ORIGINAL RESEARCH

Rapid Maxillary Expansion Versus Rapid Maxillary Alveolar Expansion in Adults

Anushka Aida Menezes Mesquita[1], Nandini V. Kamat[2]

ABSTRACT

Introduction: The main purpose of rapid palatal expansion is to normalize a constricted maxillary arch. Most transverse maxillary deficiencies have been uniquely responsive to rapid maxillary expansion in children and adolescents however in contrast the use of these expanders to treat similar deficiencies in mature patients has often been a subject of controversy.

Materials and method: This retrospective study was undertaken to evaluate the effects of rapid palatal expansion in adults.10 patients, 18.6 +/- 2 years having maxillary transverse deficiencies were treated using bonded hyrax expander. Pre and post treatment models and photographs were taken. Measurements were derived from models and palatal contour tracings to evaluate the amount of expansion that had occurred. Student t-test was performed to compare differences between pre and post treatment values.

Results: Results indicated a significant increase in transarch width across molars (4.9 +/- 1.75 mm) and premolars (5.24 +/- 1.23 mm). Rapid palatal expansion flared molars buccally by 4.7 degrees per side. There was significant increase in palatal width at gingival crest (4.93 +/- 2.78mm).

Conclusion: The study concluded that rapid expansion in adults is achieved through displacement of the alveolar process along with the posterior dentition and few patients may show expansion across the suture. Records of 1 patient included.

Keywords: RME, SARPE, RMAE, Expansion, Transverse Discrepencies

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[1]Lecturer, [2]Professor & HOD, Department of Orthodontics & Dentofacial Orthopaedics, Goa Dental College and Hospital, Bambolim, Goa

Corresponding author: Dr. Anushka Aida Menezes Mesquita**,** Lecturer, Department of Orthodontics & Dentofacial Orthopaedics, Goa Dental College and Hospital, Bambolim, Goa, India.

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INTRODUCTION

The main purpose of rapid palatal expansion is to normalize a constricted maxillary arch. The concept of opening up of the midpalatal suture was first introduced by *Angell* in 1860. Rapid maxillary expansion was first popularized by *Haas* in the 1960's.[1,2]

Most transverse maxillary deficiencies have been uniquely responsive to rapid maxillary expansion in children and adolescents however in contrast the use of these expanders to treat similar deficiencies in mature patients has often been a subject of controversy.[1-4] The pessimistic view of RME in adults is based on the theory that with maturity the midpalatal suture and adjacent circum maxillary articulations become more rigid and ultimately fuse.[4] Hence to overcome the resistance of mature sutures surgically assisted RME has been advocated encompassing a variety of surgical approaches from a subtotal lefort 1 to other osteotomies combined with fixed palatal expanders. Surgical RME however is accompanied with a variety of drawbacks like additional costs, hospitalization, morbidity associated with surgery. This then leads one to re examine the use of a non surgical rapid maxillary expansion.

Limited published cases of adults treated with rapid palatal expansion exist. *Handelman* demonstrated successful palatal expansion in 5 adult subjects with severe maxillary deficiencies.[5] More recently *Handelman* reported 47 adults who had successful expansion.[6] *Northway and Meade* reported 15 adults with successful expansion but were concerned with the level of gingival recession.[7]

Non surgical RME too, is associated with a number of limitations as well as complications like pain, swelling, ulceration, edema due to compression of the palatal tissue by the appliance. Literature stated that the expansion was limited and appropriate for dental expansion only.[8]

RME in adults is defined as rapid maxillary alveolar expansion rather than rapid maxillary expansion be-

cause the expansion appears to be centered in the alveolar process rather than in the body of the maxilla.[5]
In addition to the desirable transverse changes and arch perimeter changes[9], RME produces perceptible changes in the sagittal and vertical facial planes. It is clearly demonstrated from past literature that immediately following expansion, there is a downward maxillary displacement and extrusion of supporting teeth leading to a downward and backward rotation of the mandible.[2,10] This opening rotation of the mandible induces several cephalometric changes like an increase in the inclination of the mandibular plane and an increase in the lower anterior facial height and in the facial convexity. However *Handelman* demonstrated in his more recent article that no such consequences occur.[6]
RME has a number of applications. In children it can be used in conjunction with myofunctional therapy to correct class III associated maxillary deficiencies.[11] in children as well as in adults, it can be applied in the treatment of constricted arches, unilateral crossbites as well as bilateral crossbites.[5]
Based on the previous work by *Handelman* and coworkers, this clinical paper includes a retrospective study carried out on ten adult patients who had undergone RME treatment.

MATERIAL AND METHODS

Treatment protocol
This retrospective study includes ten adult patients who had undergone RME treatment using a bonded hyrax expander. The patients were selected because they illustrated problems that would be benefited from maxillary arch expansion. All patients were 18 years or above 18 years of age and an informed consent were duly obtained.

Appliance
The appliance used was a tooth borne expander which consisted basically of a 1mm guage wire framework around the gingival margins of the premolars and molars soldered to the hyrax screw, the size of which varied according to the size of the palate. The appliance was cemented at the start of comprehensive treatment and was turned two quarter turns that day. The patients were instructed to turn the expander one quarter turn a day and were seen at 2 week intervals. Expansion was discontinued if the patient complained of pain or swelling. Expansion was discontinued when the palatal cusp of either of the maxillary molars was about to go into buccalcrossbite. The expander was generally removed following 3 months of stabilization. Following removal of the expander, a removable acrylic palatal retainer was placed on the same day.

Measurements
Measurements were carried out on the study models as well as on the palatal contour tracings.

Study models
Measurements were made on the study models using a vernier caliper. The following measurements were carried out

Transarch widths
The maxillary transarch widths were recorded between the right and left antimeres of the canines, first premolar and permanent first molars**.** The values were measured at the cervical margin of the tooth from the point of greatest convexity on one tooth to the contra lateral side in the same arch. In the case of the permanent first molars the point on the cervical margin adjacent to the lingual development was selected.

Clinical crown height
For the premolars clinical crown heights were measured from the tip of the buccal cusp to the height of contour of the buccal gingival. For the molars record was taken from the most occlusal aspect of the buccal groove to the gingival point directly below the groove. The change in crown height is indicative of buccal attachment loss. (*Fig. 2)*

Palatal contour tracings
The maxillary model base was trimmed such that the base was parallel to the occlusal plane of the posterior dentition. The distal surface of the model was trimmed through the lingual groove of the right and left molars and this face was then photocopied. The resulting outcome was easily traced and superimpositions were carried out. Tracings were superimposed on the midpalatalraphae. The following measurements were de-

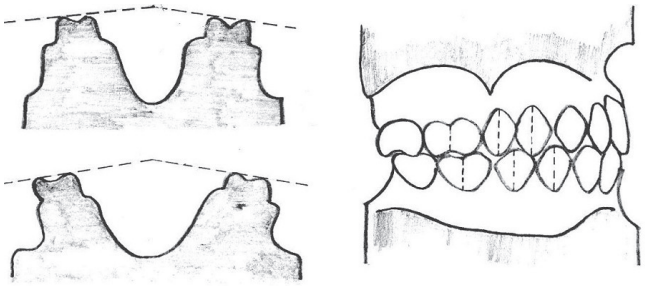

Figure-1: Measurements Of Molar Axial Angulation; **Figure-2:** Measurements of clinical crown height

rived from the tracings. *(Fig. 4, 5) The tracing in green indicates T1 and the tracing in red indicates T2.*

Molar axial angulation
From the tracings a line was drawn connecting the mesiolingual and mesiobuccal cusps of the first molars on either side and the molar axial angulation was recorded. *(Fig. 1)*

Palatal vault angle
A line was drawn tangent to the middle two-thirds of the right and left palatal surfaces. The angle formed by these 2 lines was recorded. *(Fig. 3a)*

Palatal depth from gingival height
A line was drawn connecting the point on the gingival crest adjacent the first molars. The shortest distance from the midpalatal raphe to this line was recorded. *(Fig. 3b)*

Palatal depth from molar cusp
A line was drawn connecting the occlusal surfaces of the first molars. The shortest distance from the midpalatal raphe point to this line was recorded. *(Fig. 3c)*

Palatal width at gingival height
A line was drawn from the first molar at the height of the palatal gingiva to its antimere. The length of this line was recorded. *(Fig 3d)*

Palatal width at mid-palate
A line was drawn perpendicular to the half way point between the height of the palatal vault and the gingival height line. The length of this line was recorded. *(Fig. 5e)*

Time periods
Data was collected at the start of rme treatment (T1) and at the end of RME treatment (T2).

STATISTICAL ANALYSIS

Statistical analysis was carried out using Microsoft excel software (MS office version 2005).Pre and post expansion variables were noted. Mean, standard deviation and standard error for each variable was calculated. A two tailed Students t-test was then used to determine the statistical significance of the difference between the pre and post expansion values at $p< 0.005$.

Measurement reliability
The combined error of measurement was performed

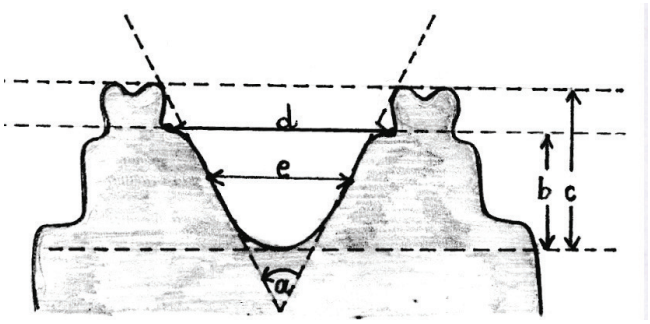

Figure-3: Palatal contour tracing measurements recorded

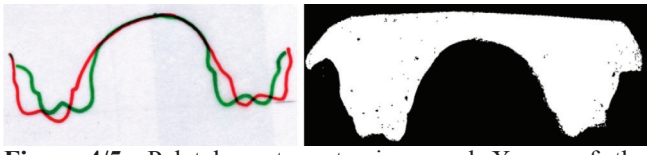

Figure-4/5: Palatal contour tracings and Xerox of the trimmed models

by randomly selecting 4 different models by the same operator and repeating the measurements. Mean and standard deviation was repeated. The combined error of performing measurements was insignificant at $p <0.005$.

RESULTS

Table 1 lists descriptive statistics summarizing the change in the various parameters following expansion.

Pain and swelling
1 patient reported with pain following which the expansion was halted. It was resumed a week later with no further complications.

Transarch widths
Pre treatmenttransarch widths were significantly less. Rapid maxillary expansion increased the transarch widths. At the level of the first molars, expansion noted was 4.96+/-1.75mm. At the level of the first premolars, expansion noted was 5.24+/-1.23mm.

Molar and palatal angle
The increase in transarch widths of the maxilla was accompanied by a significant decrease of 9.5+/-6.2 degrees in the molar angle indicating an increase in the inclination of the molars to the buccal. There was a significant increase of 12.5 +/-11.2 degrees in the palatal angle following expansion.

Palatal width at gingival height, and mid-palate
These measures define expansion at the dental-gingival junction and the mid-palate. All patients showed an

Parameters	N	Pre treatment values (T1)		Post treatment values (T2)		Difference (T1-T2)		Signif-icance
		MEAN	SD	MEAN	SD	MEAN	SD	
MX. Intermolar width (mm)	10	31.06	2.77	36.02	2.76	4.96	1.75	*
MX. Inter premolar width (mm)	10	23.25	1.62	28.45	2.50	5.24	1.23	*
MX Inter canine width (mm)	10	32.73	2.23	35.43	3.33	2.7	1.48	
Clinical crown height (Premolar) (mm)	10	7.93	1.01	7.93	1.01	0	0	
Clinical crown height (Molar)(mm)	10	5.62	1.00	5.78	0.90	0.12	0.37	
MX 1ST Molar angulation (degrees)	10	169.2	8.44	159.7	8.13	9.5	6.25	*
Overjet (mm)	10	6.37	3.33	6.72	3.51	0.35	0.35	
Overbite (mm)	10	1.92	2.38	1.92	2.38	0	0	
Palatal vault angle (degrees)	10	52.2	13.4	65.8	14.27	12.5	11.28	*
Palatal depth from gingival height (mm)	10	13.86	4.63	14.35	4.42	0.49	0.38	
Palatal depth from molar cusp (mm)	10	19.64	2.06	19.81	2.00	0.17	0.14	
Palatal width at gingival height (mm)	10	30.55	3.93	35.48	2.74	4.93	2.78	*
Palatal width at mid-palate (mm)	10	24.33	2.37	26.6	3.16	2.27	1.44	

Table-1: Descriptive statistics summarizing the change in various parameters following expansion

increase in the palatal width at both levels with a statistically significant increase of 4.93+/-2.78 mm at the level of the crest of the gingiva.

Palatal depth

These parameters are indicative of molar extrusion. The values derived were statistically insignificant.

Clinical crown height

This parameter is indicative of the amount of buccal attachment loss or gingival recession. The change was statistically insignificant.

DISCUSSION

Rapid maxillary expansion was initially advocated for use in children.[1,2] With increasing age, the midpalatal suture becomes more and more tightly interdigitated, thereby reducing the chances of maxillary expansion.[4] The theory behind rapid activation was that force on the teeth would be transmitted to the bone, and the two halves would then separate before significant tooth movement could occur. However it was not realized initially that during the time it takes for the bone to fill in the space that was created, skeletal relapse begins to occur almost immediately in spite of the retention in place. The central diastema begins to close because of a net effect of tooth movement due to stretching of the fibers and skeletal relapse. The net treatment effect is therefore approximately equal dental and skeletal expansion.[12]

The pessimistic view of RME in adults is based on the fact that with increasing age the midpalatal suture and the adjacent circum maxillary articulations become more rigid.[4] To overcome the resistance of the adult sutures, surgically assisted RME has been advocated. However this particular approach of treatment is associated with a variety of setbacks such as pain, swelling, sinus infections, cost and morbidity associated with the surgery. Furthermore, as *Proffit* had stated "surgical only widening of the maxilla is the least stable of the orthognathic surgical procedures."

Limited cases of adult RME have been published. This study is a retrospective study carried out on 10 individuals based on their need for expansion at or above the age of 18. The changes observed are as displayed in the pictures of case report included. *(Fig 6-9)* A number of measurements were recorded from the models which were photocopied as well to give a representation of the contour of the palatal vault, the tracings from which another series of measurements were recorded. *(Fig. 4, 5)* The magnitude of expansion was determined by measuring the transarch widths. There was a definite increase across the transarch widths which in it self was able to correct the crossbites. The molars in all cases were initially over expanded. Earlier literature emphasized on the improbability of adult nonsurgical maxillary arch expansion.[12,13] However a significant increase of 4.96 +/- 1.75 mm across the molars was recorded. This increase in width is consistent with the study carried out by *Handelman.*

Maxillary molar angulation decreased significantly

Figure-7: Intraoral Maxillary Occlusal View; 7a) Pre treatment; 7b) Post Expansion

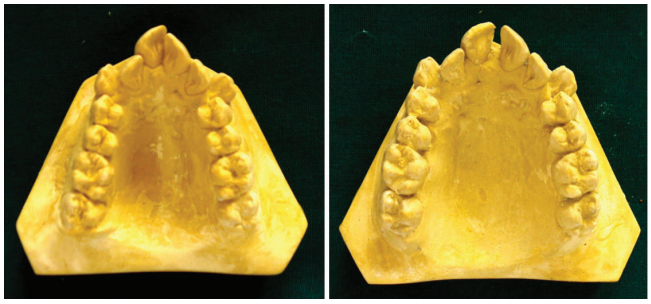

Figure-8: study models; 8a) Pre Treatment Model; 8b) Post Treatment Model

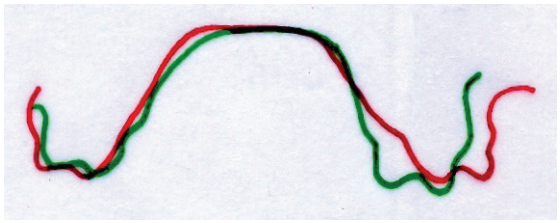

Figure-9: Superimposition Of Palatal Contour Tracings

by 9.5+/-6.2 degrees following expansion. If assumed symmetrically, each molar on either side had tipped by approximately 4.7 degrees. Palatal contour tracings show that the palatal shelves were tipped to a similar degree as the molars. *(Fig. 4)* These findings indicate that both the palatal shelves and the molars translate together rather than the dentition translating through the alveolus.

Earlier studies on the effect of rapid expansion on the bite and mandible have indicated that besides having transverse effects, RME has sagittal and vertical effects as well like downward maxillary displacement and extrusion of supporting teeth leading to a downward and backward rotation of the mandible.[2,10] These effects have been proven otherwise by *Handelman* who stated that in a bonded RME appliance, at the beginning of the expansion process, the mandible will rotate away from the cranium due to cuspal interferences. However, following the removal of the expander, the bite will close as occlusal forces and orthodontic treatment improve the inter-cuspation of the posterior teeth.[6] The parameters indicative of extrusion of the supporting teeth were statistically insignificant in this study.

*Vanarsdall*stated that RME in adults will cause the teeth to perforate their thin plate of buccal bone and consequently the gingiva will recede.[14] Evidence from contour tracings and palatal measures indicate that the posterior dentition is translated *with* rather than *through* the alveolus of buccal bone. In this study the increase in clinical crowns of the premolar and molar are statistically insignificant averaging at 0.1mm for the molars and 0mm for the premolars. These findings are consistent with those proven by *Handelman*. Whether RME can accelerate recession of the already peridontically compromised individual is still not known.

From the palatal contour tracings it can be concluded that expansion in adults is achieved through displacement of the alveolar process that starts at the apical third and to a certain degree to the midlevel of the palatal vault. *(Fig. 4)* A significant increase in the palatal width was noticed averaging at about 4.93 +/-2.78mm at the gingival level. The change at the midpalate was statistically insignificant. These findings confirm the fact that the outcome of nonsurgical RME probably represents a continuum; from young children, who experience about half their expansion in the base of the maxilla and half in the dento alveolar complex, to older adolescents who experience a greater percentage in the alveolus, to adults whose expansions occur largely in the alveolus.[6]

Thus as *Handelman* states, expansion in adults should be termed as 'rapid maxillary alveolar expansion' rather than rapid maxillary expansion.[5] Separation of the suture is rarely observed, but this is not considered essential. Occasionally patients may show expansion across the top of the palatal vault, indicating that some width increase could have happened at the suture.

The dilemma between surgical and nonsurgical RME still exists. Having these 2 viable options greatly enhances the ability to treat cases of maxillary arch deficiency. However, in view of the costs, morbidity, and surgical risks of SA-RME and the infrequently observed or minimal consequences of RME, each case should be evaluated to determine if a nonsurgical approach would provide an acceptable correction of maxillary transarch deficiency. Very limited long term studies are published on adult RME, hence more long term studies should be carried out.

CONCLUSION

From this retrospective study, one can conclude that in adults rapid expansion is basically an expansion that is achieved through displacement of the alveolar pro-

cess along with the posterior dentition rather than a true skeletal expansion.

- The increase in transarch width of 4.96+/-1.75 mm for first molars
- and 5.24+/-1.23 mm for premolars was sufficient to correct the transverse discrepancies.
- Palatal width at the gingival crest increased significantly by 4.93+/-2.78mm
- Mesial molar angulation changed significantly. Each molar on either side tipped to the buccal by approximately 4.7 degrees.
- No significant change in clinical crown height; no gingival recession
- No significant change on overjet and overbite

REFERENCES

1. Andrew J. Haas. Rapid expansion of the maxillary dental arch and nasal cavity by opening the midpalatal suture. Angle orthod.1961;31:73-90
2. Andrew J. Haas. The treatment of maxillary deficiency by opening the midpalatal suture. Angle ortho. 1965;65:200-217
3. Zimring JF, Isaacson RJ. Forces produced by rapid maxillary expansion. Angle orthod. 1965;35:178-186
4. Melsen B, Melsen F. The postnatal development of the palatomaxillary region studied on human autopsy material. Am j orthod. 1982;82:329-342
5. Chester S. Handelman. Nonsurgical rapid maxillary alveolar expansion in adults: A clinical evaluation. Angle orthod.1997; 67:291-30.
6. Handelman, Lin Wang, Begole, Haas. Non surgical rapid maxillary expansion in adults: report on 47 cases using the haas expander. Angle orthod. 2000;70:129-144
7. Nortway WM, Meade JB Jr. Surgically assisted rapid maxillary expansion: a comparison of technique, response and stability. Angle orthod. 1997;67:309-320
8. Alpern, Yurosko. Rapid palatal expansion in adults with or without surgery. Angle orthod. 1987;57: 245-263
9. Adkins, Nanda RS. Arch perimeter changes on rapid palatal expansion. Am j orthod. 1990:97:194-199
10. Chung CH, Font B. Skeletal and dental changes in the sagittal, vertical and transverse dimensions after rapid palatal expansion. Am j orthod. 2004 ;126:569-575
11. Gautam P. Valiathan A, Adhikari R. Skeletal reaction to protraction with and without expansion. Am j orthod 2009
12. Bishara SE, Staley RN. Maxillary expansion: clinical implications. Am I orthoddentofacialorthopaedics. 1987;91:3-14
13. William R Proffit. Contemporary orthodontics. Fourth edition
14. Graber Vanarsdall, VIG. Current principles and techniques. Fourth edition