

The treatment objectives were to (1) improve the anteroposterior discrepancy, (2) establish proper occlusion, (3) improve

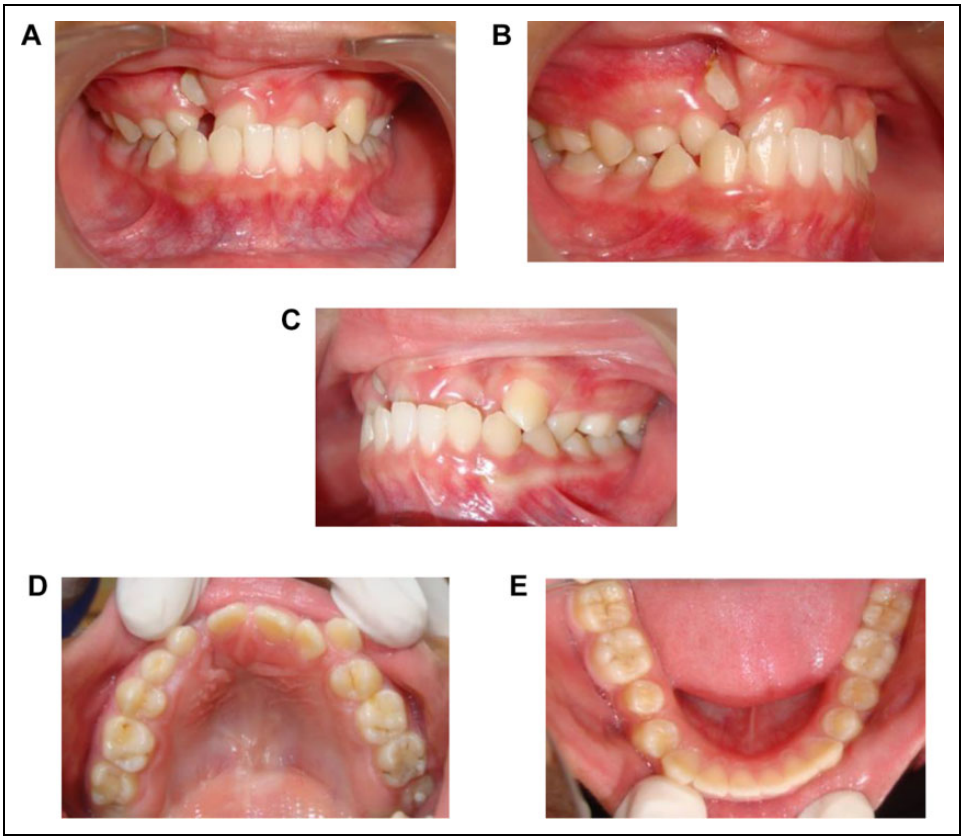

Figure 2. Pretreatment intraoral photographs of (A) frontal, (B) right lateral, (C) left lateral, (D) upper occlusal, and (E) lower occlusal.

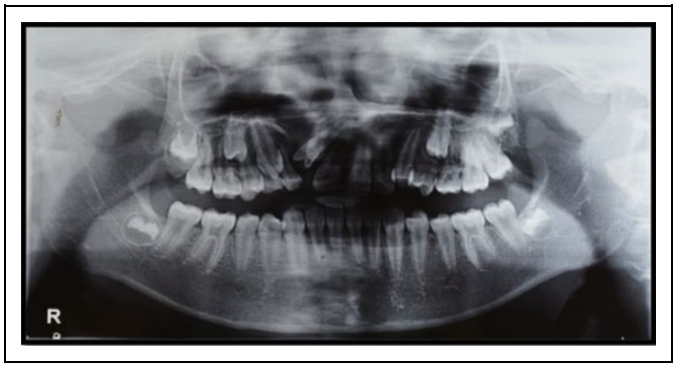

Figure 3. Pretreatment Orthopantomogram.

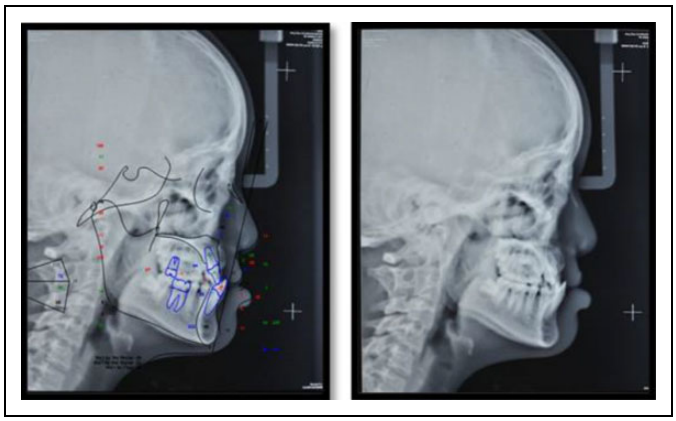

Figure 4. Pretreatment lateral cephalogram.

inclination of compensated teeth, and (4) establish an esthetic profile.

Treatment Progress

As the MP3 radiograph showed the I stage of growth, it was decided to take over the advantage of the growing stage of the patient and the treatment started with a fabrication of an expander. An acrylic-bonded tooth- and tissue-borne intraoral distractor containing a Hyrax screw was positioned parallel to the occlusal plane in an anteroposterior direction with 2 posterior arms embedded in the acrylic portion of posterior segments, whereas the remaining 2 anterior arms were embedded in the acrylic of the anterior segment which was in crossbite. The acrylic part of the appliance extended all over the occlusal and middle third of the vestibular surfaces of all teeth. The thickness of occlusal acrylic surface was such that it raised the bite by 6 mm and was in contact with all the mandibular teeth. Hooks were fabricated and embedded in the acrylic in canine region to be used for engaging the elastic for facemask therapy. The expansion plate was cemented to the maxillary dentition (Figures 6 and 7).

Facemask therapy started 1 month after the activation of expansion plate. Extraoral force from facemask was directed in forward and downward direction to the occlusal plane from

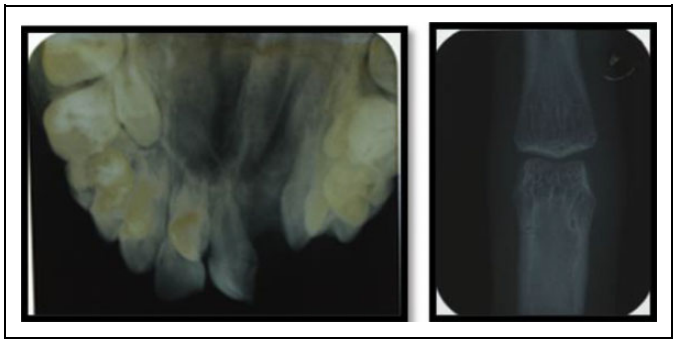

Figure 5. Pretreatment occlusal radiograph and Radiograph of Middle Phalanx of 3rd finger.

Figure 6. Photograph showing the placement of distractor on the cast.

the maxillary cuspid area of the alveolar process; 250 g of force was applied on each side for 2 months and then force was incremented to 350 g per side for next 2 months. Patient wore facemask for 15 to 16 hours per day (Figure 8).

Activation Schedule of HYRAX

First month: 1 full turn once in 1 week.

Second month and third month: half turn twice in 1 week.

Fourth and fifth month: half turn every alternate day.

This altered activation schedule was followed so as to prevent the excessive of force application on weak premaxillary region of a cleft patient and provide sufficient time for the consolidation of bone to take place before the next activation.

After 5 months of active treatment, patient was asked to discontinue with the facemask. Acrylic plate with a distractor was left intraorally for another 2 months which acted as a retainer. After 2 months of retention and post expansion (Figures 9 and 10), fixed mechanotherapy was started. Post expansion occlusal radiograph showed no bone lossin the cleft area and showed the achievement of positive jet in the lateral cephalogram (Figures 11 and 12).

Fixed Mechanotherapy

After full tenure of orthopedic treatment, all retained deciduous teeth were extracted, followed by fixed mechanotherapy.

Figure 7. Intraoral photographs showing bonded tooth tissue borne anteroposterior distractor.

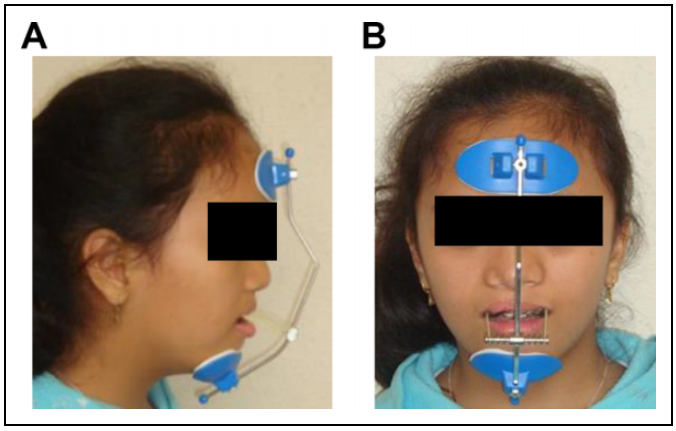

Figure 8. Extraoral photographs with Dr Henri Petit facemask and distractor.

The initial bonding was restricted to the upper arch due to excessive of malocclusion, .022 MBT (McLaughlin Bennett Trevisi) brackets were used and initial alignment was carried on .016'' NiTi followed by 17 × 25 NiTi .018'SS 17 × 25 TMA (Titanium molybdenum) (Figure 13). Once upper arch was stabilized on .018'' SS, class 3 elastics were given so as to maintain the achieved position of maxilla.

Later the occlusion was fully settled followed which temporary prosthesis was given in 13 region. Instead of protracting all the teeth anteriorly in 13 region which could lead to the formation of negative jet, decision was taken keeping all the shortcomings in mind of maintaining the anterior space as it is and replacing canine in that region for esthetic smile (Figure 14A-F).

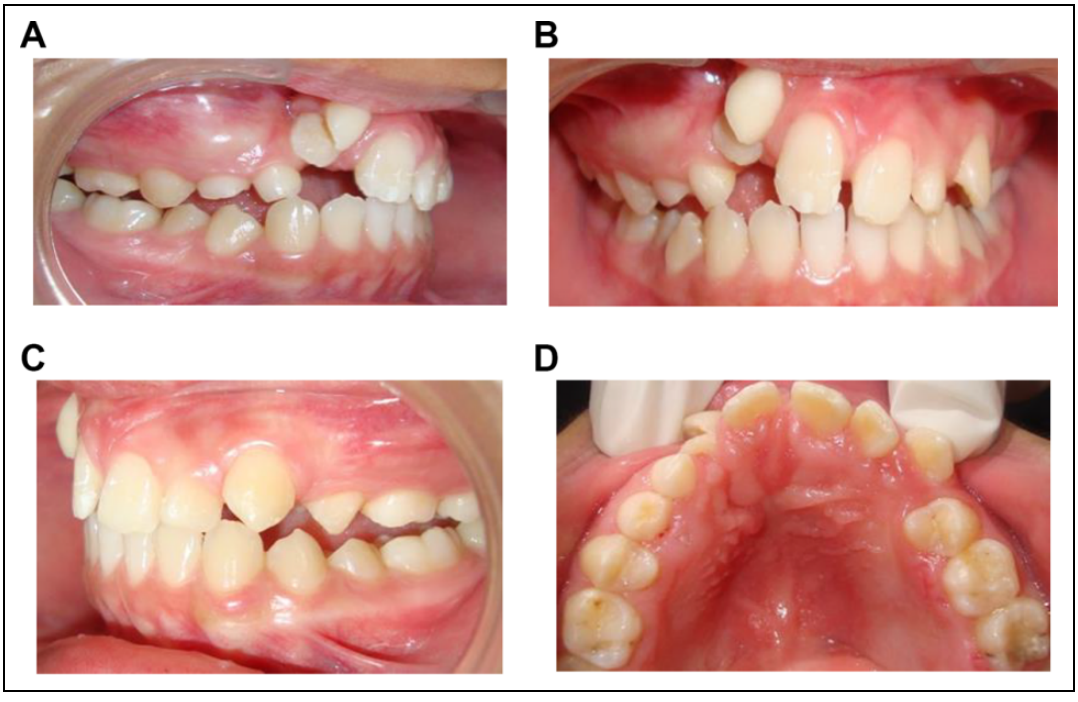

Figure 9. Intraoral photographs of postexpansion and facemask therapy: (A) right lateral, (B) frontal, (C) left lateral, and (D) occlusal.

Figure 10. Extraoral photographs of postexpansion and facemask therapy.

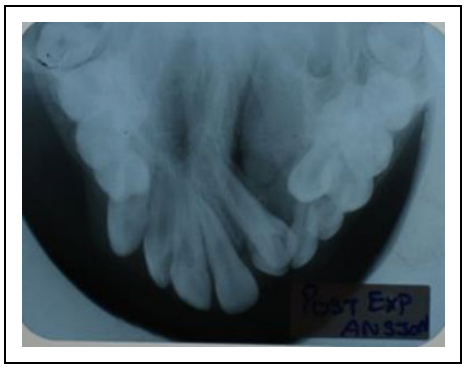

Figure 11. Postexpansion occlusal radiograph showing no bone loss.

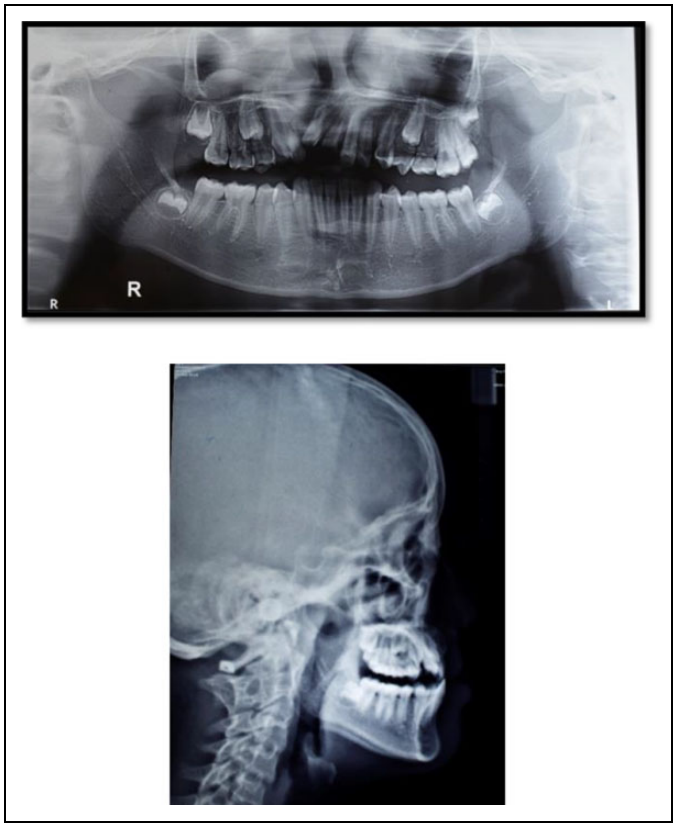

Figure 12. Postexpansion Orthopantomogram and lateral cephalogram.

Figure 13. Postexpansion bonding of upper arch.

Treatment Results

The total duration of active orthopedic treatment was 5 months with 2 months of retention phase followed by a phase of fixed mechanotherapy of 13 to 14 months. A positive jet of 3 mm and overbite of 3 mm were achieved post facemask therapy and expansion. Finally, the overjet of 2 mm and bite of 2 mm were achieved at the end of fixed mechanotherapy (Figure 15 A-D). No bone loss was noticed in the cleft area, rather formation of the bone was noticed as assessed by the occlusal and periapical radiographs. No bone grafting was therefore planned in the cleft area. Bergland grading system was done in the cleft area by comparing pre- and post-treatment intraoral periapical radiographs (Figure 16A and B). The occlusal level of the bone did not reach the amelocemental junction of the adjacent teeth, radiolucency around the incisor suggested of less than three quarters of normal interdental bone height suggestive of type III stage.

Cephalometrically, it showed the maxillary traction by 2 mm in forward direction (Figure 17).

Discussion

Maxillary retrognathism is usually present with midface retrusion, so the most favorable approach is to advance the maxilla, either with a FM or with surgery, depending on the patient's age. However, surgery cannot be performed before growth is completed, which means that young adolescents

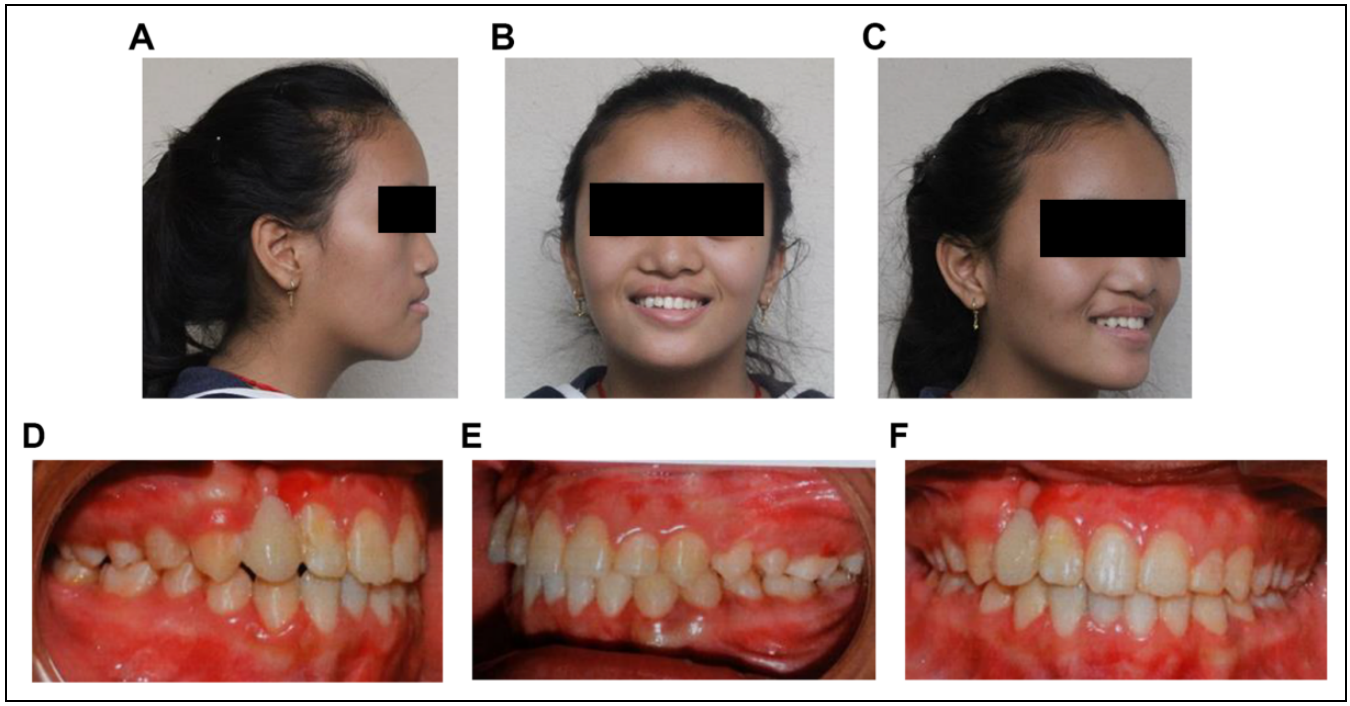

Figure 14. Extraoral and intraoral photographs post-treatment with temporary prosthesis in 13 region.

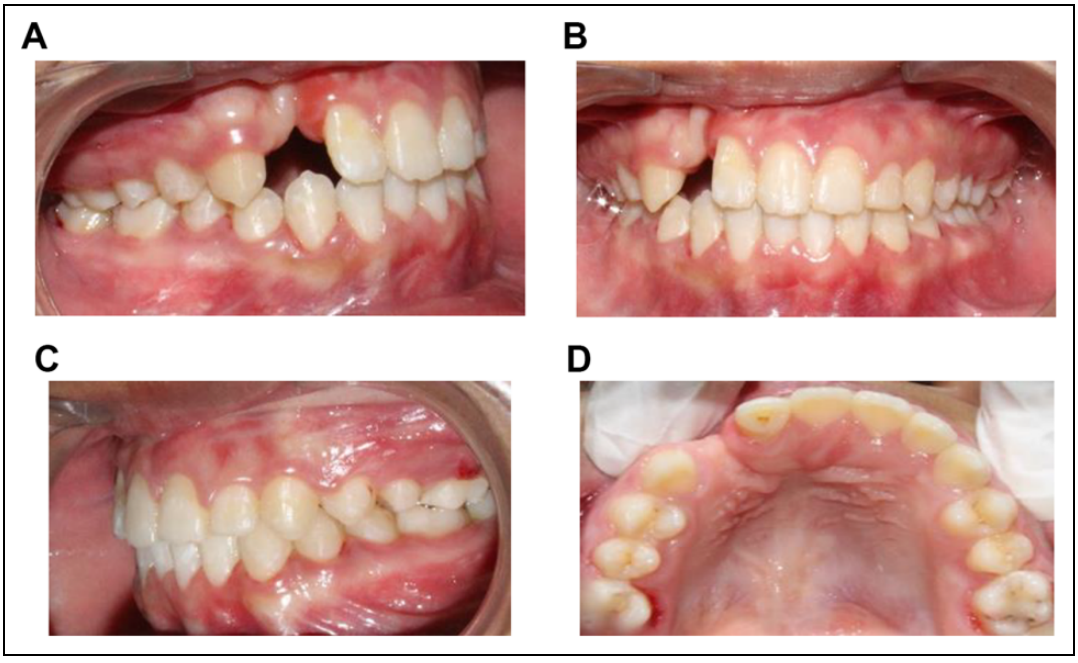

Figure 15. Intraoral photographs of post-treatment.

must live with their class III profiles as well as the potential psychological problems and lack of self-esteem that sometimes occur in these adolescents. On the other hand, the cost of orthognathic surgery is high, and some patients need grafting after down fracture, which means an extra donor site surgery (Kucukkeles et al., 2011). Therefore, using of maxillary expansion along with facemask therapy if used at the right age can correct the prognathic profile as well as can improve the functional efficiency.

Thus, the aim of the case report was to determine the skeletal, dental, and soft tissue changes with face mask treatment associated with RME (Yu et al., 2014) in the form of intraoral distractor in a young patient with remaining growth potential so as camouflage the malocclusion and minimize the chances

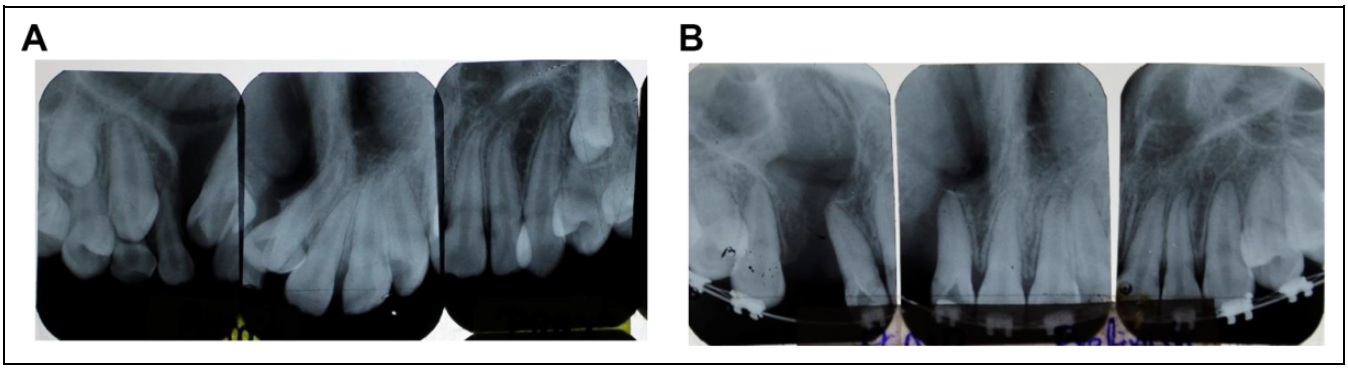

Figure 16. A, Pretreatment IOPA's and (B) post-treatment Intraoral periapical Radiographs.

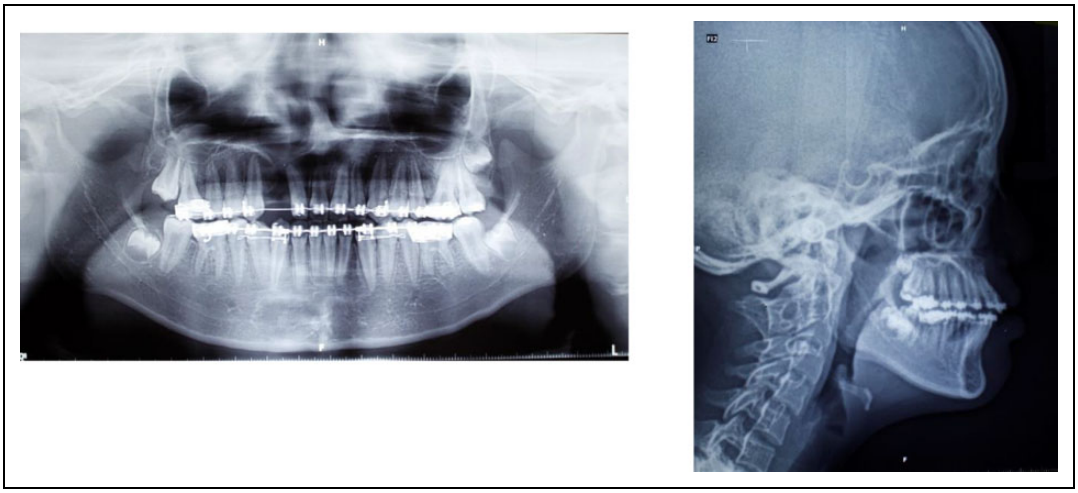

Figure 17. Post-treatment Orthopantomogram and lateral cephalogram.

of surgery later in life. Acrylic-bonded fully tooth- and tissue-borne expanders provide effective palatal expansion for patients, without the use of orthodontic bands. Although banded expansion appliances are also effective, they are more complicated to fabricate. Occasional failure in delivery may result from inaccurate band placement before the pouring and soldering steps. However, the acrylic-bonded fully tooth- and tissue-borne expander is easily fabricated and does not require orthodontic bands. All acrylic appliances have the potential for palatal mucosa ulceration, but no such ulcerations were reported in this case and even after the removal of the plate there was no swelling or hyperemia noticed (Doruk et al., 2004)

In this case, expansion was achieved with a different activation schedule in the intercanine area without expanding the intermolar region, which else would create posterior buccal crossbites that are hard to correct. The device worked without any problem despite the strong and thick palatal and buccal mucoperiosteal tissue that surrounds maxilla. We did not face any abnormal responses related to the hard and the soft tissues. We did not observe more movement of the teeth than osseous tissues, and normal overjet and overbite were obtained. The device was well tolerated by the patient. The case was observed for 5 months of active and 2 months of retentive period followed which fixed mechanotherapy started (Dolanmaz et al., 2003).

Kilic et al., 2010 reported that class III patients with maxillary deficiency often have an anterior crossbite with a concave facial profile, as observed in the present study. They stated that the concave soft tissue profiles of the class III patients with maxillary deficiency were corrected by anterior movement of the maxilla and a concomitant increase in the fullness of the upper lip in growing children (mean [standard deviation] age 12.69 [10.8] years), and that the upper lip protruded a mean of 1.15 mm after use of Face Mask. However, Yavuz et al. reported that Upper Lip-E distance decreased in adolescents (1.42 mm) more than in young adults (1.07 mm). As can be seen, there is a relationship between forward movement of the maxilla and upper lip protrusion (Halicioglu et al., 2014). In this study, UL-E distance decreased to 1.03 mm.

Therefore, the close assessment of patients is necessary before finalizing on any modality of treatment and to make use of the remaining growth potential of the patient in the favor of treatment.

Conclusion

1. Anterior maxillary bone was expanded, and maxilla got protracted with Dr Henri Petit face mask therapy.
2. Skeletal changes along with soft tissue changes were seen with no dental tipping.
3. Intraoral distractor along with facemask worked efficiently to correct the anterior crossbite and in camouflaging the prognathic profile.
4. Thus, this case report justifies the use of tooth tissue borne intraoral distractor for camouflaging class III prognathic profile (Sarkar et al., 2015).

Declaration of Conflicting Interests

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