Assessment of Immediate Skeletal Changes after Alternate Rapid Maxillary Expansion and Constriction – A Case Report

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INTRODUCTION

The Alt-RAMEC protocol was introduced by Liou in the year 2005. It allows for sutural mobilisation by opening and closing the RME screw for 7-9 weeks. Maxillary protraction after the use of Alt-Ramec (alternate rapid maxillary expansion and contraction) protocol is an efficient method for early treatment of skeletal Class III malocclusion. This case report shows the results of using a hyrax bonded maxillary expander with the Alt-RAMEC protocol to treat a maxillary hypoplasia Class III malocclusion. A 12-year-old patient with skeletal class III malocclusion with anterior as well as the unilateral posterior crossbite was treated using this protocol. CBCT scans were taken before and after expansion. These CBCT scans were used for assessing and analysing the skeletal changes that have occurred after using the Alt-Ramec protocol. The objective of this case report is to assess skeletal changes after using the Alt-RAMEC protocol.

The clinicians face a dilemma while treating a Class III malocclusion. Dentofacial orthopaedic treatment, camouflage orthodontic treatment, and a combination of orthognathic surgical and orthodontic approaches are among the treatment options.[1,2] Protraction face mask (PFM) therapy combined with rapid maxillary expansion (RME) is the most common approach for early treatment of these patients.[3] The Alt-RAMEC protocol was introduced by Liou in 2005.[4] It allows for sutural mobilisation by opening and closing the RME screw for 7-9 weeks without the need for excessive expansion. Its logic is analogous to that of basic tooth extraction, in which we regularly rock the tooth buccally and lingually until it is "disarticulated" out of the alveolar socket.[5] The Alt-RAMEC was created to open the circumaxillary sutures without the drawbacks of maxillary overexpansion.[5,6] In contrast to traditional RME, its implementation technique is to increase the frequency of rapid maxillary expansion by alternating rapid expansion and constriction many times. The extent of anterior maxillary displacement was found to be two times greater with the Alt-RAMEC protocol than with the traditional RME protocol. The investigations conducted regarding changes seen after Alt-RAMEC has suggested more protraction that was obtained in the Alt-RAMEC group (A point, 5.8 ± 2.3 mm) than in the RME group (A point, 2.6 ± 1.5 mm).[7] Studies have shown that increasing the skeletal effect can reduce post-treatment relapse, which is one of the most significant problems in orthodontic treatment.[8,9,10] The changes in skeletal relation of maxilla and mandible are important to assess the correction of skeletal Class III malocclusion and improvement of patient's profile associated with it. Cone Beam Computed Tomography (CBCT) is a three-dimensional imaging technique that has arisen as a critical diagnostic tool in dentistry.[11] High spatial resolution of bone and teeth provided by CBCT allows for a precise understanding of the relationship of the adjacent structures.[12] The purpose of this case report is to evaluate and analyse the skeletal changes immediately after alternate rapid maxillary expansion and constriction using CBCT scans taken before and after the protocol was used.

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DOI: 10.14260/jemds/2021/604

How to Cite This Article:
Pharande SV, Toshniwal NG, Potnis SS, et al. Assessment of immediate skeletal changes after alternate rapid maxillary expansion and constriction – a case report. J Evolution Med Dent Sci 2021;10(34):2954-2959, DOI: 10.14260/jemds/2021/604

Submission 14-04-2021,
Peer Review 24-06-2021,
Acceptance 30-06-2021,
Published 23-08-2021.

PRESENTATION OF CASE

The patient, an adolescent boy, aged 12 years, came to Sinhgad Dental College, Department of Orthodontics and Dentofacial Orthopedics with a complaint of backwardly placed upper teeth, an un-aesthetic dental and facial appearance. The patient also had anterior cross-bite in addition to unilateral posterior cross-bite.

CLINICAL DIAGNOSIS

The patient had Class III malocclusion associated with maxillary retrusion.

DISCUSSION OF MANAGEMENT

The treatment objectives were to obtain a normal profile by skeletal correction, correct the Class III dental relationship and obtain a Class I canine and Class I incisal relationship. The patient was delivered a bonded type of RME appliance with a Hyrax expansion screw in the middle and an occlusal splint (extending from the distal of the canines and encompassing the posterior teeth) for the Alt-RAMEC protocol. The maxilla was expanded and contracted alternating weeks by 4 one quarter turns per day (1 mm) and this was continued for 9 weeks ending with expansion.

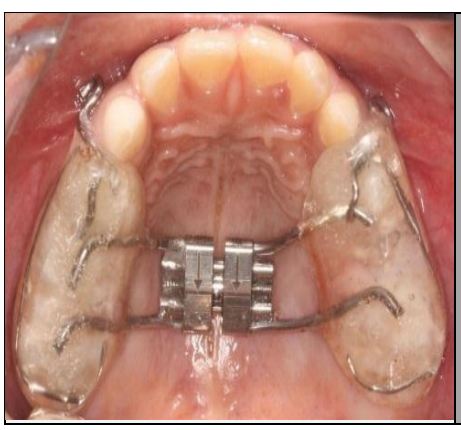

Figure 1. Rapid Maxillary Expander Delivered

Two sets of CBCT scans were taken, one before the commencement of the treatment prior to delivery of the appliance and one immediately after the expansion according to Alt-Ramec protocol was completed. The measurements were taken in both the scans and values were compared and conclusions were derived from those values. Different measurements taken were as follows -

SNA Angle

It indicates anteroposterior positioning of the maxilla with the cranial base. It is measured between sella, nasion and point A.[13] (figure 4)

SNB Angle

This angle is used to assess the antero-posterior positioning of mandible in relation to cranial base. It is measured between sella, nasion and point B.[14] (figure 5).

ANB Angle

This angle denotes the relative position of the maxilla and mandible with each other. It is measured between point A, nasion and point B[15] (Figure 6). Two reference lines were used – horizontal and vertical. Horizontal reference line (HRL) - This was determined by a line passing through the sella-nasion plane. Vertical reference line (VRL) - A line dropped perpendicular to the HRL at the sella point.

VRL-A

This linear measurement was taken from the vertical reference line to subspinale point A. Point A is the deepest point in the midline between the ANS and the alveolar crest, between the two central incisors.[16] (figure 7)

VRL-B

This linear measurement was taken from the vertical reference line to supramentale point B. Point B is the deepest point in the midline between the alveolar crest and the mental process.[17,18] (Figure 8)

VRL-Pg

This linear measurement was taken from the vertical reference line to the pogonion (Pg). Pogonion is the most anterior part of the contour of the bony chin.[17,18]

1. HRL-A
   This linear measurement was taken from the horizontal reference line to the subspinale point A.
2. HRL-B
   This linear measurement was taken from the horizontal reference line to the supramentale point B.
3. HRL-Pg
   This linear measurement was taken from the horizontal reference line to the pogonion (Pg).

	Pre-Treatment Measurements	Post-Treatment Measurements
SNA angle	78.23°	81.44°
SNB angle	84.89°	82.47°
ANB angle	-5.25°	0.72°
VRL- A	53.07 mm	56.66 mm
VRL- B	54.14 mm	52.89 mm
VRL- Pg	52.61 mm	51.54 mm
HRL- A	45.83 mm	49.19 mm
HRL- B	79.25 mm	85.67 mm
HRL- Pg	87.73 mm	93.33 mm

Table 1. Pre-Treatment and Post-Treatment Measurements of Skeletal Parameters

Results

SNA angle, ANB angle, VRL-A, HRL-A, HRL-B and HRL-Pg values increased and the SNB angle, VRL-B, VRL-Pg values decreased after the use of the Alt-RAMEC protocol.

Figure 2. Pre-Treatment Photographs

Figure 3. Pre-Treatment Photographs

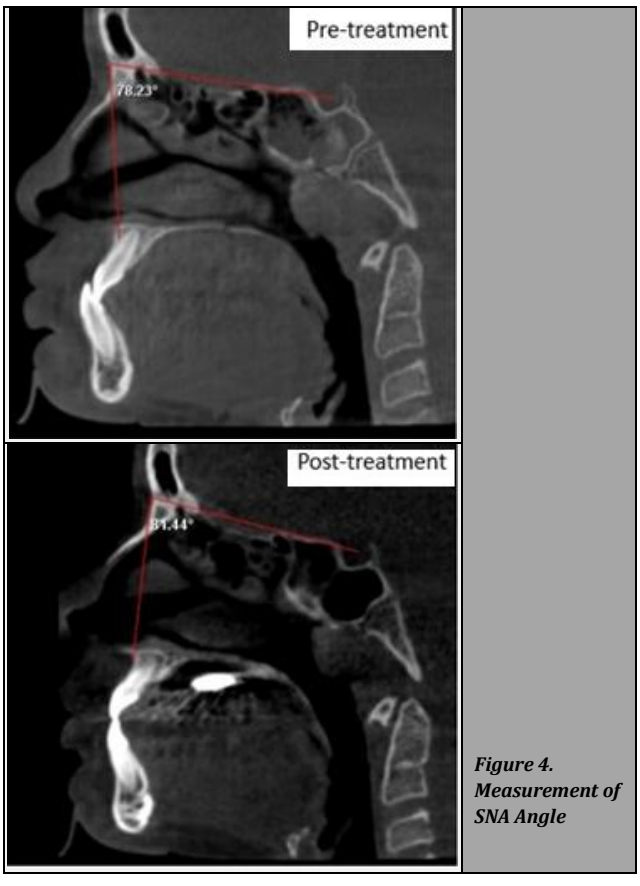

Figure 4. Measurement of SNA Angle

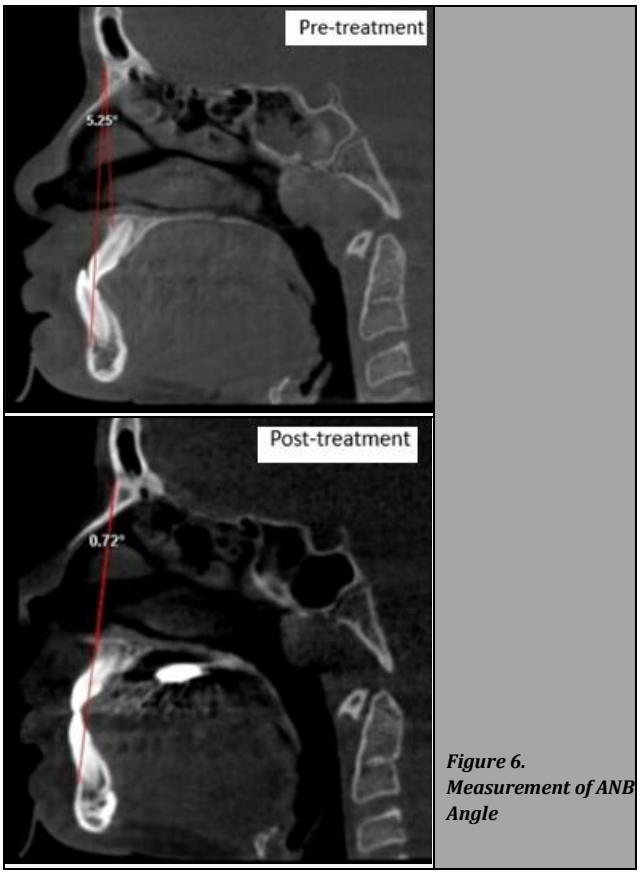

Figure 6. Measurement of ANB Angle

Figure 5. Measurement of SNB Angle

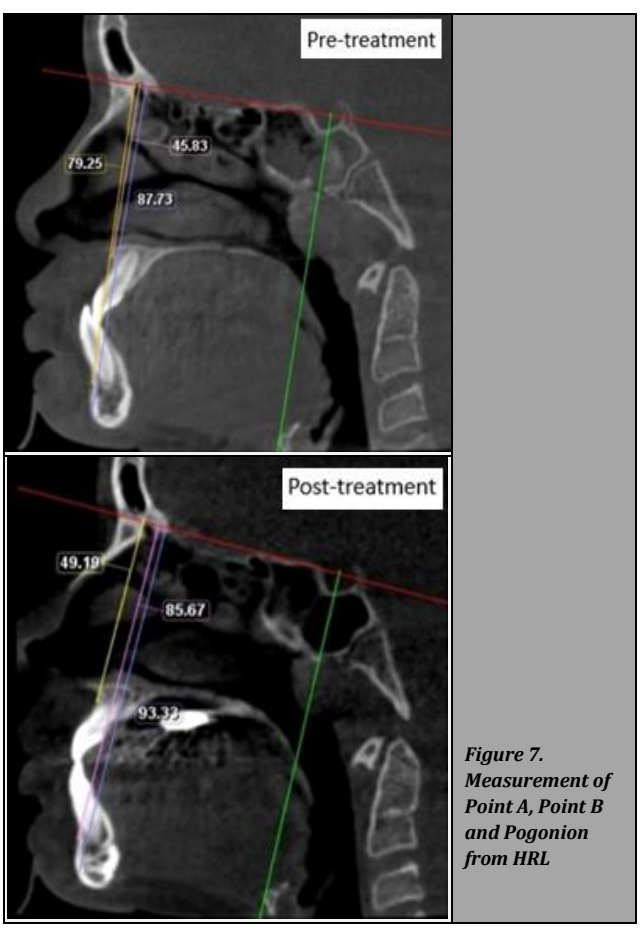

Figure 7. Measurement of Point A, Point B and Pogonion from HRL

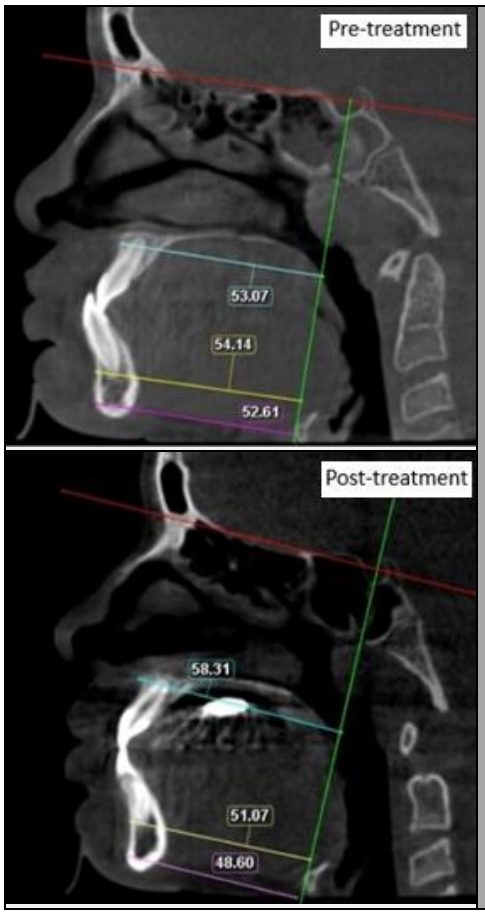

Figure 8. Measurement of Point A, Point B and Pogonion from VRL

DISCUSSIONS

Alternate rapid maxillary expansion and constriction is a modification of the conventional rapid maxillary expansion. The application of the Alt-Ramec protocol before maxillary protraction is an effective method for the early treatment of patients with Class III malocclusion.[7] The goal of this approach is to improve the efficacy of an appliance that requires patient cooperation, to increase the ease and effectiveness of the procedure in a short period of time, to prevent negative dentoalveolar effects, and to produce more skeletal effects from the procedure. Enhancing the skeletal effect will reduce the likelihood of post-treatment relapse, which is one of the most serious complications in orthodontic treatment.[8] The Alt-Ramec protocol achieves considerably more circumaxillary suture disjunction than the rapid maxillary expansion protocol. The amount of maxillary protraction observed under the Alt-Ramec protocol was 4 - 5 mm in 5 months, while it was 1.5 - 3.0 mm in 10 - 12 months under the rapid maxillary expansion protocol.[7]

SNA, SNB and ANB angles were examined as indicators of the anterior-posterior changes of the maxilla and mandible, and their inter-relationship respectively. SNA angle evaluates the maxilla's anteroposterior orientation and the SNB angle evaluates the mandible's anteroposterior orientation in relation to the cranium. An increase in SNA angle and linear distance VRL-A is seen in this study. This indicates a forward movement of point A. Hence it can be concluded that the use of Alt-Ramec protocol causes forward movement of the maxilla.

A decrease in SNB angle shows that the relative position of the mandible is retracted with the upper cranium. A very slight decrease in VRL-B and VRL-Pg is seen. An increase in ANB angle shows a change in the relative position of the maxilla and mandible to each other indicating the maxilla has moved forward as compared to the mandible. In the studies conducted by Merwin et al.[19] and Kapust et al.[20] there was a significant forward movement of Point A with respect to the VRL in the Alt-RAMEC group.

Wang et al.[21] published similar results in 2009, concluding that the circummaxillary sutures were greatly opened with Alt-RAMEC for five weeks rather than RME protocol for one week. They concluded that sagittally running sutures were opened slightly more than the coronally running sutures, regardless of whether they articulated directly or indirectly to the maxilla.

The linear measurements HRL-A, HRL-B and HRL-Pg were increased after the Alt-Ramec protocol. This signifies posterior rotation of the mandible and the increase of anterior facial height. Celikoglu and Buyukcavus[22] described similar results in their analysis with two separate Alt-RAMEC protocols: a substantial increase in maxillary development and clockwise rotation of the mandible, resulting in an improvement of the maxillomandibular relationship in both classes.

CONCLUSIONS

Mild developing skeletal malocclusions may be corrected with growth correction procedures during the growth cycle. The use of alternate rapid maxillary expansion and constriction protocol along with a facemask for maxillary protraction is an effective method for correction of skeletal Class III. The changes in maxillo-mandibular relations obtained with this protocol contribute towards improving the patient's profile. This entire cascade of events ultimately contributes to the aim of orthodontic treatment which is to enhance the esthetics and strike a balance between the teeth, supporting structures of the teeth, the surrounding soft tissue envelopes and the skeletal structures.

Financial or other competing interests: None.
Disclosure forms provided by the authors are available with the full text of this article at jemds.com.

REFERENCES

[1] Guyer EC, Ellis EE III, Mcnamara JA Jr, et al. Components of class III malocclusion in juveniles and adolescents. Angle Orthod 1986;56(1):7-30.
[2] Ellis E III, McNamara Jr JA. Components of adult class III malocclusion. J Oral Maxillofac Surg 1984;42(5):295-305.
[3] Baccetti T, Mcgill JS, Franchi L, et al. Skeletal effects of early treatment of class III malocclusion with maxillary expansion and face-mask therapy. Am J Orthod Dentofacial Orthop 1998;113(3):333-43.
[4] Liou EJ. Toothborne orthopedic maxillary protraction in Class III patients. J Clin Orthod 2005;39(2):68-75.
[5] Liou EJ. Effective maxillary orthopedic protraction for growing class III patients: a clinical application simulates distraction osteogenesis. Prog Orthod 2005;6(2):154-71.
[6] Ballanti F, Lione R, Fanucci E, et al. Immediate and post-retention effects of rapid maxillary expansion

investigated by computed tomography in growing patients. Angle Orthod 2009;79(1):24-9.
[7] Liou EJW, Tsai WC. A new protocol for maxillary protraction in cleft patients: repetitive weekly protocol of alternate rapid maxillary expansions and constrictions. Cleft Palate Craniofac J 2005;42(2):21-7.
[8] Sung SJ, Baik HS. Assessment of skeletal and dental changes by maxillary protraction. Am J Orthod Dentofacial Orthop 1998;114(5):492-502.
[9] Nanda R. Protraction of maxilla in rhesus monkeys by controlled extraoral forces. Am J Orthod Dentofacial Orthop 1978;74(2):121-41.
[10] Jackson GW, Kokich VG, Shapiro PA. Experimental and postexperimental response to anteriorly directed extraoral force in young macaca nemestrina. Am J Orthod 1979;75(3):318-33.
[11] Juneja R, Gupta A, Singh S, et al. Role of cone beam computed tomography in dentistry. J Biosens Biomark Diagn 2016;1(2):1-8.
[12] Shukla S, Chug A, Afrashtehfar KI. Role of cone beam computed tomography in diagnosis and treatment planning in dentistry: an update. J Int Soc Prev Community Dent 2017;7(Suppl 3):S125-36.
[13] Verayannont P, Hägg U, Wong RWK, et al. Assessment of maxillary position. Implant vs cephalometric methods. Angle Orthod 2010;80(5):876-83.
[14] Walker GF, Kowalski CJ. On the use of the SNA and SNB angles in cephalometric analyses. Am J Orthod 1973;64(5):517-23.
[15] Hussels W, Nanda RS. Analysis of factors affecting angle ANB. Am J Orthod 1984;85(5):411-23.
[16] Yitschaky O, Redlich M, Abed Y, et al. Comparison of common hard tissue cephalometric measurements between computed tomography 3D reconstruction and conventional 2D cephalometric images. Angle Orthod 2011;81(1):11-6.
[17] Steiner CC. Cephalometrics for you and me. Am J Orthod 1953;39(10):729-55.
[18] Steiner's CC. Cephalometrics in clinical practice. Angle Orthod 1959;29(1):8-29.
[19] Merwin D, Ngan P, Hagg U, et al. Timing for effective application of anteriorly directed orthopedic force to the maxilla. Am J Orthod Dentofacial Orthop 1997;112(3):292-9.
[20] Kapust AJ, Sinclair PM, Turley PK. Cephalometric effects of face mask/expansion therapy in class III children: a comparison of three age groups. Am J Orthod Dentofacial Orthop 1998;113(2):204-12.
[21] Wang L, Lee W, Lei DL, et al. Tissue responses in corticotomy-and osteotomy-assisted tooth movements in rats: Histology and immunostaining. Am J Orthod Dentofacial Orthop 2009;136(6):770.e1-11.
[22] Celikoglu M, Buyukcavus MH. Changes in pharyngeal airway dimensions and hyoid bone position after maxillary protraction with different alternate rapid maxillary expansion and construction protocols: a prospective clinical study. Angle Orthod 2017;87(4):519-25.