

# MAXILLARY EXPANSION - A REVIEW

## ABSTRACT

A major portion of the treatment rendered in any orthodontic practice is concerned with lack of space – the transverse and sagittal crowding of teeth within the alveolus. Expansion is a conservative choice of treatment in treating space discrepancy in transverse dimension. Expansion can be Passive, Orthopaedic or Orthodontic based on the mode of force application and can Slow or Rapid based on the rate of expansion. Surgically assisted rapid palatal expansion (SARPE) has gradually gained popularity as a treatment option to correct maxillary transverse deficiency in adult patients. Miniscrew-assisted rapid palatal expansion (MARPE) was devised and used to treat adult patient with severe transverse discrepancy nonsurgically. Alternative Rapid Maxillary Expansion and Constriction (Alt-RAMEC) procedure introduced by Liou has been introduced in 2019 to improve the effectiveness of the maxillae relative to the surrounding sutures and the enhancement of the maxillae. With patient cooperation, expansion of the dental arches has yielded good results.

**Keywords:** Rapid maxillary expansion, mini screws, Alt RAMEC.

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## INTRODUCTION

A major portion of the treatment rendered in any orthodontic practice is concerned with lack of space – the transverse and sagittal crowding of teeth within the alveolus. Orthodontic philosophies over the years have vacillated between a strict non-extraction approach and an approach, which requires extraction of teeth.<sup>1</sup> Angle believed that ideal occlusion requires a full complement of teeth and each tooth shall be made to occupy its normal position in the arch to achieve maximum functional efficiency and to ensure a permanent result.<sup>2</sup> Thus, Palatal expansion to such a degree as to accommodate a full complement of teeth was thought to be the only way to ensure treatment stability.

## TYPES OF EXPANSION

### Passive expansion

When the forces of the buccal and labial musculature are shielded from occlusion and when there is no application of extrinsic biomechanical forces but rather intrinsic forces such as those produced by the tongue.(Fig 1)

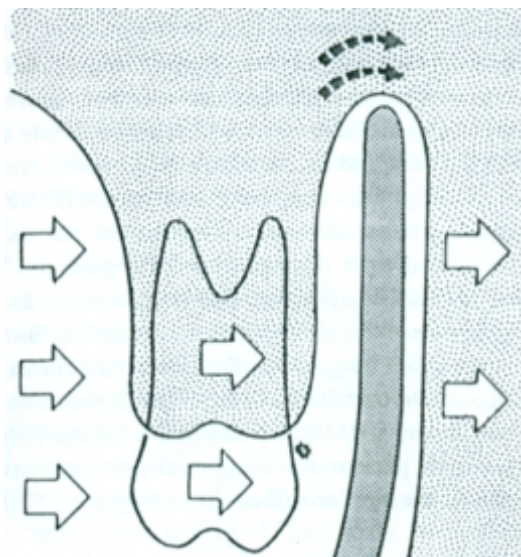


Figure 1- Passive expansion

McNamara JA, Brudon WL, Kokich VG. Orthodontics and dentofacial orthopedics. Ann Arbor, Mich: Needham Press; 2001.

### Orthodontic expansion

It produces lateral movement of posterior segments with labial/buccal tipping of crown and lingual tipping of root. The forces of cheek musculature still remain, providing a force that may lead to relapse or rebound of the achieved orthodontic expansion.(Fig 2)

### Orthopaedic expansion

The term orthopaedic has been introduced to describe those procedures developed to change the relationship of bones to facilitate the correction of malocclusion.<sup>3</sup> (Fig 3) In true orthope-

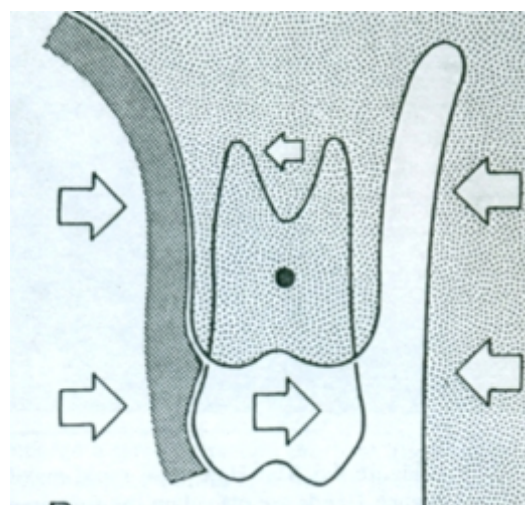


Figure 2- Orthodontic expansion (McNamara JA, Brudon WL, Kokich VG. Orthodontics and dentofacial orthopedics. Ann Arbor, Mich: Needham Press; 2001).

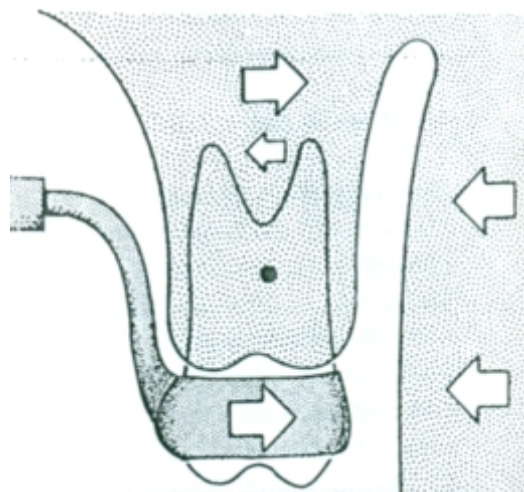


Figure 3-Orthopaedic expansion

(McNamara JA, Brudon WL, Kokich VG. Orthodontics and dentofacial orthopedics. Ann Arbor, Mich: Needham Press; 2001.)

dic expansion, changes are produced primarily in the underlying skeletal structure rather than by the movement of teeth through alveolar bone. Orthopaedic expansion not only separates the midpalatal suture but also affects the circumzygomatic and circum maxillary sutural systems.<sup>4</sup>

### Slow maxillary expansion (SME)

It is a form of dentoalveolar expansion which involves increase of arch width by movement of few teeth or many teeth. The results are more stable, when the maxillary arch is expanded slowly at a rate of 0.5 - 1 mm per week. The forces generated is much lower 2-4 pounds. Slow expansion may take as much as 2-5 month.<sup>2</sup> Slow palatal expansion is mainly achieved by the use of removable expanders eg Quad Helix, W-arch, Coffin spring, Ni-Ti expander, Schwarz appliance, Crozat appliance.

### Rapid maxillary expansion (RME)

It 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. RME expands at rate of 0.5mm or more/day Its indication includes correction of cross bite, addition of arch length, correction of axial inclination of posterior teeth, spontaneous correction of classII malocclusion, reduction of nasal resistance ,broadening of smile and cleft palate with collapsed arch.<sup>5</sup> They can

be Banded or Bonded RME appliances. Eg: Derichsweiler, Haas, Isaacson and Hyrax type.<sup>3</sup>

### Surgically Assisted Rapid Palatal Expansion (SARPE)

Correction of maxillary transverse deficiency in a skeletally mature patient is more challenging because of changes in the osseous articulations of the maxilla with the adjoining bones. Surgically assisted rapid palatal expansion (SARPE) has gradually gained popularity as a treatment option to correct maxillary transverse deficiency in adult patients. Palatal osteotomy is done in patients who are above the age of 25 years or younger if rapid maxillary expansion has been tried and has failed.<sup>6</sup>

### Miniscrew Assisted Rapid Palatal Expansion (MARPE)<sup>7</sup>

Nonsurgical maxillary expansion helps to avoid a 2-stage surgical procedure surgically assisted rapid palatal expansion followed by orthognathic surgery and detrimental periodontal effects and relapse. So a miniscrew - assisted rapid palatal expansion was devised and used to treat adult patient with severe transverse discrepancy. (Fig4)

### Alt-RAMEC

Alternative Rapid Maxillary Expansion and Constriction (Alt-RAMEC) procedure introduced by Liou, which improves the effective-

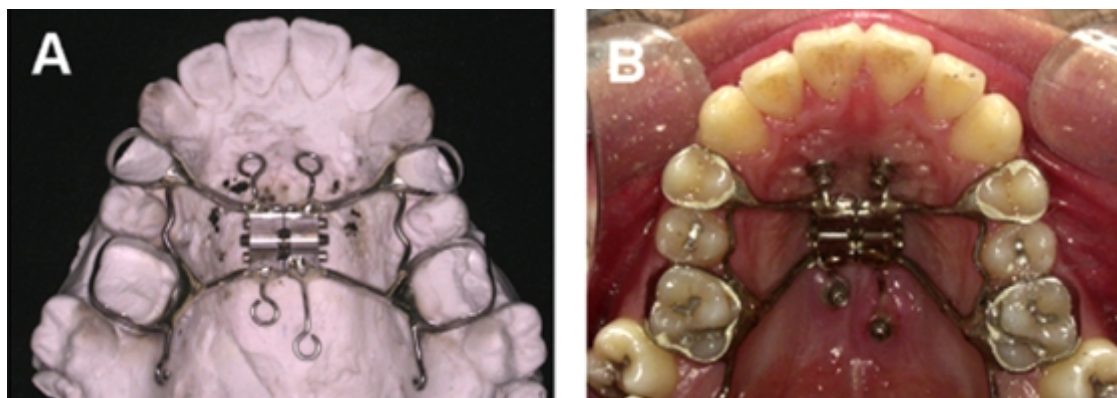


Figure 4-Miniscrew-assisted rapid palatal expansion

(Miniscrew-assisted nonsurgical palatal expansion before orthognathic surgery for a patient with severe mandibular prognathism. Am J Orthod Dentofacial Orthop 2010;137:830-9)

ness of the maxillae relative to the surrounding sutures and the enhancement of the maxillae. In the Alt-RAMEC protocol, maxillae will be enlarged 1 mm per day, first enlarged to 7 mm, and then the 1 mm screw is closed. In other weeks, in this order the screw of the expansion device is turned on for one week and then closed for one week, completing the Alt-RAMEC protocol at the end of the 9-week process. Alt-RAMEC procedure, a method commonly used in the treatment of class III malocclusion.<sup>8</sup>

## DISCUSSION

The first palatal expansion appliance was developed by Angell in 1860.<sup>9</sup> The objective of maxillary expansion is to increase the transverse width of the maxillary dental arch at the apical base with minimal concomitant movement of the posterior teeth within the alveolus. The maxilla can be considered as a bone held within the facial area of the skull by a series of calcified bony interdigitations, some of which are permanently connected to other bones of the cranium, such as the frontal, zygomatic, and palatal bones, by connective tissue fibers which form the suture system. The expansion by these expansion appliances has been related to orthodontic or orthopedic effect. Upon the application of transverse forces, initial changes produce lateral tipping of the posterior maxillary teeth due to controlled orthodontic movements when the compressed buccal alveolar plate resorbs at the root periodontal ligament interface as a result of continued force application.<sup>10</sup> If the applied transverse forces are of sufficient magnitude, movement and expansion of maxillary segments can occur.<sup>3</sup>

RME has been used extensively in arch expansion<sup>11,12</sup> but limitations associated with it includes bite opening,<sup>13</sup> relapse,<sup>14</sup> microtrauma of the temporomandibular joint and the midpalatal suture, root resorption,<sup>15,16</sup> tissue impingement and pain, and excessive tipping of anchorage teeth.<sup>17</sup> Martina et al demonstrated that SME is as effective as RME in determining skeletal transverse expansion of the maxilla in patients with posterior crossbite. Slow maxillary expansion may be preferred to rapid maxillary expansion because of the

reduced pain and discomfort.<sup>18</sup> This was favoured by Isaacson and Zimring suggesting that slower rates of expansion would allow for a physiologic adjustment at the maxillary articulations and would prevent the accumulation of large residual loads within the maxillary complex.<sup>19,20</sup> SME procedures produce less tissue resistance around the circummaxillary structures and, therefore, improve bone formation in the intermaxillary suture, which theoretically should eliminate or reduce the limitations of RME. Fabio et al claimed that long term results yielded by RME and SME were similar, and it can be assumed that a certain degree of skeletal maxillary constriction can be compensated with buccal tipping of posterior teeth when correcting posterior crossbite.<sup>21</sup> But in contrary Juliana et al observed that both treatment approaches were able to make some changes, especially at dental level, but RME generated greater changes.<sup>22</sup> Gray et al claimed an increase in the width of the nasal cavity immediately following expansion thereby improving breathing capacity.<sup>23</sup> An RME procedure separates the external walls of the nasal cavity laterally and causes lowering of the palatal vault and straightening of the nasal septum.<sup>24</sup> This remodeling decreases nasal resistance, increases internasal capacity, and improves breathing.

Isaacson et al showed that the facial skeleton increases its resistance to expansion as it ages and matures.<sup>25</sup> After sutural closure or completion of skeletal maturation, expansion without surgery causes less bony displacement and more dentoalveolar movement. This can lead to many problems in adults, including pain upon activation of the appliance, extrusion of the teeth, and periodontal complications. Therefore, large transverse discrepancies in adults are corrected preferably through Surgically assisted rapid palatal expansion (SARPE) to overcome the resistance of maturing suture. Socuci et al found that the dentoalveolar responses with RME and SARPE are similar after orthodontic treatment.<sup>26</sup>

In 2010, Lee et al treated a 20-year old patient with severe transverse discrepancy and mandibular prognathism. Before orthognathic surgery, the patient used an expansion appliance secured to the palate by means of miniscrews (miniscrew-assisted rapid palatal expander, or



MARPE). Expansion was achieved with minimal damage to teeth and periodontium, with stable outcomes confirmed by clinical and radiographic examination. The authors concluded that it is an effective treatment modality used for transverse correction and which might eliminate the need for a few surgical procedures in patients with craniofacial discrepancies, thus taking advantage of the possibilities offered by the sutures.<sup>27</sup>

## CONCLUSION

With patient cooperation, expansion of the dental arches has yielded good results. As with any form of therapy there are contraindications, occasional unfavorable responses and at times partial success. Nevertheless when properly used, expansion is of great value in treating malocclusion.

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