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Molding Facial Growth with Facemask Therapy: A Case Report

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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Case Report

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ABSTRACT

Class III malocclusion presents significant challenges during the mixed dentition phase, often requiring timely and effective intervention to address skeletal and dental discrepancies. This article presents the case of a 9-year-old girl diagnosed with maxillary deficiency, treated with early facemask therapy in conjunction with the alternate rapid maxillary expansion and constriction (Alt-RAMEC) protocol. The intervention aimed to enhance maxillary protraction and correct the skeletal imbalance during the early mixed dentition phase. The patient was followed longitudinally through the transition to permanent dentition, culminating in fixed orthodontic treatment to finalize occlusal alignment and achieve functional and aesthetic goals. This case highlights the importance of early diagnosis, compliance, and a multidisciplinary approach in managing Class III malocclusion, demonstrating favorable outcomes in both skeletal and dental parameters.

Keywords: Class III malocclusion; maxillary deficiency; dental issues; cephalogram.

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1. INTRODUCTION

Class III malocclusion and anterior crossbite are commonly encountered clinical issues, particularly in individuals of Asian descent (Graber et al. 2005). A significant prevalence of Class III malocclusion has been noted in Asian populations such as the Chinese, Japanese, and Koreans (Proffit et al. 1998) Treating developing Class III malocclusion remains a complex task for healthcare practitioners, as it involves addressing both skeletal and dental aspects. Patients with Class III malocclusion and anterior crossbites may exhibit various combinations of skeletal and dental issues. Even those with a normally positioned or protruding mandible tend to show a deficiency in the maxilla, with maxillary skeletal retrusion being more prevalent in individuals of Asian descent. Early orthopedic treatment for Class III malocclusions, administered at the end of primary dentition or the beginning of mixed dentition, before the growth spurt, can yield successful outcomes. This treatment aims to achieve facial balance, modify maxillofacial growth and development, and potentially prevent the need for future surgical interventions by enhancing stability. Facemask therapy can result in several beneficial effects, including 1) correcting the discrepancy between the centric relation and centric occlusion, 2) protracting the maxilla by 1 to 2 millimeters, and 3) moving the upper teeth forward and tipping the lower teeth toward the lingual side. These effects are particularly significant in younger patients (Ishii et al. 1987). As a result, careful patient selection, an extended treatment duration, and ongoing follow-up are crucial for considering orthopedic growth modification as successful.

Over the past 20 years, the combination of alternate rapid maxillary expansion and constriction (Alt-RAMEC) protocol with facemask therapy has become a common approach for the early treatment of maxillary deficiency (Westwood et al. 2003; Rota et al. 2019; Büyükçavuş et al. 2023) This case report demonstrates the successful implementation of this technique in addressing Class III malocclusion with maxillary deficiency in a 9-year-old patient.

2. CASE REPORT

A 9-year-old female patient presented herself at the Department of Orthodontics and Dentofacial Orthopaedics in Regional Dental College and Hospital, Guwahati, Assam. She expressed her primary concern about missing upper front teeth and lower front teeth being positioned too far forward. There were no significant pre- or post-natal history or family medical background. Upon conducting an external examination, it was observed that the patient had a concave facial profile with a lack of projection in the upper jaw (see Fig. 1). Her lower lip extended beyond the upper lip, and she displayed an average clinical FMA (Frankfort Mandibular Plane Angle) and an acute nasolabial angle. Her smile was aesthetically pleasing, showing 1 mm of upper incisors and 8 mm of lower incisors, which indicated a vertical deficiency in the upper jaw.

Various records, including study casts, an orthopantomogram (OPG), a cephalogram (as shown in Fig. 2), and photographs, were obtained to assess and confirm the diagnosis. During the intraoral examination, it was observed that the gingival tissues appeared normal. The patient exhibited an anterior dental crossbite with a reverse overjet of -4 mm and an overbite of 6 mm, and there was a missing tooth at position 11 (as depicted in Fig. 3). Furthermore, the temporomandibular joint function was deemed normal, as there were no indications of pain upon palpation, clicking, popping, or crepitus noises, and the patient displayed a normal range of motion.

Cephalometric analysis revealed a skeletal Class III pattern, primarily attributable to a retruded maxilla and a protruding mandible with a horizontal growth pattern. The assessment of skeletal maturity, as indicated by the Cervical Vertebral Maturation Index (CVMI), showed that the patient was at Stage 3, suggesting a growth potential in the range of 25-65%.

3. TREATMENT OBJECTIVES

The treatment goals were to address the disparities in the arches both in the front-to-back (sagittal) and side-to-side (transverse) dimensions. This would be achieved by promoting growth in the maxilla while altering the direction of mandibular growth. Additionally, the treatment aimed to correct the anterior crossbite, establish Class I relationships for both molars and canines, ensure proper overbite and overjet, align the midlines, and resolve the impaction of tooth (Miyajima et al 1997).

4. TREATMENT PLAN

The patient was diagnosed with a skeletal Class III malocclusion, characterized by an anterior

crossbite and impaction of tooth (Miyajima et al 1997). The treatment plan was divided into two phases. The first phase focused on correcting the skeletal imbalance using a combination of alternate rapid maxillary expansion and constriction (Alt-RAMEC) protocol alongside facemask therapy. In the Alt-RAMEC protocol, maxillae will be enlarged to be 1 mm per day, first enlarged to 7 mm, and then the 1 mm screw is closed. In other weeks, in this order the screw of the expansion device is turned on for one week and then closed for one week, completing the Alt-RAMEC protocol at the end of the 9-week process. Once the skeletal objectives were achieved, the second phase involved fixed appliance therapy to address the impaction of the central incisor and refine the occlusion. This comprehensive approach aimed to enhance facial aesthetics, improve dental alignment, and establish a stable, functional occlusion.

5. TREATMENT PROGRESS

A Hyrax expansion screw, along with an occlusal splint, was inserted. Activation of the expander began 24 hours after its cementation. The activation schedule employed was Alt- RAMEC (as shown in Fig. 4). Following nine weeks of Alt-RAMEC, a smaller facemask was fitted to commence maxillary protraction, initially with 8 ounces (approximately 200 grams) of bilateral elastic force during the first 14 days (as depicted in Fig. 5). Subsequently, the elastic force was increased to 14 (Mandall et al.2016)

Fig. 1. Pre Extroral Photos

Fig. 2. Pre lateral cephalogram and OPG reords

Fig. 3. Pre intraoral records

ounces (around 500 grams). The patient was instructed to wear the facemask full-time, except during meals, and was strongly encouraged to maintain a high level of oral hygiene. Regular follow-up appointments were scheduled every 6 weeks. At her first follow-up visit while wearing the facemask, a positive overjet was observed. The patient continued wearing the appliance until a 2 mm positive overjet was achieved. Once this 2 mm positive overjet was attained, the appliance usage was reduced to part-time, either during the day or at night (as shown in Fig. 6). As the patient was in the transitional phase, the same appliance was adjusted for 8-hour wear. Following this, the treatment plan progressed to fixed appliance therapy to address the impaction of tooth 11 and refine the occlusion.

Fig. 4. Bonded Hyrax

Fig. 5. Facemask

6. TREATMENT RESULT

Following the active treatment, virtually all of the desired skeletal and dental outcomes had been successfully met. The correction of the anterior crossbite had been accomplished, and there was a substantial improvement in the sagittal alignment which can be appreciated with advancement of point A on lateral cephalogram. The maxilla had been advanced, as evidenced by an increase in the SNA angle from 79 degrees to 81 degrees, a decrease in the SNB angle from 81 degrees to 80degrees, and a change in the ANB angle from -2 to 1, as outlined in Table 1. Once all of the permanent teeth have erupted, the next step will involve commencing treatment with fixed appliances.

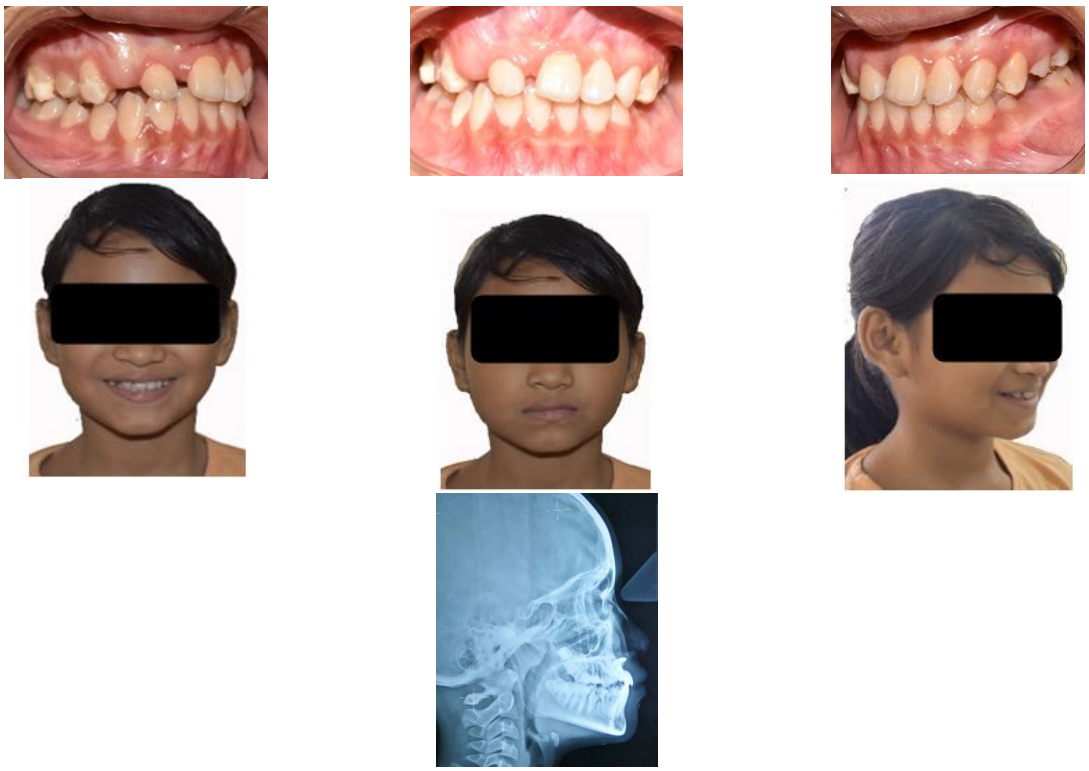

Fig. 6. Post Extroral Records

Table 1 Pre and post treatment cephalometric values

Variables	Pre-treatment	Post -treatment
Sagittal Skeletal		
SNA (degree)	79	81
SNB (degree)	81	80
ANB (degree)	-2	1
AB plane angle (degree)	4	-3
Angle of convexity (degree)	-5	-1
Vertical Skeletal		
SN Mandibular plane (degree)	27	27
Y axis (degree)	60	59
Jaraback ratio (%)	65	65
Sn Occlusal plane (degree)	16	14
Dental Relation		
Upper incisor to NA (deg/mm)	27/5	29/5
Lower incisor to NB (deg/mm)	30/5	28/3
IMPA (degree)	84	92
Internincisal angle (degree)	118	119
Soft Tissue		
Nasolabial angle (degree)	100	101
Lower lip to E line (mm)	4	1
Upper lip to E line (mm)	0	0

7. DISCUSSION

The effective management of Class III skeletal malocclusion hinges on the early orthopedic treatment approach, aiming to achieve successful outcomes without the need for surgical interventions in adulthood. Early intervention, specifically involving maxillary protraction, has demonstrated its effectiveness, especially in cases characterized by maxillary retrusion, which is a common feature of Class III malocclusion. Additionally, the Alt-RAMEC protocol, when compared to the conventional rapid maxillary expansion (RME), has shown to produce quicker and more genuine skeletal advancement. Alt-RAMEC protocol seem to modulate maxillary development in patients near the pubertal growth spurt (Rota et al. 2019; Büyükçavuş et al. 2023; P J M et al. 2023).

One significant reason for addressing the early correction of anterior crossbite is to prevent the potential complications often associated with it. These complications include gingival recession in the labial area of lower incisors (Harrison et al. 1991; Harrison et al. 1993) excessive wear of the incisal edges, an increased risk of temporomandibular joint dysfunction (Wisth et al. 1984), a growth pattern that worsens with age, compromised dental and facial aesthetics, and the related negative psychosocial impacts (Miyajima et al. 1997).

In this particular case, a combination of rapid maxillary expansion and facemask therapy was employed. Various circummaxillary sutures played a vital role in the development of the nasomaxillary complex. The use of an expansion appliance helped "disarticulate" the maxilla, initiating cellular responses in the circummaxillary sutures, thereby allowing for a more favorable response to protraction forces. A bonded Rapid Palatal Expansion (RPE) appliance was utilized, offering several advantages, including a reduced number of appointments, serving as posterior bite blocks to aid in correcting the anterior crossbite, and minimizing buccal crown tipping during expansion due to the appliance's sturdy framework.

Prospective clinical trials have revealed that the maxilla remained stable for up to two years and exhibited long-term success in 67% to 75% of cases (Hagg et al, 2003).

The positive outcomes of early Class III facemask protraction therapy initiated in patients under 10 years of age are sustained at a 3-year follow-up, particularly in terms of ANB angle, overjet, and percentage improvement in the PAR score. While the direct effect on SNA remains favorable, it is not statistically significantly superior to the control group. Notably, 70% of patients in the protraction facemask group maintained a positive overjet, which was defined

as a marker of ongoing treatment success. However, early facemask treatment does not appear to have a significant impact on self-esteem or reduce the perceived personal effects of malocclusion at the 3-year follow-up (Anne Mandall et al. 2012) Early Class III protraction facemask therapy has been shown to reduce the likelihood of requiring orthognathic surgery later in life. However, this outcome cannot be solely attributed to the preservation of skeletal cephalometric changes (Mandall et al. 2016).

8. CONCLUSION

Timely action is crucial when dealing with the development of Class III malocclusion. In the mixed dentition phase, employing facemask therapy proves to be an efficient approach for addressing Class III malocclusion. Utilizing palatal expansion alongside maxillary protraction serves to "unhook" the maxilla and triggers cellular responses in the sutures. This, in turn, leads to a more favorable response to protraction forces, ultimately improving both function and aesthetics.

Statement of Informed: Consent Written informed consent was obtained from the subject for the use of photographs for publication. The patient understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declared that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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