

# Transverse Discrepancy Correction with Rapid Maxillary Expansion followed by retention with Modified Transpalatal arch and corrective orthodontic treatment.

Dr. Ravindra Manerikar<sup>1</sup>, Dr. NG Toshniwal<sup>2</sup>, Dr. Nilesh Mote<sup>3</sup>,  
Dr. Shubhangi Mani<sup>4</sup>, Dr. Deeksha Devadiga<sup>5</sup>

<sup>1</sup>Principal and Professor, <sup>2</sup>Head of the Department and Professor, <sup>3</sup>Professor, <sup>4</sup>Professor, <sup>5</sup>PG Student  
<sup>1,2,3,4,5</sup>Department of Orthodontics,  
<sup>1,2,3,4,5</sup>Rural Dental College, Pravara Institute of Medical Sciences, Loni, Ahmednagar, Maharashtra  
Corresponding Author- Dr. Deeksha Devadiga

---

## ABSTRACT

Maxillary Transverse deficiency is one of the most pervasive skeletal problems in the craniofacial region. Addressing transverse deficiency as soon as diagnosed is crucial in orthodontic treatment. Rapid Maxillary Expansion (RME) has been widely used by many orthodontists to increase the maxillary transverse dimensions in young patients. Rapid Maxillary expansion or Split palate is a skeletal type of expansion that involves the separation of the mid-palatal suture and movement of the maxillary shelves away from each other. A combination therapy of a bonded rapid palatal expansion appliance and orthodontic treatment with pre adjusted edgewise appliance therapy was instrumental here in the correction of a severe skeletal Class II malocclusion with an orthognathic maxilla and retrognathic mandible. This two-phase therapy resulted in a dramatic improvement of the facial and smile esthetics with good occlusal interdigitation that enhanced the patient's speech, personality and self-esteem.

**Index Terms**—Rapid maxillary expansion, Ectopic Canine, Crowding, Narrow arch.

---

## INTRODUCTION

Maxillary Transverse deficiency is one of the most pervasive skeletal problems in the craniofacial region. Haas A J in his 1970 article stated the presence of mandibular functional retrusion in Class II division 1 cases in which the retrusion was due to constriction of maxillary dental arch, with reduced intercanine width.[1,2] It was further observed that the functional retrusion greatly improved on widening of the constricted maxilla.[3] The correction of constricted maxillary arch promotes widening of lower arch as well. The lower arch widening is due primarily to "decompensation," an uprighing of the lower posterior teeth, which often have erupted into occlusion in a more lingual orientation because of the associated constricted maxilla.

Addressing transverse deficiency as soon as diagnosed is crucial in orthodontic treatment. Maxillary deficiency particularly may be due to any number of reasons including mouth breathing, deleterious habits, like thumb sucking and/or pacifiers, and atypical phonation and swallowing[4]. Various methods for transverse expansion of maxilla have been used by orthodontists now for over a hundred years. The two expansion treatment modalities used today based on speed of correction are: rapid maxillary expansion (RME), slow maxillary expansion (SME). Since each treatment modality has advantages and disadvantages, controversy regarding the use of each exists. The choice of a treatment alternative depends on certain factors, such as age, sex, degree of maxillary hypoplasia and maturation of the midpalatal suture.

Rapid Maxillary Expansion (RME) has been widely used by many orthodontists to increase the maxillary transverse dimensions in young patients. Rapid Maxillary expansion or Split palate is a skeletal type of expansion that involves the separation of the mid-palatal suture and movement of the maxillary shelves away from each other. They are fixed and generate 3-10 pounds of force (Zimring and Isaacson, 1965) and produce an increase in the transverse width of the maxillary base.[5]

Canines are known to be the cornerstones of dental arches and also have the longest path of eruption which is why they are also vulnerable to various local influences. Ectopic buccally erupted maxillary canines are one of the most frequently encountered conditions in orthodontic practice. The prevalence of permanent maxillary canine impaction or ectopic eruption in the general population is approximately 1–2%. An early intervention is best suited for management of such ectopically placed canines.[5,6]

### **DIAGNOSIS AND AETIOLOGY**

An 11-year-old male patient in pubertal spurt stage with CVMI (Cervical Vertebral Maturation Index) stage 3 reported to the Orthodontic department with the chief complaint of irregularly placed teeth. His past medical history did not indicate anything significant. On investigation and clinical assessment patient had mouth breathing habit. No abnormalities were detected on temporomandibular joint examination clinically or radio graphically.

Extraoral examination revealed a convex profile and obtuse nasolabial angle (Fig. 2). On soft tissue analysis Upper and Lower lip were 2mm ahead of Steiner's Line. Intraorally he had Angle's Class II molar relation with proclination and crowding in the upper and lower anteriors and ectopically placed canines bilaterally. Examination also showed a V shaped narrow Maxillary arch.(Fig. 1)

Radiographic assessment showed presence of all four third molar tooth buds. Pre-treatment Cephalometric analysis indicated a Skeletal Class II relationship (ANB,7°) with orthognathic maxilla (SNA,83°), retrognathic mandible (SNB,76°, Mandibular Base Length- 91mm), proclined upper and lower anteriors (U1-A Pog, 9mm; IMPA,116) and a vertical growth pattern (Mandibular plane angle - 37°, Jarabak ratio-64.64% and Gonial angle-134°) with mandible having a tendency of backward rotation. On soft tissue analysis the patient had optimum Nasolabial angle (110°). (Table 1)

Pont's Analysis indicated expansion required in both molar and premolar region. Ashley Howe's index suggested a borderline extraction case whereas Boltons showed an Anterior as well as Overall Mandibular tooth material excess.



**Figure 1- Pretreatment Intraoral photographs**



**Figure 2- Pretreatment Extraoral photographs**

### **TREATMENT OBJECTIVES**

The treatment objectives for the patient were

- (1) Correction of constricted maxilla,
- (2) Correction of retrognathic mandible,
- (3) Correction of proclined upper anteriors and crowding of upper anterior to achieve proper alignment,
- (4) To achieve Class I molar and canine relationship,
- (5) To achieve proper lip seal to avoid mouth breathing and motivate nasal breathing,
- (6) to maintain pleasant soft tissue profile
- (7) to achieve a pleasant and well-balanced smile

### **TREATMENT ALTERNATIVES**

A case presenting with bilateral highly placed canines, palatally placed laterals in upper arch and moderate level of crowding in lower arch customarily goes for all 1st premolar extraction. The only glitch would be when the patient presents at an adolescent age, or having a close to optimum nasolabial angle. Here the patient not only had a close to optimum nose- lip relation but also had a tendency for mandible rotating clockwise, so distalization was hardly possible.

In essence of adolescent stage, and a constricted upper arch, Maxillary expansion followed by autorotation of the mandible was a good surrogate option, as it would help in the overall improvement of the outlook of the patient and also help treat the case without any extractions. Though this option would give more discomfort to the patient in the form of pain as well as treatment duration with respect to the other two options, the patient opted for this approach.

### **TREATMENT PROGRESS**

Since he had an average growth pattern, after recording the posterior bite for fabrication Bonded RME with Hyrax screw was cemented in the upper arch involving the posterior segment. Following the Timms protocol the activation schedule was two 90° turns per day, once in the morning and once in the evening. Patient was recalled after 2 weeks for follow up and motivation for screw activation. Adequate expansion was achieved clinically manifesting as Midline Diastema after 1 month and the RME screw was sealed with brass wire and used as retention. (Fig. 3)

Subsequently the appliance was removed and anchorage preparation for Fixed Mechanotherapy was done. The palate had a soldered quadrahedral wire framework in order to maintain the expansion that was achieved through the RME device. Fixed preadjusted edgewise appliance with 0.022 MBT prescription were bonded. Initial alignment and leveling was attained in both arches by placing nickel-titanium archwires in sequence. Stiffer archwires were progressively placed in both arches and were worked up to 0.019 x 0.025 in stainless-steel archwires.

Then a Piggyback arch technique was used with 0.020 AJ wilock SS as the base arch wire and 0.012Niti was engaged in the canines. Once the Canine were almost at same alignment with other teeth, wire sequence was followed till 0.021x0.025 SS With respect to the lower arch, it had expanded passively post RME and was bonded. Routine wire sequence was followed all the way till 0.021x0.025 SS. After the upper and lower arch alignment was done class II elastics were given. The final wire was kept for 2-3 months for prime torque expression especially for the lower incisors, upper arch. (Fig. 4)

Patient was referred to period ontology for gingivectomy in the premolar region to help in repositioning of brackets. Finishing and detailing was done and settling elastics were given, After debonding a Fixed Flexible Spiral Wire Retainer from Canine to Canine in upper and lower arches. A Removable Hawley's retainer for day time wear and activator for night time wear was given as retention protocol. The overall active treatment duration was 24 months.



**Figure 3- Post RME Midline Diastemma**





**Figure 4- Extruding canine with piggy back technique**

### TREATMENT RESULTS

As revealed in the post treatment records, the treatment objectives were achieved. A balanced facial profile and well-aligned dentition were obtained. Extra oral examination indicated a significant improvement in profile and mandibular plane. (Fig. 6)

Correction of constricted v shaped Maxillary arch, and buccally blocked canine was accomplished and a bilateral Angle's Class I Molar and Canine relation was successfully attained. (Fig. 5)

Panoramic radiographs demonstrated acceptable root parallelism. There was no obvious root resorption observed. Post treatment cephalometric assessment revealed successful correction of Skeletal discrepancy with significant changes in ANB, Witt's appraisal and B- angle. Remarkable changes in upper and lower incisor inclinations were also observed.

The patient was satisfied with the final facial esthetics and occlusion.



**Figure 5- Post treatment intraoral photographs**



Figure 6- Posttreatment Extraoral Photographs

Table 1- Cephalometric Analysis

Parameter	Normal Value	Pre-treatment	Posttreatment
<b>Sagittal - Maxillo-Mandibular</b>			
ANB	2°	7	2
Facial Angle	87.8°	81	81
Angle of Convexity	0°	14	2
AB plane angle	4.6°	8	2
Wits appraisal	0mm	Bo is 1mm behind of Ao	BO coincides with AO
B – angle	27-32°	29	35
<b>Sagittal – Individual Jaw</b>			
<b>Maxilla</b>			
SNA	82°	83	76
N L- A	0-1mm	0mm	-6mm
Effective Max Base (Co – A)		75mm	79mm
<b>Mandible</b>			
SNB	80°	76	74
N L – Pog	Small -8to-6 med -4 to 0 Large -2 to 2	-11mm	14mm
Effective Mand Length (Co-Gn)		91mm	104mm
Saddle angle	123°+/-5°	122	121
Articular Angle (effect of ramus orientation)	128°+/-7°	143	148
Gonial Angle	143°+/-6°	134	128
S-N to Go-Gn	32°	37	36
FMA	25°	32	36
FH – MP	21.9°	33	33
Y axis (N-S-Gn)	66°	70	74
Y axis (FH to S-Gn)	59.4°	60	68
Jarabak ratio	62-65%	64.64%	64.34%
Bjork sum	394°	400	399
Upper gonial angle	52°-55°	54	49
Lower gonial angle	70°-75°	80	79
Facial Axis	90°	97	96
Basal Plane angle	25°	33	27
Angle of inclination (Max rotation)	85°	89	89
SN – OP	32°	22	23
FH – OP	14°	16	12
U1 – SN	102°	104	105
U1 – NA	22°,4mm	21,5mm	29,10mm
U1 – A-Pog	4mm	9mm	12mm

U1 – N-Pog	2mm	13mm	12mm
U1 – Pal plane	70°+/-5°	70	64
FMIA	65°	32	48
IMPA	90°	116	99
L1 – NB	25°,4mm	36,8mm	36,10mm
L1 – N-Pog	2mm	7mm	9mm
Holdaway ratio (L1-NB:NB-Pog)	1:1	8:0	7:1
Interincisal angle	131°	115	115

**Table 2- Soft Tissue Analysis**

Parameter	Normal Value	Pre-treatment	Post-treatment
S line	U-0	U +2mm'	U 3mm
	L-0	L +2mm	L +5mm
E line	U-4mm	U 0mm	U (-1)mm
	L-2mm	L 0mm	L 1mm
NLA	102 <sup>0</sup>	110	116
U lip strain	15+/-1mm	10mm	12mm
H angle	7°-15°	23	25
Soft tissue chin thickness	10-12mm	11mm	12mm

## DISCUSSION

RME is a widely used procedure with a long history. EH Angle published this procedure in 1860 in Dental Cosmos since then it has gone through periods of popularity and decline. Rapid palatal expansion (RPE) or Rapid Maxillary Expansion (RME) is an expansion technique where expansion of 0.5mm to 1mm is achieved each day until the posterior crossbite is relieved. The work was discredited at the time, but the technique is now generally accepted as a relatively simple and predictable orthodontic therapy. Correction of the transverse discrepancy usually requires expansion of the palate by a combination of orthopaedic and orthodontic tooth movements.[7]

The transverse dimension of the maxilla may be the most adaptable of all the regions of the craniofacial complex. Cross bite and Crowding are one of the common features of maxillary deficiency [8]. The other effects of maxillary deficiency are not that easily identifiable or detectable. It includes laterally flared maxillary posterior teeth in order to camouflage the maxillary deficiency. These patients have normal occlusion but on closer inspection have narrower maxilla accompanied with accentuated Wilson's curve.

Another important clinical manifestation in patients with narrow, tapered maxilla is the dark spaces in the corner of the mouth as seen in this patient, which Vandersall (RL Vandersall, Jr, Personal communication, 1992.) Referred to as Negative spaces. RME can be used to increase the Transpalatal width, which in turn eliminates the dark spaces in the buccal corridors giving a more pleasing frontal facial appearance.

The quadrahedral wire framework given post RME therapy helped to maintain the expansion that was achieved in the premolar region Also expansion through maxillary suture widening by rapid maxillary expanders has been claimed to promote stability after retention. Stability has been attributed to the skeletal component of Arch enlargement obtained by the expansion appliance as opposed to dental expansion as a result of edgewise appliance mechanotherapy.

In addition to this, RME is known to improve nasal airway function. Buccally blocked maxillary canines is mainly attributed to the inadequate space in the arch. Patients with palatally displaced canines usually have more arch length available than patients with buccally displaced canines. Early assessment helps to plan the direction of movement to be intended first. A two-phase treatment therapy was instrumental in reducing the severity of the skeletal jaw discrepancy. [9]

## CONCLUSION

A combination therapy of a bonded rapid palatal expansion appliance and orthodontic treatment with pre adjusted edgewise appliance therapy was instrumental in the correction of a severe skeletal Class II malocclusion with an orthognathic maxilla and retrognathic mandible. This two-phase therapy resulted in a dramatic improvement of the facial and smile esthetics with good occlusal interdigitation that enhanced the patient's speech, personality and self-esteem.

## REFERENCES

- [1]. Nagrik AP, Bhad WA, Chavan SJ, Doshi UH. A randomized clinical trial to assess the sagittal effects of Transforce transverse appliance (TTA) and NiTi palatal expander (NPE) on skeletal class II malocclusion in growing patients during retention phase - A cephalometric study using a historical control group. *Int Orthod.* 2020 Dec;18(4):722–31.
- [2]. Haas AJ. Palatal expansion: just the beginning of dentofacial orthopedics. *Am J Orthod.* 1970 Mar;57(3):219–55.
- [3]. Majourau A, Nanda R. Biomechanical basis of vertical dimension control during rapid palatal expansion therapy. *Am J Orthod Dentofacial Orthop.* 1994 Sep;106(3):322–8.
- [4]. Melink S, Vagner MV, Hocevar-Boltezar I, Ovsenik M. Posterior crossbite in the deciduous dentition period, its relation with sucking habits, irregular orofacial functions, and otolaryngological findings. *Am J Orthod Dentofacial Orthop.* 2010 Jul;138(1):32–40.
- [5]. Işeri H, Tekkaya AE, Oztan O, Bilgiç S. Biomechanical effects of rapid maxillary expansion on the craniofacial skeleton, studied by the finite element method. *Eur J Orthod.* 1998 Aug;20(4):347–56.
- [6]. Jain S, Debbarma S. Patterns and prevalence of canine anomalies in orthodontic patients. *Med Pharm Rep.* 2019 Jan;92(1):72–8.
- [7]. Lu J, Gong FF, Shen G. [The preliminary study of the treatment timing for rapid maxillary expansion]. *Shanghai Kou Qiang Yi Xue.* 2006 Aug;15(4):363–6.
- [8]. McNamara JA. Maxillary transverse deficiency. *Am J Orthod Dentofacial Orthop.* 2000 May;117(5):567–70.
- [9]. Baratieri C, Alves M Jr, de Souza MMG, de Souza Araújo MT, Maia LC. Does rapid maxillary expansion have long-term effects on airway dimensions and breathing? *Am J Orthod Dentofacial Orthop.* 2011 Aug;140(2):146–56.