**Bulletin of Environment, Pharmacology and Life Sciences**
Bull. Env. Pharmacol. Life Sci., Vol 15 [3] February 2026. 10-13

Online ISSN 2277-1808
Journal's URL: http://www.bepls.com
CODEN: BEPLAD


**REVIEW ARTICLE** **OPEN ACCESS**

# Understanding Maxillary Expansion in Orthodontics

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**ABSTRACT**
*In the general population, there is occurrence of all types of malocclusions. In many patients, there is presence of narrow arches due to many biological and functional reason, so the patients have more chances of developing unilateral or bilateral crossbite. However, to correct these types of discrepancies, expansion is introduced in the orthodontics. Rapid maxillary Expansion (RME) has a very important role in orthopaedics treatment. With the help of RME, we can correct various transverse discrepancies. RME is a unique type of process which helps in movement of palatal process away from each other and to open the midpalatal suture so that expansion can occur. Selection of the appliance will depend on the biomechanical requirement of RME.*
***Keywords****: RME, Expander, midpalatal suture, SARPE, Alveolar bone.*

Received 06.01.2026 Revised 20.01.2026 Accepted 04.02.2026

## INTRODUCTION

Rapid and Slow maxillary expansion are the two forms of expansion that are possible. In 1860, Emerson Angell delivered the inaugural RME lecture and after that it was simplified by Dr. Haas. RME was first applied on girl to correct the transverse problem [1]. Firstly, expansion was applicable to correct posterior crossbite which occur because of inadequate width of arch. In the past years, it was noticed that expansion is difficult and impossible and dangerous because of strengthening effect of maxillary suture [2]. By the age of 17 years, growth is almost completed. Maxilla will grow in small quantity all over the life and the crossbite which exist in secondary teeth will not be treated by itself [3].

### Maxilla Anatomy:

Maxillary bone is large bone among all facial bones after mandible. Maxilla communicates with the [4]:

i) Ethmoid bone
ii) Frontal bone
iii) Nasal bone
iv) Lacrimal bone
v) Vomer
vi) Zygomatic bone
vii) Palatine bone
viii) Inferior nasal concha

### Sutures of Maxilla [3]:

The stiffness of circummaxillary suture is due to presence of strong holding laterally and medially. Palatine bone fuses with the maxilla and lead to formation of floor of nasal cavity and hard palate.
The shape of midpalatal suture will modify according to age:
It is Y- shaped in infancy, T shaped in juvenile and jigsaw shaped in adulthood [4]. There are many sutures which connects maxilla to the cranial base:

i) Frontomaxillary suture
ii) Nasomaxillary surure
iii) Zygomaticotemporal suture
iv) Vomeromaxillary suture

v) Ethmoidomaxillary suture

The onset of closing of these sutures is important and necessary to know. Many of the suture are closes before the age of 25 years, but these will close slightly earlier in females than males.

**Mechanics of RME:**

Patients with maxillary constriction and transverse deficits frequently receive rapid maxillary expansion (RME), which encourages the opening of the midpalatal suture. RME does, however, have a significant propensity for relapse. Craniofacial bone is restricted by the sutures and dentition is restricted by the periodontium. By using RME, the biological principle which require tooth movement will be implied with the craniofacial bones [5]. So, 950-4000gm force which will need to separate the craniofacial suture.

**Indications [3]:**

a) Patient who has narrow maxilla with widened mandible (Maxillary deficiency)
b) Patient having unilateral or bilateral crossbite
c) Patient having highly placed or narrow maxilla
d) Patient who has cleft lip and palate having narrow maxilla.

**Contraindication [3]**:

a) Patient who has true unilateral crossbite.
b) Tendency for gingival enlargement as in Dilantin hyperplasia is a relative contraindication and the case must be followed up very closely.
c) Patient who shows soft tissue pathology in the pressure bearing area is not a candidate for both tissues borne appliance until pathology is corrected.
d) If maxilla is narrow and long and is associated with mandible retrognathism, RME is contraindicated.
e) Crowding of the teeth alone is not an indication as not much space is obtained by RME.
f) If more than half of the roots of primary teeth are resorbed, they cannot be used to provide retention in RME.

**Schedule for RME Activation:**

According to Timms [4]-

Patients less than 15 years- turn of 90° in morning and evening

Patients between the age of 15-20 years- activation of 45° turn 4 times in a day

Patients having age more than 20 years- activation of 45° turn in morning and evening

According to Issacson[6]-

In starting of 4-5 days, patient will instruct to give 2 turns in a day and after that one turn in a day. For non-growing patients, for first two days, patient is instructed to give 2 turns in a day and then every alternate day one turn should be given.

**Records for the diagnosis of RME:**

a) Study Models
b) Photographs
c) Orthopantograph
d) Occlusal view radiograph of maxillary arch
e) Lateral and PA view Cephalogram

**General Guidelines for RME:**

- Lower posterior teeth's buccal surfaces and higher posterior teeth's buccal grooves should match.
- Expansion should to be stopped if the palatal cusps of upper premolars and molars are aligned with buccal cusp of lower premolars and molars [6-8].
- The dimensions of lower teeth should be deducted from the upper teeth.
- Determine the distance along which the buccal cusp points of the upper posterior teeth meet.

**EFFECTS AND RETENTION OF RME:**

**Reaction of PDL to RME:**

The average size of Periodontal Ligament is around 0.22mm. The maxillary suture expansion is around 0.2mm when ¼ turn is given to the expander and causes an overall constriction of 0.2mm to the periodontal ligament. So, if the expansion will be greater than 0.5 mm, then it will cause disrupt the membrane and blood supply of the PDL.

**Effect on Upper and lower arch:**

The expander constricts the PDL space and turns the alveolar bone along with tipping the posterior teeth buccally and hence opening the maxillary suture [9].

**RME effects on Mandible:**
The mandible moves backward and downward due to maxilla enlargement. Alveolar processes that are bowing and the posterior teeth of the maxilla that are tipping and projecting cause an increase in the mandibular plane's angle. Therefore, caution should be exercised when utilising RME in patients who have a sharp mandibular plane angle or a tendency toward open bite.

**Nasal airway following RME:**
The first instance of a nasal blockage being cleared up by rapid palatal expansion was documented by Brown in 1902 after separating the palatal helves and opening the midpalatine suture. Immediately after expansion, there is an increase in nasal cavity capacity, notably where the midpalatal suture and nose's floor meet. The average increase in nasal cavity width is 1.9 mm, yet at the level of the inferior turbinates, it may widen by 8–10 mm. Nasal airflow effect can be minimal or significantly improved.

**RME effects on Soft tissue:**
The soft tissue at point A follows the nasal tip after the anterior migration of the maxillary incisors. In their investigation, Nihat, Kilic, and colleagues came to the conclusion that after RME, the angle of soft tissue face is decreased, H angle increased, the profile convexity increased.

**Retention in RME:**
The stability of maxillary expansion varies among studies; some report shows that there is no recurrence for the first five years following treatment, but the others report revealed that 50% of the accomplished expansion relapsed five to fifteen years after expansion. However, after the proper activation schedule, retention for 3 months is given to the patient so that there can be recovering of bone within the palatine shelves. So, if we don't give any retention to the patient after RME, then there will be risk of relapse [10].

**Side effects of RME:**

- Patient is not able to maintain oral health.
- Risk of removal and fracture of the appliance.
- Injury to the tissue
- Increased chances of ulcerative lesion.
- High chances of suture not opening.

**RECENT CONCEPTS REGARDING MAXILLARY EXPANSION**

Command for non-surgical expansion of maxilla may enlarge as both the patient as well as clinician try to ignore the two-phase surgical procedure and damaging effects on periodontium and failure [10]. Even though non-surgical expansion is viable, sufficient orthopaedic enlargement of the bone preferably alveolar tipping is necessary to block the injurious periodontal as bone dehiscence and organize proper posterior occlusion [11]. Since expansion that are tooth or tooth and tissue borne causes negative effects on the basal bone, For this reason, a miniscrew assisted rapid palatal expander has designed [12]. To lengthen the maxilla, a surgical incision along the Midpalatal suture should be combined with the Le Fort 1 osteotomy operation. After that, the half of the maxillary bone is split apart and positioned in their new location. Due to the palatal mucoperiosteum's relative stiffness, expansion is constrained. Fixed orthodontic therapy can separate the maxillary incisors root, making a surgical midline cut like the SARPE easier.

Berger [13] et al concluded that they do not segregate the pterygoid processes due to the 17.5% relapse in the posterior teeth one year after SARPE. After undergoing orthodontic treatment, Anttila14 observed stability after SARPE both with and without pterygoid process disjunction, and a difference in long-term relapse in the molars.

**RECENT ADVANCES**

Recent advances in maxillary expansion have emphasized achieving greater skeletal effects with reduced dentoalveolar side effects and enhanced patient comfort. Miniscrew-assisted rapid palatal expansion (MARPE) has emerged as a significant innovation, enabling successful orthopedic maxillary expansion in late adolescents and young adults without the routine need for surgically assisted procedures [14-17]. Advances in cone-beam computed tomography (CBCT) have improved assessment of midpalatal suture maturation, skeletal expansion patterns, and transverse stability, allowing more individualized treatment planning [18]. Digital orthodontics has further transformed maxillary expansion through CAD/CAM-designed and 3D-printed expanders, offering superior appliance precision and force control. Recent studies have also highlighted the beneficial impact of maxillary expansion on upper airway dimensions, nasal airflow, and breathing patterns, reinforcing its role in managing airway-related problems [19]. Additionally, developments in biomaterials and biomechanics, including optimized miniscrew positioning and hybrid expanders, have contributed to improved clinical outcomes and long-term stability. Collectively,

these advances reflect a paradigm shift toward minimally invasive, evidence-based, and patient-specific maxillary expansion therapies.

## CONCLUSION

RME is the technique of choice in some cases, including severe lateral discrepancies. This also assist the length of arch in moderately crowded case where length of arch is insufficient[15]. Lateral orthopedic orthodontics may be performed by lilting the molars and premolar teeth to the buccal side, with the separation of the central suture of the palatal bone. The clinician must choose to overcorrect so that there will be compensation for fallback. Today, CBCT is helps to evaluate precise 3D orthopedic changes after RME[16]. The orthodontic professional has access to a variety of RME appliance designs, including banded designs, bonded designs, tooth, tissue, bone-retained RME, or hybrid designs. According to the literature, RME appliances can be used for a variety of conditions, from treating a constrained maxilla to treating bedwetting. Carefully crafted device design and successful splitting of the midpalatal suture are essential for the RME therapy to be successful. SARPE and segmental maxillary surgery, which are straightforward, noninvasive, and comparable to RME, are advancements in orthopaedic expansion via surgical technique. A successful, thorough, and stable course of orthodontic treatment can develop a satisfactory occlusion.

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**CITATION OF THIS ARTICLE**

Anamika, Tarun K, Santosh K. Understanding Maxillary Expansion in Orthodontics. Bull. Env. Pharmacol. Life Sci., Vol 15 [3] February 2026. 10-13