

Innovative Way of Distracting Maxilla with Controlling Mandibular Growth Distinctive Cost-Effective Approach for Treating fetal Alcohol Syndrome

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Abstract: Class III malocclusion has been the subject of interest because of the challenges in its treatment. During adolescence, Class III malocclusion with a substantial skeletal component poses a treatment difficulty. These malocclusions may be caused by maxillary retrognathia, mandibular prognathism, or both. When a Class III malocclusion solely affects the alveolar bone, treatment is usually straightforward. Protraction facemasks have often been used in the treatment of early-stage midfacial retrusion in children. Maxillary protraction can be accomplished more successfully with rapid maxillary expansion (RME), which disengages the articulations of the maxillary complex from the rest of the skull. The optimistic outcomes of a customized, two-stage treatment plan that was used to successfully treat a growing boy's severe skeletal Class III malocclusion without surgery are presented in this study. An orthopaedic approach involving simultaneous alternate rapid maxillary expansion and constriction (Alt-RAMEC) protocol with class 3 elastics was adopted in phase 1 to correct the sagittal skeletal discrepancy. Phase 2 involved the implementation of fixed orthodontic therapy in order to achieve a well-interdigitated occlusion. The retention phase with the reverse bionator marked the end of the treatment. Orthopedic and orthodontic treatment resulted in considerable improvements in soft tissue profile, smile aesthetics, and occlusion when treatment was completed.

Key Words: Class III malocclusion, Growth modification, Alt-RAMEC, Orthopaedic

Introduction

Solving Skeletal Class III malocclusions are among the most difficult cases. Mandibular prognathism, maxillary retrognathia, or both may be the cause of these malocclusions. For about 40% of Class III people, maxillary retrognathia is the primary cause of the issue⁽¹⁾.

Treatment for Class III malocclusions that only impact the alveolar bone is typically simple. On the other hand, therapy becomes more difficult, and after treatment is finished, malocclusion is more likely to return when retrognathia of the upper or

prognathia of the lower affect the basal bone. The course of treatment for this craniofacial defect will depend on the patient's age and growth phase. The goal of early orthopaedic care is to reduce the need for further therapy⁽¹⁾.

Treatment for early-stage midfacial retrusion in children has usually involved the use of protraction facemasks. Rapid maxillary expansion (RME) makes it possible for maxillary protraction to be more effectively achieved by disengaging the maxillary complex's articulations from the rest of the skull⁽²⁾.

Liou and Tsai created the Alt-RAMEC protocol in 2005 for disarticulating circummaxillary sutures without overexpansion⁽³⁾.

The Alt-RAMEC procedure permits disarticulation of the circummaxillary sutures in patients approaching the culmination of their facial development. The method makes use of a 2-hinged rapid palatal expander, whose special biomechanics cause each maxilla half to rotate and expand outward. The timing of the treatment seems to be critical to the method's long-term effectiveness. When the vertebral maturation stage lies between the second and third stages, treatment is initiated, or V₂ and V₃⁽⁴⁾.

The term "Fetal Alcohol Syndrome" (FAS) describes a set of congenital abnormalities that are present in infants born to pregnant women who consumed excessive amounts of alcohol⁽⁵⁾.

Case Report

This case report details the use of the Alt-RAMEC procedure with class 3 elastics to treat the current state of a developing patient with anterior crossbite and skeletal Class III malocclusion.

An 11-year-old boy first came to the Division of Orthodontics at Pravara Institute of Medical Sciences Rural Dental College Loni with a chief complaint of "forwardly placed lower front teeth and difficulty in biting with front teeth." Following an assessment by the medical centre's craniofacial experts, he was referred for orthodontic treatment. Fetal alcohol syndrome was confirmed by the medical history, and snoring was also noted. Small eyelid fissures, a flat face, maxillary hypoplasia, a short nose, a long, hypoplastic nasal filter, and a thin upper lip are the most prevalent orofacial abnormalities. Features of Fetal Alcohol Syndrome depicted in figure 1.

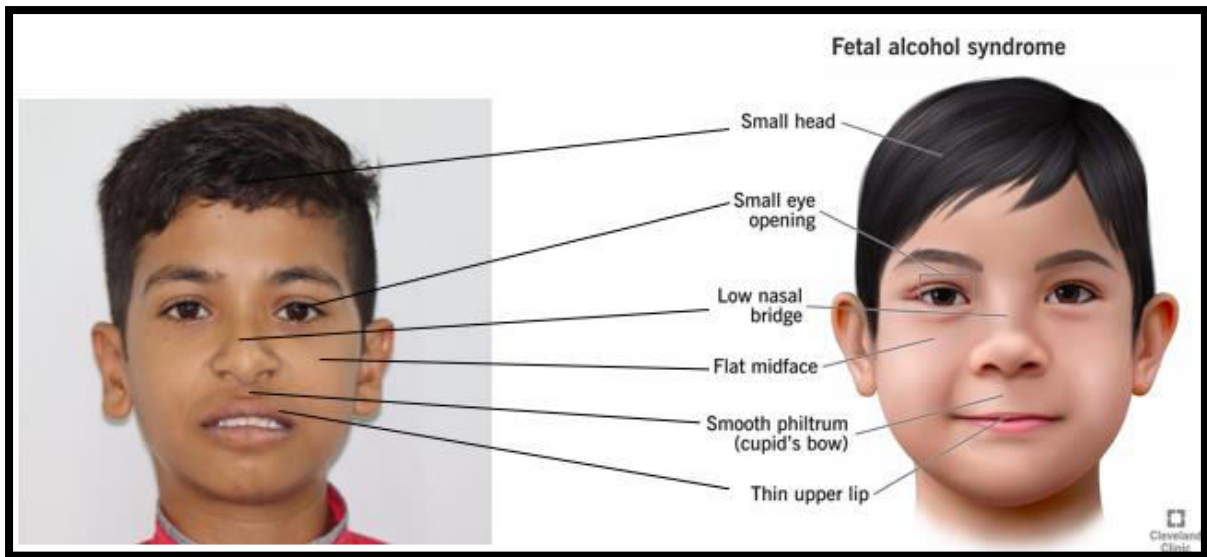


Figure 1- Depicting Features of Fetal Alcohol Syndrome

Upon examination, the patient revealed a moderately prognathic chin, a deficient midface, and a concave profile. Upon intraoral examination, it was discovered that the patient had a 4 mm negative overjet and a Class I molar and Class III cuspid connection on each side. The upper dental midline was coinciding with facial midline. Pretreatment Intraoral and extraoral photographs of patients shown in figure 2.

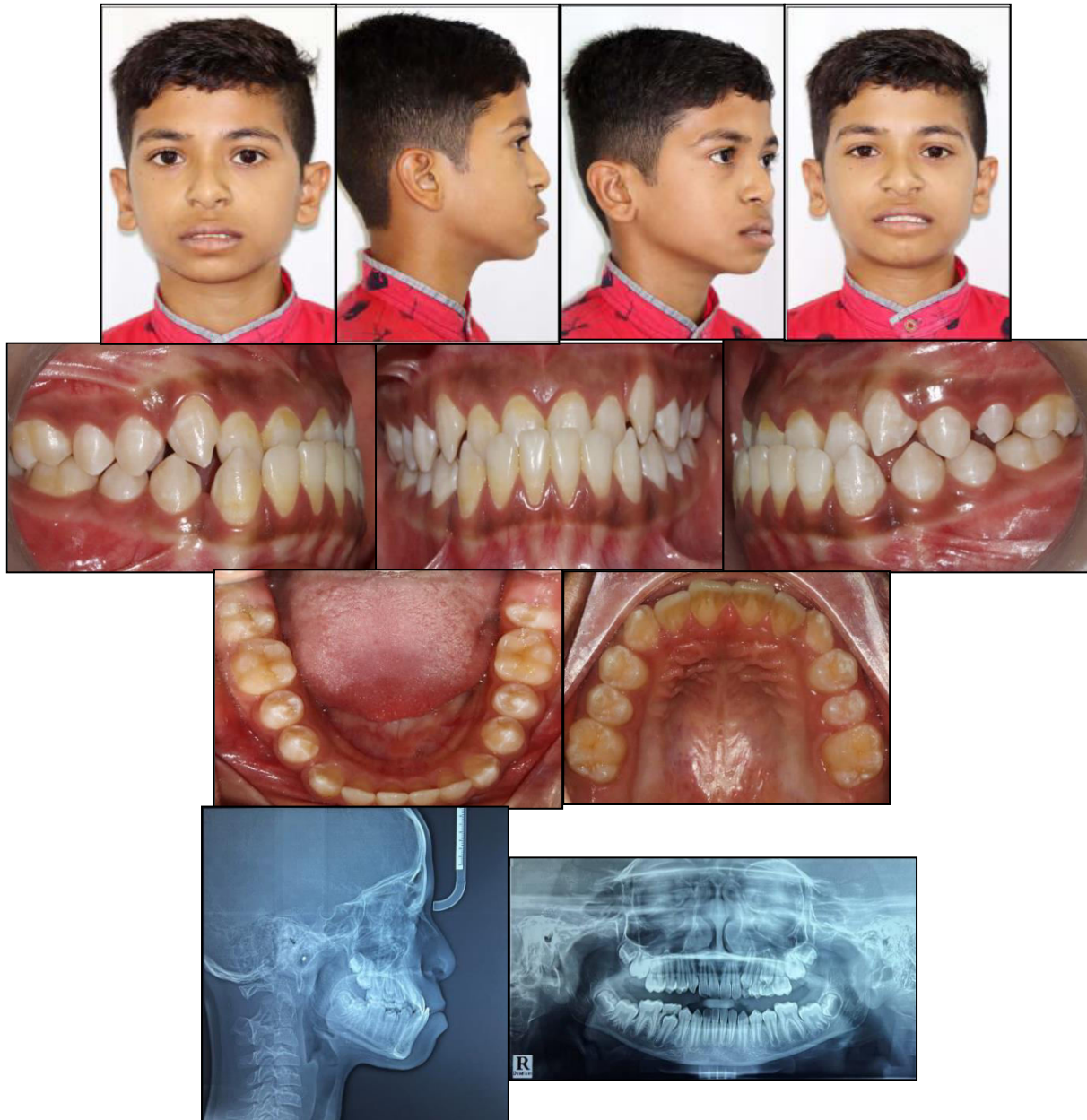


Figure 2- Pretreatment Extraoral and Intraoral Photographs

The extraoral examination revealed significant lip incompetence, a convex profile, dolichocephaly with increased lower facial height, and facies compatible with mouthbreathing. The patient's forehead, philtrum, and eye opening were all small, and the nasal bridge was flat. The patient was predisposed to gingival margin and incisal edge inconsonance and development, and exhibited an undesirable grin arc and smile projection. When smiling, the patient also displayed greater incisor display. An intraoral examination revealed a large arch length-tooth size disparity, a maxillary transverse discrepancy, occlusion on only the first molars, and a negative overjet of 5 mm. Additionally, his range of motion was restricted when it came to protruding and lateral movements. A cephalometric study was carried out together with the

acquisition of panoramic and lateral cephalometric radiographs. This investigation (Table 1) revealed a high ANB angle and a decreased SNB angle, which corroborates the clinically reported micrognathia. With an SN-GoGn value of 65.2, the steep mandibular plane angle was more than 6 SD from the norm. This fit the description of the syndrome.

The cephalometric express a skeletal Class III malocclusion with upper jaw deficiency (ANB, -1°). The upper incisors were normal (U₁ to SN, 108°), and the lower incisors were normal (L₁ to Go-Me, 93°).

Cephalometric Analysis

Skeletal Analysis:

Parameter	Normal Value	Pre-treatment	Post treatment
ANB (degree)	2	-1°	1.5°
Angle of Convexity (degree)	0	-3°	3.5°
Wits appraisal (mm)	0	-2	1mm
SNA (degree)	82	79.5°	85.5°
N L- A (mm)	0-1mm	-3	1mm
Effective Max Base (Co - A) (mm)		70mm	74 mm
SNB (degree)	80°	82°	82°
N L - Pog (mm)	Small -8to-6 med -4 to 0 Large -2 to 2	-1mm	0 mm
Effective Mand Length (Co-Gn) (mm)		91mm	95mm
S-N to Go-Gn (degree)	32°	25°	24°
Y axis (N-S-Gn) (degree)	66°	64°	62°
Angle of inclination (Max rotation)	85°	86°	94°
U ₁ - SN (degree)	102°	108°	118°
U ₁ - NA(degree)(linear)	$22^\circ, 4\text{mm}$	$26^\circ, 6\text{mm}$	$32.5^\circ, 7.5\text{mm}$
U ₁ - A-Pog (mm)	4mm	6mm	8.5mm
U ₁ - N-Pog (mm)	2mm	5mm	9.5mm
IMPA (degree)	90°	93°	92°
L ₁ - NB (degree)(linear)	$25^\circ, 4\text{mm}$	$26^\circ, 8\text{mm}$	$22.5^\circ, 6\text{mm}$
L ₁ - N-Pog (mm)	2mm	8mm	7.5mm
Interincisal angle (degree)	131°	130°	121°

B) Soft Tissue Analysis:

Parameter	Normal Value	Pre-treatment	Post-treatment
S line	U-o	+4	+5
	L-o	+8	+6
E line	U-4mm	+2	+2
	L-2mm	+7	+5
NLA (degree)	102°	68°	83°

Treatment Objectives**1. Phase 1- Craniofacial growth modulation**

1. Promote the transverse and anteroposterior growth of maxilla
2. Redirect the growth of mandible

2. Phase 2- fixed mechanotherapy – MBT technique

1. alignment and levelling with correction in overbite and overjet
2. Consolidation of space
3. Finishing and detailing

3. Phase 3- Retention protocol

Reverse bionator

And also, to correct

1. To correct Class III skeletal growth pattern
2. To correct Class III molar and cuspid relation
3. To correct negative overjet and Overbite
4. To correct concave profile
5. To correct incompetent lips

Treatment mechanotherapy

In order to correct the maxilla and break the circummaxillary suture and to promote its sagittal positioning the concept of ALTRAMEC was selected.

Instead of using a reverse pull headgear or a facemask a mechanotherapy has been modified in form of modified lower appliance.

Patient is planned to be treated with non-extraction fixed mechanotherapy using by 0.022 MBT appliance

Stage 1- Alt- RME with Class III elastics

Stage II- space management and alignment using 0.022 slot MBT

Treatment Progress

The hyrax consisted of a central jackscrew and two posteriorly orientated rotational hinges. In the mandibular arch, molar and premolar bands were soldered onto a

double lingual arch including anterior hooks. The upper splint, which incorporates HYRAX for rapid maxillary expansion (RME), is held in place by acrylic blocks on the palatal and occlusal surfaces of the maxillary teeth. As shown in figure 3, patients intraoral photographs with appliance.



Figure3 - With Alt-Ramec Appliance

Following the nine-week Alt-RAMEC regimen, the rapid maxillary expansion (RME) appliance with acrylic coverage was cemented. Liou (6) suggested a seven-day expansion and seven-day constriction therapy regimen with a daily increment of one millimetre. After the patient underwent seven weeks of alternate expansion and constriction, there was minimal mobility across the maxilla and some minor discomfort, especially in the paranasal area. A set of 300 g intraoral class 3 tooth-borne elastics was used to generate maxillary protraction. The elastics needed to be worn all day, even when eating.

After achieving positive overjet, post Alt-Ramec intraoral and extraoral photographs shown in figure 4, the fixed treatment phase then began after the removal of the acrylic covered RME appliances. Upper and lower arch was bonded followed by alignment and levelling with 0.014, 0.016, 0.018, 017x025- inch NiTi & 19x25ss wires was done. Upper and lower bonding followed by alignment and levelling as shown in figure 5. 0.16 SS wires were used for finishing and detailing in the upper and lower arches following levelling and alignment. Following the post-distalization phase, settling elastics were administered and adjusted in accordance with ABO (American Board of Orthodontics) guidelines to enhance the intercuspation. After 20 months of therapy, fixed bonded retainers were inserted in the maxillary and mandibular arches. Post treatment intraoral and extraoral photographs shown in figure 6.



Figure 4- Post Alt-Ramec Protocol Extraoral and Intraoral Photographs Showing Improvement in Profile and Appearance of Bilateral Posterior Openbite



Figure 5- Phase 2-Fixed Mechanotherapy with Upper and Lower Bonding Followed by Alignment and Leveling.

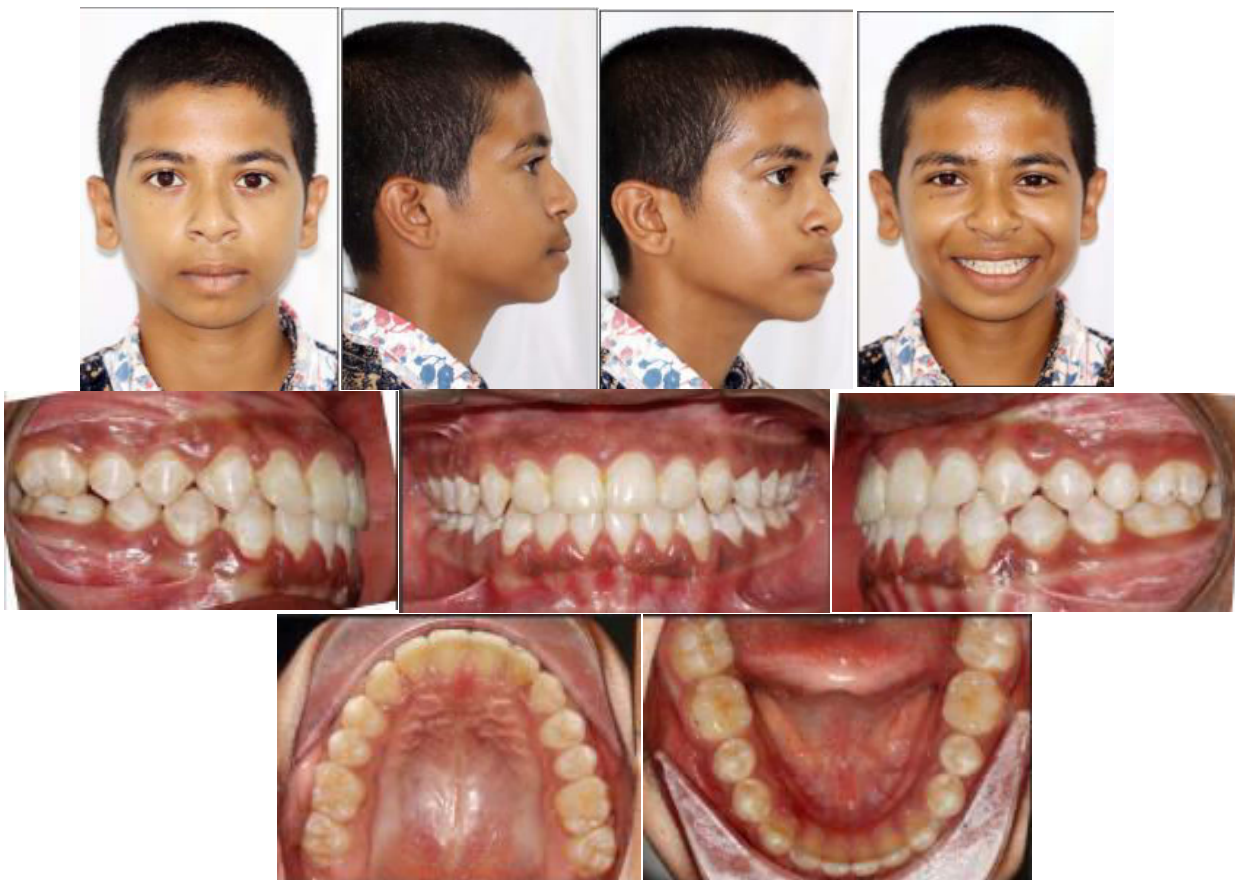


Figure 6 - Posttreatment Extraoral and Intraoral Photographs After Removal of Appliance

Following the procedure, there was a noticeable improvement in profile and maxillary forward movement. Appropriate overbite and overjet were established, and anterior crossbite was fixed. Subsequently, the orthodontic appliance was removed through the debonding process. Utilizing a reverse bionator, the post-treatment lateral cephalogram indicated an improvement in the profile and retention. Figure no. 7 depicts photographs with reverse bionator as retainer. After 6 months of post-treatment photographs shows there is no change in skeletal and dental relation. (Figure8)



Figure 7- Retention with Reverse Bionator

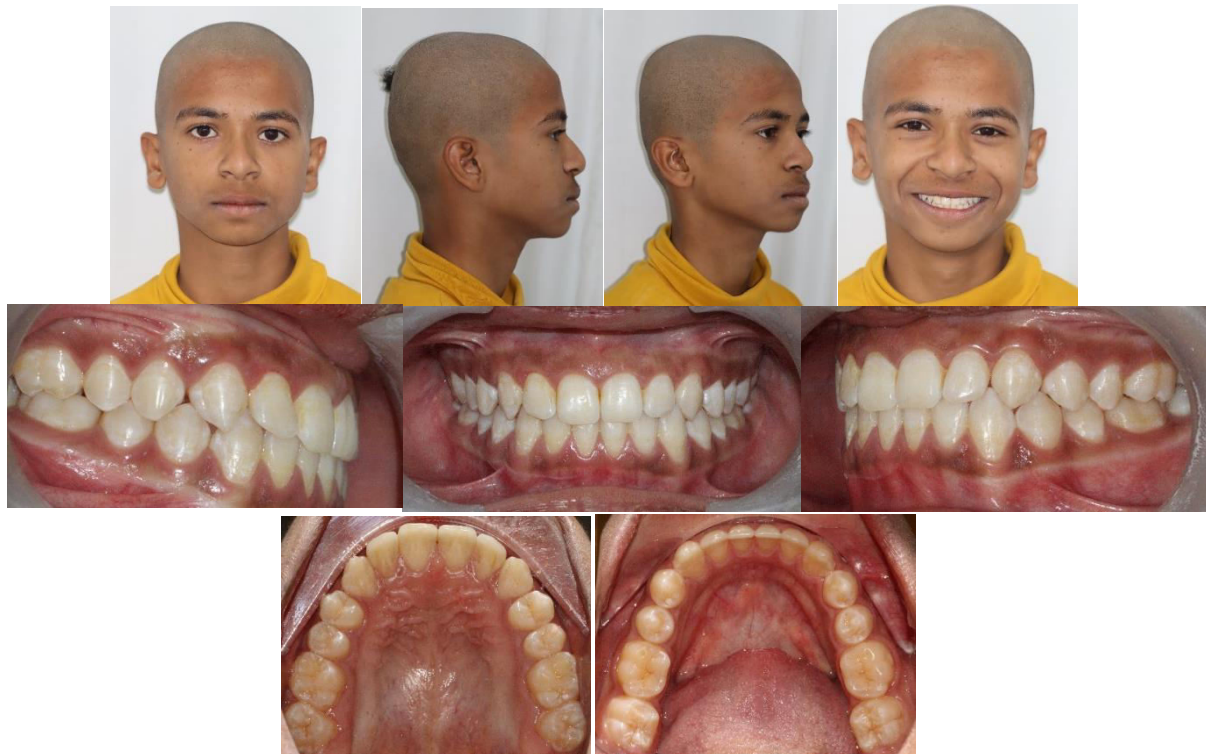


Figure 8- 6 Months Follow Up Intraoral and Extraoral Photographs

Result

Data collected after therapy showed that the objectives of the treatment were met. After nine months, progress records revealed the correction of the anterior crossbite and the mandible's and maxilla's favourable growth patterns. The malocclusion was fixed and the original concern was mostly addressed. The anterior crossbite and smile aesthetics both enhanced, and the dental midlines coincided with the face midlines. Class I canine and molar relations produced an acceptable overbite and overjet.

Discussion

Skeletal Class III malocclusions are quite challenging in orthodontics. These malocclusions can be brought on by maxillary retrognathia, mandibular prognathia, or amalgamation of the two. Maxillary retrognathia accounts for approximately 40% of Class III cases. The patient's age and developmental stage have a significant role in determining the optimal course of treatment for this craniofacial deformity. Early orthopaedic intervention aims to minimize the need for additional therapy down the road.

The Alt-RAMEC therapy has immediate benefits for growing skeletal Class III individuals, such as promoting maxillary protraction, which is essential for addressing specific malocclusions and enhancing face aesthetics⁽⁶⁾.

A case study published by Ganesh G et al. describes how a young person with Class III malocclusion was treated with an amalgamation of orthopaedic and orthodontic treatment utilizing Hyrax, Class III elastics on lower jaw miniplates, and upper jaw mini-implants⁽⁷⁾.

Young Class III individuals with maxillary deficit have been given an arrangement of maxillary protraction and rapid expansion. It has been suggested that rapid expansion of the maxilla separates it from its adjacent bones that are joined by circumaxillary sutures. Facilitating the maxilla's forward motion was the aim of coupling RME with maxillary protraction. By increasing the quantity of maxillary protraction, it is suggested that Alt-RAMEC can reduce the length of time that protraction lasts. To enable the maxilla to glide forward more easily, RME and maxillary protraction were combined⁽⁸⁾.

Pithon MM et al. supervise a comprehensive review of the literature and discovered that, when treating Class III malocclusion, the Alt-Ramec technique considerably improves both the skeletal and dental relations⁽⁹⁾.

For nine weeks, the maxilla underwent alternating weeks of expansion and contraction, involving four quarter rotations every day (1 mm).

This approach seeks to reduce the risk of unfavourable dentoalveolar consequences, improve the treatment's speed and efficiency, increase the effectiveness of an appliance that requires patient participation, and increase the procedure's skeletal outcomes⁽¹⁰⁾. Improving the skeletal effect can help lower the risk of relapse after orthodontic treatment, which is one of the most serious consequences⁽¹¹⁾.

Under the fast maxillary expansion technique, maxillary protraction was measured at 1.5–3.0 mm in 10–12 months, compared to 4–5 mm in 5 months under the Alt-Ramec regimen⁽⁴⁾.

In this study, an increase in the SNA angle was observed. SNB, ANB, and SNA angles were analysed as markers of the anterior-posterior alterations of the maxilla and mandible, as well as their interrelationship. This shows that point A is moving ahead. Thus, it may be said that the maxilla moves forward when the Alt-Ramec protocol is used.

The mandible is retracted in relation to the upper cranium when the SNB angle decreases or stays the same. An increase in the ANB angle indicates a shift in the maxilla's and mandible's relative positions, with the maxilla moving forward relative to the mandible.

Point A significantly moved forward with respect to the VRL in the Alt-RAMEC group in the study done by Merwin et al.¹⁹ and Kapust et al.^(12,13).

ANB, Wits, Maxillary length and Overjet increased, while the overbite decreased and these findings were in line with those of previous studies⁽¹⁴⁾.

The upper lip moved forward, the lower lip and soft tissue pogonion backward and nasolabial angle increased, thus improving the soft tissue profile.

1. The patient's overall better profile was aided by small elevations in the mandibular plane, decreased facial height, and a counter clockwise tipping of the palatal plane, as evidenced by post protraction radiographs in this case report. The maxilla moved forward and the mandible moved backward, causing a significant increase in ANB.
2. **Treatment Justification:** The patient's age and the requirement for craniofacial growth modulation made the use of the Alt-RAMEC protocol appropriate. The protocol's ability to disrupt the circummaxillary sutures more effectively than traditional methods is particularly beneficial in cases like this, where maxillary protraction is crucial.
3. **Treatment Phases:** The treatment was strategically divided into phases, addressing the transverse and anteroposterior deficiencies of the maxilla, followed by fixed mechanotherapy for alignment, leveling, and detailing. This phased approach allowed for targeted interventions at each stage of treatment.
4. **Mechanotherapy Modifications:** The adaptation of the Alt-RAMEC protocol with a modified lower appliance and the use of non-extraction fixed mechanotherapy using a 0.022 MBT appliance demonstrates a customized approach to the patient's specific needs.
5. **Treatment Progress and Compliance:** The patient's compliance with the treatment regimen, including the use of intraoral Class III elastics, was crucial for achieving the desired outcomes. The report highlights the importance of patient cooperation in complex orthodontic treatments.
6. **Outcomes:** With the anterior crossbite corrected, the facial profile improved, and Class I canine and molar relationships established, the post-treatment outcomes were outstanding. These outcomes not only addressed the functional aspects of the malocclusion but also significantly improved the patient's smile aesthetics.
7. **Retention Strategy:** The use of a reverse bionator as part of the retention protocol suggests a forward-thinking approach to maintaining the treatment results, especially in a growing patient where future growth can impact the stability of the outcomes.
8. **Limitations and Considerations:** While the treatment was successful, it is important to consider the potential limitations of the Alt-RAMEC protocol, such as patient discomfort, the need for strict compliance, and the reliance on the patient's growth pattern for optimal results.
9. **Future Implications:** The case provides valuable insights into the management of complex malocclusions with growth modulation and highlights the potential for similar approaches in other patients with comparable diagnoses.

Conclusions

In summary, this case report shows how the Alt-RAMEC procedure can be used to treat a skeletal Class III malocclusion with anterior crossbite in a developing patient. It can also be used in conjunction with Class III elastics. The favourable results highlight

the necessity of a carefully thought-out treatment plan, patient adherence, and an extensive retention strategy in order to guarantee the effects' long-term stability.

By the end of the treatment, the upper and lower teeth had a Class I molar and canine relation, as well as an ideal overjet and overbite. With the use of Alt-Ramec, the patient's concave profile was corrected, resulting in an attractive soft tissue profile and lip competency.

Skeletal Class III can be effectively corrected by using class 3 elastics for maxillary protraction and an alternate quick maxillary expansion and constriction regimen. The protocol's modifications to the maxillo-mandibular relations help to improve the patient's profile.

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