

ALT-RAMEC: A Review

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Abstract

Early intervention of skeletal class III treatment has always been a laborious task for the Orthodontists. Understanding the nature of circumaxillary suture favors more stable forward movement of maxilla. The aim of this study is to collate all the benefits of Alt-RAMEC, which was first introduced by Loui [3] in combination with protraction facemask providing more efficient and stable results in comparison to standard RME regime in subjects with maxillary hypoplasia.

Keywords: Alt-RAMEC; Maxillary Expansion; Face Mask; Sutures

Introduction

Skeletal Class III malocclusion has always been very challenging treatment modality since past. Various factors such as age, patient compliance, retention and maxillary expansion, which essentially becomes a prerequisite for patients with transverse discrepancy of maxilla plays an important role for outcome of various factors such as inheritance, imbalance of buccinators mechanism, cleft palate, thumb sucking, trauma leading to maxillary hypoplasia. Altering this discrepancy helps in correction of crossbites, maxillary protraction, accommodating tooth size arch discrepancies, correct buccal root torque in molars to broaden the smile and also helps in widening of upper airways as well as nasal cavity as explained by Mc Nmara [38]. Most commonly involved non surgical treatment in rectifying skeletal Class III malocclusion with transverse discrepancy is by banded or bonded RME with hyrax followed by protraction face mask. A positive outcome with respect to sagittal correction of maxilla has been concluded by various authors [20-25].

Need for ALT-RAMEC

Conventional method performed for non surgical RME has more of dental effects in comparison to skeletal effects [2], the

latter being the cardinal requisite for treatment given to class III malocclusion patients as there is significant opening of mid palatal suture along with circumaxillary suture which scores the main phase of skeletal changes.

To achieve this Loui [3] in 2005 introduced the concept of Alt-RAMEC which is “alternate rapid maxillary expansions and contractions” claiming that the principal key to this success is the protocol followed in the technique which displace the maxilla anteriorly more effectively by disarticulating circumaxillary sutures rather than expanding it only transversely [3]. In this way the maxilla can be convincingly protracted without overexpanding it. This minimal invasive protocol has been more beneficial for cleft patients as explained by Yen [14], that scarring in maxilla hinders its advancement by orthognathic surgeries which can result in relapse. The concept of alternate expansion and contraction of screw was described akin to simple posterior tooth extraction, where forces are transmitted to buccal and lingual alveolar bone alternately with help of forceps so that the tooth becomes loose and easy to extract [3].

Classification of circummaxillary sutures [2]

- Sutures-1 Intermaxillary suture
- Nasomaxillary suture
- Sutures-2 Frontomaxillary suture
- Frontomaxillary suture
- Frontomaxillary suture
- Zygomaticomaxillary suture
- Sutures-3 Internasal suture
- Zygomaticotemporal suture
- Sutures-4 Nasofrontal suture

Considering the various types of circummaxillary sutures, the sutures which run sagittal and directly articulate to the maxilla are categorized as Sutures-1.

For the sutures running coronally and articulating directly to the maxilla comes under Sutures-2.

Sutures running sagittal and articulating indirectly to the maxilla are part of Sutures-3, and the ones running coronally and articulating indirectly to the maxilla describes Sutures-4.

Although, Sutures running sagittal are perpendicular to the expansion screw and in line of action of expander, opened significantly more as compared to sutures in coronal direction and for maxillary protraction, extensive opening of coronally directed sutures are more essential, however direct or indirect articulation revealed to be insignificant [2].

Discussion

The necessity to achieve satisfactorily anterior posterior expansion of maxilla and convincing profile, Loui [3] in 2005 came up with alternate expansion and constriction protocol for 7 weeks at the rate of 1 mm per day followed by 3 months and 3 weeks of maxillary protraction on a sample with unilateral cleft lip and palate which was operated by double hinged expander and intraoral beta-titanium maxillary protraction spring, where the jack screw was oriented perpendicular to the alveolar cleft which was expanded 1 mm per day. The protocol begins with expanding the screw and keeping the expander opened at the last week with alternate constriction in between, allowing the maxilla to protract to a greater extent. The above study was done in comparison to 2nd group with

conventional RME protocol of 1 week of expansion followed by 5 months and 3 weeks of maxillary protraction.

On cephalometric analysis, nasal bones and maxilla were significantly protracted and due to counter clockwise rotation of maxilla, mandible rotated inferiorly and posteriorly in both the groups. Point A was displaced anteriorly ranging between 5.6+-2.3 mm with Alt-RAMEC in contrast to RME group where it ranged between 2.6+-1.5 mm. This result is conclusive of anterior displacement of maxilla being highly significant amongst Alt-RAMEC group as compared with conventional RME group, as justified by Loui, the 2 hinges expander rotate each half of the maxilla outward and forward around maxillary tuberosities and not around posterior nasal spine where hyrax expander works, eliminating the resorption behind the tuberosities.

Overall study interpreted the amount of maxillary advancement was 3 times greater than RME group, on the other hand it was twice and 1.4 times more as concluded by Isci., *et al.* [8] with 4 week protocol and Liu., *et al.* [4] with 7 week of protocol respectively. In a study conducted by Yu Chi Wang [2] on cats following 5 weeks protocol at the same rate as study [2] of 1 mm per day for Alt-RAMEC, although the maxilla was advanced by 5.8 mm in 6 months with point A movement ranging from 2 mm to 4.5 mm, which was two to three times greater than RME, it was concluded that more than 5 weeks of Alt-RAMEC is required to open coronally running circummaxillary sutures efficiently. On contrary, Berza [6] following 9 weeks of Alt-RAMEC protocol at the rate of 1 mm per day using double hinge screw followed by facemask concluded very less maxillary protrusion i.e. 0.8 mm of forward movement of point A, reason explained could be by smaller sample size and non cleft maxillary structure of the patients.

In a randomized study reported in 2015 done by weito Lui [4], where a RME group with 1 week was compared with RPE/C group with 7 week protocol at the rate of 1 mm per day using hyrax palatal expanders followed by face mask maxillary protraction with 400mg to 500mg force on either side, resulted in more significant movement of point A by 3.04 mm and counter clockwise rotation of palatal plane in RPE/C group. Hence less downward and backward movement of mandible. This was explained by the extent of opening of circummaxillary suture enhancing the protraction of maxilla by the force of facemask. Similar results were seen with Demet., *et al.* [5] study with mini plates, where counter clockwise

rotation of palatal plane was also observed. Negligible extrusion of maxillary molars favoured less clockwise rotation of mandible. They concluded another reason of shorter face mask duration in RPE/C group, therefore lesser mandibular plane rotation resulting in correction of overbite. However, Viera., *et al.* [15] study showed significant increase in mandibular plane angle indicating clockwise rotation of mandible, thereby moving point B by 4.54 mm downward due to vertical movement of maxillary molars and retrusive force by chin cup. They applied 7 week of Alt-RAMEC protocol by cementing modified Hass type palatal expander banded on maxillary first premolar and first permanent molars followed by 500g of force with facemask. With significant anterior movement of maxilla by 2.33 mm, an increase of ANB by 2.16 degree was observed. The counterclockwise rotation of palatal plane was interpreted by force vector below the centre of resistance of maxilla. In this study, the author inferred that during facemask therapy, maxilla moved sagittal more rather than in RME phase, which was in contrast to Loui [1] who concluded more anterior movement during RME phase.

Isci, *et al.* [8] and others have revealed both skeletal as well as dentoalveolar changes with maxillary incisor protrusion as a dental compensation in both Alt-RAMEC and RME group along with orthopaedic treatment (face mask) for class III malocclusion patients, In an attempt to achieve pure orthopaedic movement, various authors have tried rigid anchorage systems like osteointegrated implants, on plants, miniplates [11], mini screws and at times a natural rigid anchorage from ankylosed tooth [35-37]. Demet [5] described the effect of alternate expansion and constriction in face mask treatment using miniplates screwed in the lateral nasal wall of maxilla as the force vector is nearer to the centre of resistance of nasomaxillary complex, which will enhance the opening of circumaxillary suture when force is applied. Here the author followed Alt-RAMEC protocol for 8 weeks at the rate of 0.5 mm per day, beginning with expansion and constriction in the final week. With force of 100 gm per side in the initial week via elastic between miniplate and facemask and then subsequently increasing force to 300 to 400 gm per side in the second week, the cephalometric analysis resulted in significantly increase in SNA, maxillary depth and length. Anterior posterior measurements depicted by ANB and WITS were also significant, similar to C. Masucci., *et al.* [7] and Wilmes B., *et al.* [11]. Counterclockwise rotation of palate was also significantly proved. Among mandibular parameters, SNB decreased significantly with no increase in mandibular length, a favourable parameter for class III correction was explained by effective and patient

compliant facemask therapy.

As Isci [8] study resulted in significant change of angulation of upper and lower incisor, Demet's study attained pure orthopaedic movement by insignificant maxillary and mandibular incisor angulation which revealed its successful goal. Similar insignificant incisor inclination with more prominent upper lip in forward direction with 9 weeks of Alt-RAMEC at the rate of 1mm per day with double hinge expander followed by face mask was seen by Berza Sen [6] who, through CBCT imaging, evaluated skeletal, soft tissue and airway changes, however no significant changes were seen with respect to lower lip which was similar to Cozza., *et al.* and [5]. Although [15] summarized there was almost negligible change in maxillary incisor inclination, they along with maxillary molars were extruded and protruded leading to vertical changes.

To reify pure orthopaedic changes Liou and Nagan [11], inserted two mini implants in the area of 2nd and 3rd rugae of midpalatal suture. A hybrid hyrax sagittal split screw was fixed which was activated by a 180 degree rotation twice at the rate of 8 mm per day and then deactivated for the 2nd week. this protocol was followed for 8 weeks followed by facemask at 400 mg of protraction force on each side. Wits evaluation showed positive results (values not understood) which was evident of the fact that the forces received by maxilla was in sagittal direction, owing to halt the dental effects.

To avoid unnecessary forces on periodontal apparatus of the permanent teeth many authors [30,31] did RME in mixed dentition period by bonding appliance on 2nd deciduous molar and canine avoiding 1st permanent molar. This prepubertal age group also enhances the skeletal effect of various functional appliances. To achieve these benefit, Mauscci., *et al.* [7], in his controlled study, divided sample into 3 groups of ALT-RAMEC/FM, RME/FM and control group of untreated class III malocclusion patients where the mean age of all the patients was 6.4+-0.8 yrs at the maxillary expansion stage and 8.1+-0.9 yrs at the completion of the treatment. The study was operated on maxillary acrylic splint expander with soldered hooks for face mask attachment which was bonded to deciduous canine and first and second deciduous molar. A 4 week Alt-RAMEC protocol was followed with additional activation of expansion screw twice daily to achieve overexpansion. Facemask therapy with 400 to 500 force was delivered after the 2nd grp of RME was advised to activate screw till overcorrection was achieved followed by facemask therapy. Alt-RAMEC group showed more significant

results as compared to RME group with increase of SNA by 3.1, SNB by -1.9, ANB by 4.9 and WITS by 4.2 mm as compared to 2nd grp which incremented by 2,-1.3,3.2 and 2.6 mm respectively.

Similar age criteria case of 6yrs female with maxillary hypoplasia and prognathic maxilla as a sequelae of down syndrome Diego and Nagan [10] followed protocol of 6 weeks Alt-RAMEC and observed an increase of 3.6 degree of SNA, decrease of SNB by 4 degree and remarkable 10 mm and 7.7 mm refinement of WITS and ANB respectively was the benefit of early class III treatment.

Considering the other bones of nasomaxillary complex, this study [6] showed backward movement of zygomatic bone by 75 mm along with slight significant widening of bilateral zygomaticotemporal and zygomaticomaxillary sutures by 0.45-.065 mm and 1.61 mm respectively along with 3 mm expansion with respect to nose which was highly significant as compared to Poddser and Ballatani [20] and Ghoneima A., *et al.* [34] i.e. 0.6 mm after conventional RME. [6] resulting in decreased airflow resistance, beneficial among mouth breathers. The tight interdigitation of sutures and their insufficient opening with conventional RME as compared to efficient opening with Alt-RAMEC explained the above conclusion

Isci., *et al.* [8] with 4 week protocol on a sample of mean age of 11yrs inferred more significant result with Alt-RAMEC group in comparison to conventional RME group in terms of anterior movement of point A, increase in SNA, ANB, increase of maxillary posterior height. Considerable maxillary skeletal component changes attributed more for overjet correction as compared to madibular skeletal part.

In contrast to all the above Alt-RAMEC studies where a positive anterior sagittal movement was seen, Do-de Latour., *et al.* [12] demonstrated more forward and less downward movement of maxilla in conventional RME group as compared to Alt-RAMEC group concluding that factors such as age of the patient, facemask therapy duration impact the treatment along with Alt-RAMEC [12].

Considering the soft tissues changes, significant improvement was seen with respect to forward movement of upper lip and retrusion of lower lip as well as soft tissue pogonion was observed by many authors [8,18] as a result of both maxillary protraction and increased maxillary incisor proclination, however [5], the author concluded more significant forward upper lip movement without maxillary incisor proclination, the reason being pure orthopae-

dic changes with combine use of ALT-RAMEC and miniplates for protraction. Celiko [18] evaluated significant increase in upper pharyngeal dimension in contrast to lower pharyngeal space along with change in vertical position of hyoid bone.

Clinically, pain and discomfort was also observed in nasal, supraorbital region and zygomatic regions in Alt-RAMEC group which indicated stresses on circumaxillary suture due to alternate expansion and constriction causing disarticulation of nasomaxillary complex which was insignificant in the RME group [3].

Conclusion

To our conclusion, age of the patient, type of RME appliance along with its rate per day, no. of hours protraction appliance is used intraoral appliance such as used by loui provides continuous force as compared to facemask, magnitude of force and most important patient compliance, all these factors along with Alt-RAMEC proved to present satisfactory results.

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