

CONSTRICTED TO BE EXPANDED - A REVIEW

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Abstract:

Rapid maxillary expansion sometimes it is called as a palatal expansion, occupies unique place in Orthodontic treatment therapy. Rapid maxillary expansion is a skeletal expansion which involves the mid-palatal suture separation and movement of the maxillary palatine shelves away from each other. An objective to design a suitable appliance should be made by preparing a list of criteria based on the biomechanical requirements of RME. RME effects the maxillary complex, palatal vaults, palatal mucoperiosteum, maxillary anterior and posterior teeth, mandible, mandibular teeth, adjacent periodontal structures to bring about an expansion. As a result of RME, the majority of dental transverse measurements changed significantly.

Keywords: RME, transverse measurements, mid-palatal suture, palatal vaults.

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INTRODUCTION:

Growth ceases first in the transverse dimension. Skeletal or dental constriction of the maxilla possesses a problem for an Orthodontist. So, diagnosis and treatment planning of constricted maxillary arch is important. Rapid maxillary expansion, sometimes called a palatal expansion, occupies a unique place in Orthodontic treatment therapy. Rapid maxillary expansion is a skeletal expansion which involves the mid-palatal suture separation and movement of the maxillary palatine shelves away from each other.^{1,2}

CASE REPORT:

HISTORICAL BACKGROUND

The narrow maxilla has been recognized for thousands of years by Hippocrates. Several slow expansion techniques were employed by early dental practitioners like Fauchard (1728), Bourdet (1757),

White (1859), Fox (1803), Robinson (1846). The first published work was organized in the United States by Angell (1860), who placed screw appliance between maxillary premolars of a girl of age 14 years and widened her arch one-quarter inch in two weeks. His finding could not be substantiated by X-rays as they were yet to be developed. In 1877 Walter Coffin introduced coffins spring for arch expansion. In the early 1900s, the debate started regarding the usage of RME or SME. In the 1940s, Graber advocated RME for the treatment of cleft lip and palate patients. After demonstrating its potential in experimental animals, the method was reintroduced in the United States in the early 1960s by AJ Haas. Since then, the clinician has increasingly included in the treatment of their patient.

ANATOMY

The tenacity of circummaxillary attachments is strong due to buttressing, postero-supero-medially,

and postero supero laterally. A palatine bone has a strong relationship with the maxilla to give rise to the complete hard palate (or) floor of the nose and lateral wall of the nasal cavity. Anteriorly it articulates with the maxilla through transverse palatal sutures and posteriorly via the pterygoid process. The interpalatine suture joins the two palatine bones and continues as inter maxillary sutures. The junction of three opposing pairs of bones is formed by these sutures: the premaxillae, maxilla, and the palatine. All these forms mid-palatal suture

SUTURAL ANATOMY

Mid Palatine Suture plays a crucial role in R.M.E.¹ Morphology of mid palatine suture has been studied by Melsen.

- i. Infancy - Suture is too broad and Y-shaped with vomerian bone placed in a v-shaped groove between the two halves of the maxilla. [Fig 1]
- ii. Juvenile - The suture is found to be wavy and T-shaped, with increased interdigitation.
- iii. Adolescence - More tortuous, increasing interdigitation, islets of bone are formed jigsaw puzzle. [Fig 2]

It is important to know when the sutural closure occurs by synostosis², and on average, 5% of sutures get closed by 25 yrs of age. Suture first closes in girls aged 15 yrs. Obliteration occurs more posteriorly than anteriorly.^{2,3}

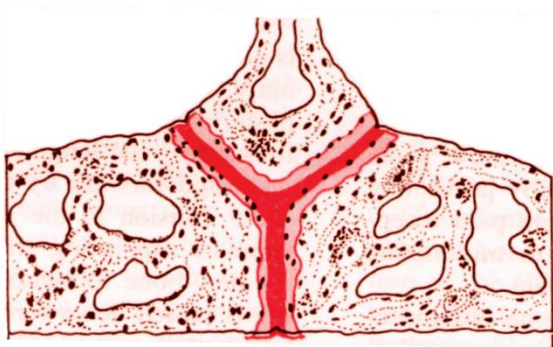


Fig-1: Mid palatal suture in infancy

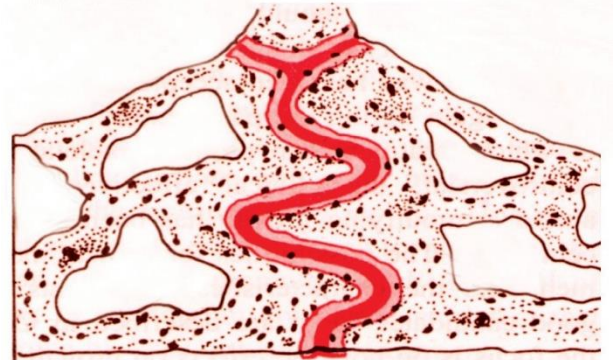


Fig-2: Mid palatine suture in early adolescence

FACTORS TO BE CONSIDERED PRIOR TO EXPANSION

1. **Rate of Expansion:** By expansion rates of 0.3-0.5mm per day, active expansion is achieved in 2-4 weeks, leaving little time for the cellular response of osteoclasts and osteoblasts seen in slow expansion.
2. Form of Appliance
3. Age and Sex of the patient
4. Discrepancy between maxillary and mandibular
5. Severity of crossbite.
6. Initial angulation of molars or premolars.
7. Assessment of roots of a deciduous tooth.
8. Physical availability of space for expansion.
9. Nasal Obstruction.
10. Medical history
11. Metabolic disorders
12. Periodontal Type.⁴
13. Mucogingival Health

INDICATIONS FOR RME

1. Patients who have a transverse discrepancy that results in either unilateral or bilateral crossbite.
2. Anteroposterior discrepancy as a reason for RME.
3. Cleft lip and palate patients with the collapsed maxilla.
4. Maxillary deficiency with negative ANB angle.
5. Patients with mild to moderate crowding of 3 to 4mm.

6. Medical indications for RME are -
 - a. Poor nasal airway
 - b. Septal deformity
 - c. Recurrent ear nasal or sinus infections.
 - d. Allergic rhinitis
7. Preparation of mandibular advancement surgery.
8. Broadening of the smile.
9. Correction of axial inclination of teeth.

CONTRAINDICATIONS OF RME

1. Mid palatal suture synostosis.
2. Patients with anterior open bite, steep mandibular plane, and convex profile.
3. Uncooperative patients.
4. Patients who have a single tooth in crossbite.
5. Patients who have skeletal asymmetry in the maxilla or mandible.
6. Patients with periodontally weak dentitions.
7. Adults with severe anteroposterior and vertical skeletal discrepancy.

RAPID MAXILLARY EXPANSION CAN BE OF FOLLOWING TYPES

- A.
 1. Orthodontic
 2. Passive
 3. Orthopedic
- B.
 1. Tissue borne: Haas type expansion.
 2. Tooth borne: Banded - Hyrax or Biedermann type.

Bonded maxillary expansion.
Minne Expander or Isaacson type
- C.
 1. Rapid
 2. Slow

APPLIANCES USED FOR RAPID MAXILLARY EXPANSION (RME)

They can be either banded appliances or bonded appliances.

➤Banded RME-TYPES:

- 1) Tooth and tissue born RME - Haas and Derichsweiler
 - HAAS
 - DERICHSWEILER
- 2) Tooth borne RME - Hyrax (Fig 3) and Isaacson
 - HYRAX expander

• Isaacson expander

➤Bonded Rapid palatal expander

➤IPC Rapid palatal expander

APPLIANCES FOR SLOW MAXILLARY EXPANSION (SME)

- 1) Coffin appliance
- 2) W-arch (Fig 4)
- 3) Quad Helix (Fig 5)
- 4) Spring jet (Fig 6)
- 5) NiTi Expander (Fig 7)



Fig 3 Hyrax Expander



Fig 4 W - Arch

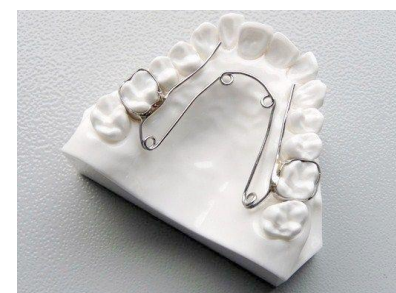


Fig 5 Quad Helix



Fig 6 Spring Jet



Fig 7 NITI Expander

THE REGIME OF ROTTON

1. TIMMS

- <15 yrs - 90-degree rotation once in the morning and evening.
- 15 to 20 yrs - 45-degree activation four times a day.
- >20 yrs - 45-degree turn in the morning and 45-degree turn in the evening.
- >25 yrs - The palatal suture is surgically opened.

2. ZIMRING and ISAACSON

- **In growing young patients** - 2 turns per day for 4-5 days and later one turn per day till desired expansion is achieved.
- **In adults** - 2 turns per day, one turn/day for the next 5-7 days, and 1 turn every alternate day till desired expansion is achieved.

EFFECTS OF RME ON THE MAXILLARY COMPLEX

Rapid maxillary expansion occurs when the force applied to the teeth and the maxillary alveolar process is more significant than required to carry out orthodontic tooth movement. [Fig 8]

VIEWED OCCLUSALLY

In 75 to 80% of the cases observed, the palatine process of maxilla separated in a nonparallel fashion, more anteriorly, and less posteriorly. This can be viewed in post-RME occlusal radiograph.⁵

VIEWED FRONTALLY

The maxillary suture was found to separate in a nonparallel fashion superoinferiorly. It has a pyramid shape, and the base of the pyramid is located at the oral side. The magnitude of the opening varies in different individuals and at different parts of the suture. In general, opening is smaller in adult patients. The fulcrum of rotation for each of the maxillae is said to be approximately at frontomaxillary suture. Implants can be used to tip the maxillae anywhere between -1 and +8. According to Krebs, two halves of the maxilla rotate in the sagittal and coronal plane. In the coronal plane, two halves of the maxilla rotate away from each other. The maxilla is found to rotate in a downward and forward direction in the sagittal plane. The maxilla increases in width that can be obtained is 10mm.^{6,7}

ALVEOLAR PROCESS

Because the bone is resilient, lateral bending of the alveolar processes occurs early during RME.^{8,9,10}

Applied force gets dissipate within 5-6 weeks. After stabilization is terminated, any residual force in the displaced tissues will act on the alveolar process causing them to rebound.

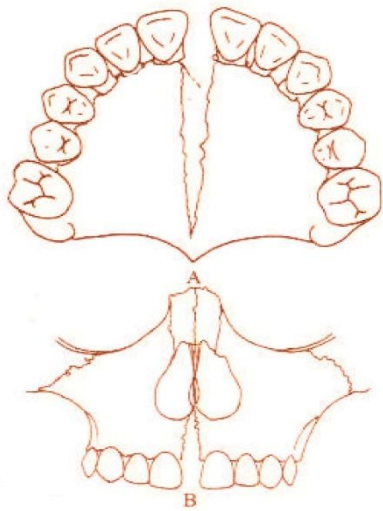


Fig-8: Effects of RME on the mid palatine suture

MAXILLARY ANTERIOR TEETH

One of the most important changes accompanying RME is the opening of a diastema between the maxillary central incisors. After this separation, the incisor crowns converge and establish proximal contact. The reason behind the mesial tipping of the crowns is, elastic recoil of the transseptal fibers. As the crowns contact, the fibers' continued pull causes the roots to convergence toward their original axial inclinations. This cycle generally requires 4 months. [Fig-9,10,11]



Fig-9: Effects of RME on anterior teeth



Fig-10: Effect of the appliance on midline diastema

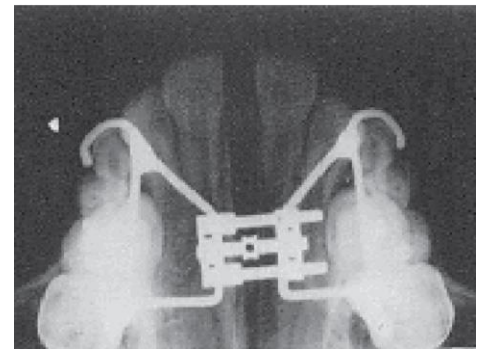


Fig-11: Effect of appliance on midline diastema

MAXILLARY POSTERIOR TEETH

A definite change in the long axis of the posterior teeth occurs with the initial alveolar bending and compression of the periodontal ligament.¹¹ There is buccal tipping and extrusion of teeth to some extent.

EFFECTS OF RME ON THE MANDIBLE

The up righting of the buccal segments was more in the bonded RME in the lower arch.¹² RME could cause the expansion of the lower arch as much as 4 mm in inter-canine width and 6 mm in inter-molar width.

EFFECTS OF THE RME ON ADJACENT FACIAL STRUCTURES

All craniofacial bones have got direct articulation with the maxilla; they got displaced except the sphenoid bone. The cranial base angle is constant. Displacement of the maxillary halves was asymmetric; the sphenoid bone was the main

buttress against maxillary expansion, and not the zygomatic arch.

EFFECTS OF RME ON NASAL VOLUME CHANGES

The nasal width and volume increase by RME. There was a 5.1 percent increase in nasal volume in patients after RME, according to a study by W. Deeb.¹³

EFFECT OF RME ON SOFT TISSUE

Nihat Kilic et al., confirmed in their study that there was a decrease in soft tissue facial angle and the H angle and profile convexity increases after RME.¹⁴

ADVANCEMENTS IN TREATMENT

The most recent techniques incorporated in maxillary transverse deficiency (MTD) treatment are Miniscrew Assisted Rapid Palatal Expander (MARPE). Surgically Assisted Rapid Palatal Expansion (SARPE). In mature patients, Orthopedic Maxillary expansion (OME) has been found associated with laterally tipping of teeth, extrusion, periodontal membrane compression.^{15,16,17}

ROLE OF LITHIUM

Tang H et al, studied the effect of Lithium related to RME. They concluded that lithium treatment could aid in improving the stability of ortho treatment like expansion, because beta-catenin formation enhances new bone formation.

CONCLUSION

RME causes changes in the majority of dental transverse measurements. The success rate of the treatment with RME is determined by the maturity of the maxilla-facial structures.

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