

Protraction Facemask With Alt-ramec Protocol : An Effective Early Intervention For Skeletal Class III Malocclusion

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ABSTRACT

Early intervention of skeletal Class III malocclusion in a growing child through application of orthopaedic forces is crucial as it can prevent future surgical procedures and avoid the detrimental effects produced by the facial deformity on the patient's social life. This intervention mostly relies on protraction of maxilla whose growth ceases earlier than mandible, in the pre-adolescent period that signifies the importance of early treatment. This case report describes the treatment of a child aged 9 years 6 months who had a skeletal Class III malocclusion. The treatment plan involved the use of bonded Hyrax with Alt-RAMEC protocol and reverse pull headgear (facemask) followed by comprehensive fixed mechanotherapy resulting in successful correction of the malocclusion. The treatment results were highly satisfactory achieving improved facial esthetics, skeletal Class I relationship, Class I molar and canine relationship, an ideal overjet and overbite. Thus, orthopaedic therapy, if done in properly selected cases, alleviates the need for surgical intervention.

KEY WORDS

Class III malocclusion, facemask therapy, growth modification, maxillary deficiency

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INTRODUCTION

Prevalence of class 3 malocclusion in school children in India has been found to be 0.6 - 3.4% according to studies conducted in various states.¹ It may result from various combination of skeletal patterns with or without functional abnormality. Ellis and McNamara found a combination of maxillary retrusion and mandibular prognathism to be the most common (30%) followed by combination of retrusive maxilla and normal mandible (19.5%) and normal maxilla with prognathic mandible(19.1%) in his sample of adult class 3 subjects.²

Nonsurgical treatment of Class III problems remains a challenge in our profession. However, prompt diagnosis and early intervention of Class III malocclusion may be helpful to reduce the severity of Class III malocclusion in late adolescence.³ It was suggested in previous studies that the use of a protocol of alternating expansion and contraction of the palatal suture through Hyrax potentiate the effects of maxillary protraction with facemask.⁴

The purpose of this report is to illustrate the skeletal, dental, soft tissue effect of RME (Rapid Maxillary Expansion) using the Alt-RAMEC (Alternate Rapid Maxillary Expansion and Contraction) protocol and facemask started before the pubertal growth spurt in a Bengali patient.

CASE PRESENTATION

An 8year old female patient in mixed dentition reported to the Department of orthodontics with complaint of inward positioning of upper front teeth.

Extraoral features

1. Concave facial profile with no gross asymmetry, retrusive upper lip and reduced malar prominence. Lower lip is slightly protrusive.
2. Middle and lower facial 1/3rd are proportionate and angle of mandible is not steep.
3. Chin is not prominent and neck-chin angle is normal.



Pre treatment Intraoral and Extraoral photographs

Intraoral Features

Patient was in mixed dentition with retained primary canines and molars. There was class 3 malocclusion with negative overjet of 1mm and positive overbite. Posterior teeth was not in crossbite.

Radiological features

Lateral cephalometric analysis reveals skeletal class 3 malocclusion (ANB : -5°, Wits: -6.5mm) with retrognathic Maxilla (SNA 75°, N perp.to pt.A = -7.5mm)

Mandible had not grown to an excessive amount (SNB: 80°, N perp. to Pt A= -5mm). Upper and Lower facial height are proportionate. Growth stage of the

patient as evaluated from cervical vertebra images on lateral cephalograms was CS 2.5

Diagnosis

Skeletal class 3 malocclusion with more of a maxillary component

Prognosis

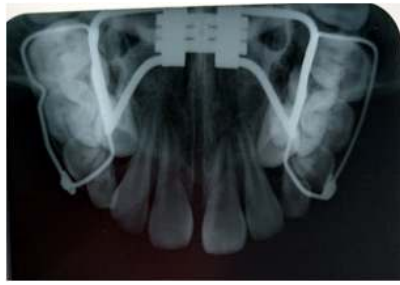
Average growth pattern of mandible (SN-GoGn: 27°, FMA: 24°, Y axis: 58°), proportionate vertical facial



Pretreatment Lateral cephalogram



Pretreatment OPG



Maxillary protraction with RME and Facemask

1/3rds, growth status (CVMI 2) indicates favourable prognosis for protraction facemask therapy with proper patient cooperation.

Treatment Progress

Phase 1: Patient's skeletal age, growth pattern of mandible was suitable for growth modification with orthopedic forces through Rapid Maxillary expansion and Reverse Pull Headgear. A bonded RME framework incorporating 9mm Hyrax screw prepared and cemented to the maxillary dentition. As there was no posterior crossbite before treatment an Alternate Rapid Maxillary Expansion and Contraction (Alt-RAMEC) protocol was taken to achieve better disarticulation of circum-maxillary sutures.6 (Fig. 11, Fig. 12)

Beginning 1 day after cementation, the expander was expanded 1 mm per day for a week and constricted in the next week at the same rate of 1mm per day. A total of 3 such cycles of expansion and contraction were carried out followed by final expansion spanning a total duration of 7 weeks.

Maxillary protraction

A Petit-type facemask was used taking anchorage from forehead and chin. Crosspiece position was adjusted vertically so that elastic traction from hooks in the maxillary splint made an angulation of 20° - 30° with occlusal plane. A force of 400g, measured clinically using a force gauge, was

applied on both sides 14 hrs a day for 3mos. At the end of this phase positive overjet and overbite achieved.

Phase 2

Fixed Mechanotherapy

Orthodontic treatment was carried out by using the pre-adjusted 0.022-inch slot brackets (MBT prescription). After removal of Hyrax 2x4 appliance (019/025 SS Utility arch) along with rigid Trans palatal Arch is fixed to maintain arch length and arch-width respectively till the deciduous molars are replaced with fully erupted premolars.

Once the premolars are erupted all the teeth are bonded, aligned and levelled with continuous NiTi wires 0.014, 0.016 x 0.022", 0.017x 0.025 followed by stainless steel wire 0.019 x 0.025. Finishing and detailing was done with 016 SS wire and light class III elastics.

After debonding, wrap-around retainer was given in the upper arch and was advised to wear chin cup at night(12 hrs) for 1yr. Post treatment lateral cephalogram after 1yr when growth stage found to be CS 4 from cervical vertebrae morphology.

Cephalometric superimposition was done as per ABO guideline. Superimposition on cranial base and maxillary superimposition reveals downward



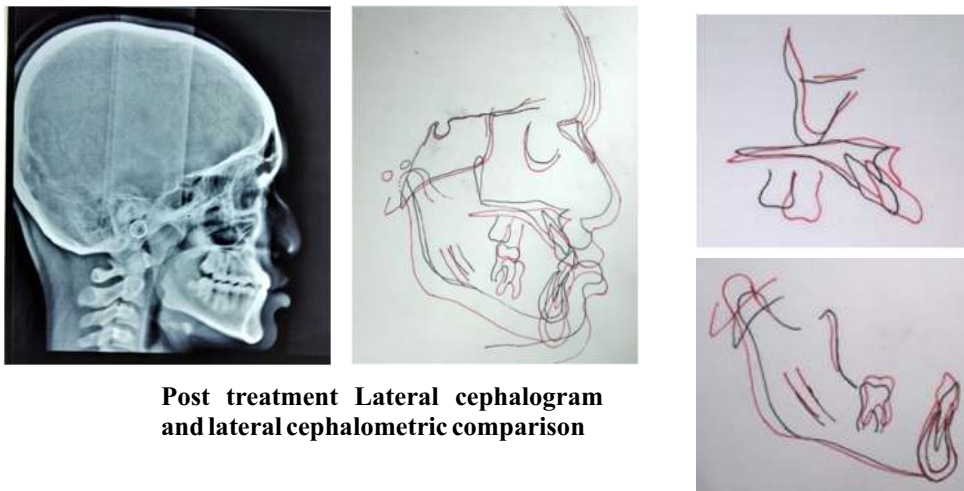
Mid Treatment



Post treatment intraoral photograph



Post treatment extraoral photograph



Post treatment Lateral cephalogram and lateral cephalometric comparison

forward movement of maxilla and extrusion of maxillary molars. Mandibular growth is redirected downward - backward and lower incisors are retroclined.

DISCUSSION

Ellis et al. reported that 40–60% of skeletal Class III patients have a maxillary deficiency or retrusion.² In the last few decades, protraction facemask therapy in conjunction with palatal expansion has been the mainstay in growth modification in growing Class III

patients. Baccetti et al⁵ advised orthopedic treatment of maxilla at pre-pubertal growth stage (CS 1/ CS 2) as the circummaxillary sutures becomes more interdigitated around puberty.

Kim et al.¹⁸ conducted a meta-analysis to analyze the treatment effects of protraction facemask in children with Class III malocclusion and found the correction to be due to a combination of skeletal and dental changes of maxilla and mandible -

a) maxilla moves downward and forward,

Lateral cephalometric comparison

Table - 1: comparison of Pre and Post treatment values of skeletal, dental and soft tissue parameters

Variable	Description	Pre treatment	Post Treatment	Interpretation
SKELETAL CHANGES				
SNA	Position of maxilla w.r.t Ant. Cranial Base	75°	77.5°	Moderate advancement of A point due to maxillary advancement
Pt A to N perp.	Linear measure of maxillary position w.r.t Ant. Cranial Base	- 7.5mm	- 6.0 mm	
FH - PP	Palatal plane angle	3°	2°	1° counterclockwise rotation
SNB	Position of mandible w.r.t Ant. Cranial Base	80°	80°	Mandibular growth is re-directed so that chin is moved slightly downward and backward
Pog to N perp.	Linear measure of chin position w.r.t Ant. Cranial Base	- 5 mm	- 7 mm	
SN -GoGn	Mandibular plane angle	27°	29°	
FMPA	Mandibular plane angle	24°	26°	
ANB	Skeletal Profile	- 5°	-2.5°	Profile concavity is reduced
N A Pog		-14°	-11°	
wits appraisal	maxillo-mandibular relationship on occlusal plane	- 7mm	- 4 mm	
N - ANS	Upper Ant Facial Height	40	42	downward and backward movement of chin, moderately increased lower facial height
ANS - Me	Lower Ant Facial Height	47	52	
	UAFH / LAFH	0.85	0.8	
DENTAL CHANGES				
11 to NA	Upper incisor angulation and position w.r.t skeletal base	39.5°, 6mm	39°, 8mm	Maxillary incisors not proclined, forwarded along with its skeletal platform
11 to N perp.	Upper incisor position w.r.t ant. cranial base	- 3.5mm	- 2mm	
31 to NA	Lower incisor angulation and position w.r.t skeletal base	18° , 4mm	11° , 3mm	Mandibular incisors were retroclined
IMPA		89°	82°	
SOFT TISSUE CHANGES				
N-L angle		60°	86°	Subnasale(Sn) was moved forward
U lip to E line		- 5mm	- 2mm	Soft tissue profile became more harmonious at post-treatment
L lip to E line		3 mm	2 mm	

b) mild anti-clockwise rotation of maxilla as the line of force is passing below the centre of resistance resulting PNS and posterior maxillary teeth to move downward and mandible to rotate downward and backward by wedge effect,

c) redirection of mandibular growth in downward & backward direction by reactive force on chin-pad of facemask

d) improvement in maxillo-mandibular relationship at the cost of lengthening of lower facial height

e) Upper incisor labial inclination increased due to mesial dental movement and lower incisor uprighting occurs as the result of pressure on the chin cup.

The objective of facemask therapy is to bring

about class III correction contributed more by downward forward movement of maxilla than by dental movement causing labial proclination of maxillary incisors.

Eric Liou et al. showed in their study with lateral cephalometric radiographic evidence that Alt-RAMEC protocol disarticulates circum-maxillary sutures better than single course of RME and results in more effective protraction of maxilla.¹⁹

Tanne et al.⁷ found in their three dimensional finite element study (FEM) on biomechanical effect of anteriorly directed extraoral forces on the nasomaxillary complex that a 30° downward angulation of force vector with occlusal plane results in repositioning of the complex in almost translatory manner.

In this patient using Alt-RAMEC protocol followed by extraoral force on maxillary splint from facemask resulted in significant maxillary advancement, confirmed by pre and post lateral cephalometric comparison - increase in angle SNA (2.5°), forward movement of A point w.r.t Nasion perpendicular (1.5 mm). Upper incisors are not proclined but repositioned forward along with 'A' point, thus ensuring better stability of negative overjet correction. Concavity in skeletal profile improved significantly confirmed by increase in ANB (2.5°), increase in wits appraisal (3mm). These values are greater compared to previous studies on long term effect of skeletal class III treatment with single course of RME and facemask by Gallagher R W et al.⁹, Macdonald K E et al.¹⁰, Westwood P V et al.¹¹

PNS is moved slightly downward evident by 1° counter-clockwise rotation of palatal plane despite 30° downward angulation of force vector with occlusal plane to compensate for negative moment created due to application of force below centre of resistance of maxilla. This has increased downward-backward movement of chin and elongation of lower facial height to some extent. Similar findings was noted by Castrillón-Marín RA.¹²

Soft tissue profile of the patient is improved significantly with maxillary protraction. Cant of upper lip is decreased with forward movement of subnasale (Sn) and improves Nasolabial angle from 60° to 86°. Upper and lower lip relationship with nose-chin line (E line) become more harmonious with forward movement of upper lip and backward movement of soft tissue pogonion (Pog').

CONCLUSION

The combination of facemask and Hyrax with Alt-RAMEC protocol, presented in this report, was efficient for the management of class III malocclusion in this preadolescent Bengali patient and fulfils the objective of forward translation of maxilla and retains the correction in post-adolescent period.

REFERENCES

- 1 Kharbanda OP, Sidhu SS. Prevalence studies on malocclusion in India — retrospect and prospect. *J Ind Orthod Soc* 1993;24(4):115-18.
2. Ellis E, McNamara J A Jr: Components of Adult

Class 3 Malocclusion 1984 : *J of Oral and Max. Surg.* vol42, 295 - 305

3. Campbell PM. The dilemma of Class III treatment: Early or late? *Angle Orthod* 1983;53:175-91.

4. Masucci C, Franchi L, Giuntini V, Defraia E. Short-term effects of a modified AltRAMEC protocol for early treatment of Class III malocclusion: a controlled study. *Orthod Craniofac Res.* 2014;17:259-269.

5. Baccetti T, Franchi L, McNamara JA : The Cervical Vertebral Maturation (CVM) Method for the Assessment of Optimal Treatment Timing in Dentofacial Orthopedics *Semin Orthod* 2005; 11:119–129

6. Eric Jein-Wein Liou, Wen-Ching Tsai : A new protocol for maxillary protraction in Cleft patients : Repetitive weekly protocol of Alternate Rapid Maxillary Expansions and Constrictions. *Cleft Palate–Craniofacial Journal*, March 2005, Vol. 42 No. 2, 121 - 127

7. Tanne K, Hiraga J, Kakiuchi K, Yamagata Y, Sakuda M: Biomechanical effect of anteriorly directed extraoral forces on the craniofacial complex: A study using the finite element method *Am J Orthod Dentofacial Orthop* 1989;95:200-7.

8. Kim JH, Viana MA, Graber TM, Omerza FF, BeGole EA. The effectiveness of protraction face mask therapy: A meta-analysis. *Am J Orthod Dentofacial Orthop* 1999;115:675-85.

9. Gallagher RW, Miranda F, Buschang PH. Maxillary protraction: Treatment and posttreatment effects. *Am J Orthod Dentofacial Orthop* 1998;113:612-9

10. Macdonald K E, Kapust A J, Turley P K : Cephalometric changes after the correction of ClassIII malocclusion with maxillary expansion/facemask therapy : (*Am J Orthod Dentofacial Orthop* 1999;116:13-24)

11. Westwood P V, McNamara J A, Baccetti T, Franchi L, Sarver DM : Long-term effects of Class III treatment with rapid maxillary expansion and facemask therapy followed by fixed appliances: *Am J Orthod Dentofacial Orthop* 2003;123:306-20

12. Castrillón-Marín RA, Barbosa-Liz DM, Ardila CM. Treatment of Class III malocclusion using Hybrid Hyrax, Face Mask and Alt-RAMEC Protocol: A Case Report in a Latin-American patient. *J Clin Exp Dent.* 2019;11(7):e665-9