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ORIGINAL ARTICLE

EFFECTS OF RAPID MAXILLARY EXPANSION ON FACIAL SOFT TISSUES IN UNILATERAL POSTERIOR CROSSBITE PATIENTS

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ABSTRACT

Numerous studies have been conducted evaluating the maxillary changes following Rapid maxillary expansion but few have evaluated the changes associated with facial soft tissue following maxillary expansion. Although the expansion takes place in the maxillary arch, there are changes in mandibular dimension as well as in the facial soft tissues. Therefore, this study was done to examine the mean changes in soft tissues measurements with rapid maxillary expansion for management of unilateral posterior cross bite.

This Quasi-experimental study was conducted at the Department of Orthodontics, Lahore Medical & Dental College, Lahore for 6 months i.e. 30th July 2019 to 29th January 2020. Children of age 10-15 years of either gender presenting with unilateral posterior cross bite with angle Class I or Class II malocclusion were recruited in the study by using non-probability consecutive sampling. All palatal expanders (Hyrax- bonded) were fabricated, cemented and activated bilaterally, according to the protocol. Holdaway soft tissues assessment was applied to examine the changes in soft tissues on lateral cephalograms. Soft tissues facial angles, skeletal profile convexity, nose prominence and H angle were assessed after 3 weeks by using lateral cephalogram and change in these values were calculated.

The mean change in soft tissue facial angle was 1.15 ± 0.48o, mean nose prominence was 0.11 ± 0.06 mm, skeletal profile convexity was 0.57 ± 0.15 mm and H angle was 1.79 ± 0.2o. Thus the rapid maxillary expansion can be used routinely for management of posterior cross bite but it affects the facial soft tissues. Hence its effects should always be taken into consideration in order to achieve good functional and esthetic results.

Keywords: *posterior cross bite, rapid maxillary expansion, Holdaway soft tissue measurements.*

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INTRODUCTION

Posterior Cross-bite is the most common malocclusions among individuals with primary and mixed dentition. It can be observed in about 8-22% individuals.[1] Posterior cross-bite is the presence of malocclusion in canines, premolars as well as in molars, categorized through buccal cusps of maxillary teeth occluding lingually to buccal cusps of parallel mandibular teeth.[2] Cross-bite can be unilateral or bilateral.

Posterior cross bite may occur as a result of skeletal or dental causes or be a result of certain habits e.g. thumb sucking and mouth breathing resulting from upper airway obstruction presenting as hypertrophied adenoids or tonsils and allergic rhinitis.[3] In unilateral cross bite, the mandible may need to move asymmetrically to allow the posterior teeth to meet together.[4,5] Rapid maxillary expansion is the common procedure for correction of posterior cross-bites in orthodontics.[6] This method has a distinctive position in dento-facial

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therapy. It is also known as Split palate, i.e skeletal type of expansion. This method includes the separation of mid-palatal sutures and maxillary shelves movement away from each other. It is applied to increase the transverse dimensions in individuals having limited maxillary arch. The increase in the dimensions of maxilla is justified by an increase in the inter-molars, inter premolars and inter canine widths.[7]

Numerous studies have been conducted evaluating the maxillary changes following Rapid maxillary expansion[8] but few have evaluated the changes associated with mandible following maxillary expansion.[6, 8] Although the expansion takes place in the maxillary arch, there are changes in mandibular dimension as well.[6] So as to maintain the appropriate occlusal relationship, mandibular arch should respond the maxillary expansions, even without treatment in lower arch. Facial soft tissue also exhibits changes following rapid maxillary expansion. Kilic [9] found that with rapid maxillary expansion (n=18), mean change in Soft tissue facial angle was 1.15±0.21^{o}, mean change in nose prominence was 0.12±0.06mm, mean change in skeletal profile convexity was 1.6±0.05mm and mean change in H angle was 1.7±0.71^{o}.[9]

The objective of this study was to evaluate the changes in soft tissue measurements with rapid maxillary expansion for management of unilateral posterior cross bite. We get to know from literature that rapid maxillary expansion is a method used in routine for management of posterior cross bite in children, but data regarding the extent it affects facial soft tissues, is scarce. There have not been many studies describing the effects of RME on facial soft tissues. Therefore, rationale of this study is to assess the role of RME in producing the soft tissue effects in addition to its skeletal changes, in a local setting; this will help the Orthodontists by improving the understanding of dimensional changes in facial soft tissue following RME in future.

MATERIALS & METHODS

This Quasi-experimental study was done at Department of Orthodontics, Lahore Medical & Dental College, Lahore for 6 months i.e. 30th July 2019 to 29th January 2020. Sample size of 60 cases was estimated by keeping confidence level at 95%, absolute precision required at 1% and mean change in soft tissue facial angle i.e. 1.15±0.21^{o} with rapid maxillary expansion for management of unilateral posterior cross bite.[9] All children were included through non-probability, consecutive sampling technique. Children of age 10-15 years of either gender presenting with unilateral posterior cross bite with angle Class I or Class II malocclusion were included. Children with previous orthodontic therapy, hypodontia of any quadrant, temporomandibular joint disorder or cleft lip and palate were excluded from the study. Informed written consent was taken from selected patients. Demographic details like name, age, sex, laterality were noted. Lateral cephalograms and study casts of all the patients were taken before commencement of expansion. All palatal expanders (Hyrax-bonded) were fabricated by a single technician, cemented and activated bilaterally, following the standard protocol of RPE i.e. two quarter turns (0.5mm)/ day. Subsequently, appliance was triggered one quarter turn two times a day. The individuals were observed every week for about 3 weeks. When the anticipated over-correction was achieved i.e. Lingual cusps of upper teeth occluded with the lingual inclines of the buccal cusps of the lower teeth, the appliance was stabilized. After expander removal, a removable palatal full-coverage acrylic plate was placed as a retainer. Holdaway soft tissues assessments were used to evaluate the changes in soft-tissues, detected on lateral cephalograms. Soft tissue facial angles, skeletal profile convexity, nose prominence and H angle were evaluated after three weeks on lateral cephalogram and changes were calculated for these variables. The landmarks were positioned and measurements were implemented as defined by Holdaway.[9] (Figure I: Holdaway soft tissue measurements). All this information was recorded on proforma.

The data was analyzed on SPSS version 25.0. Paired sample t-test was used to compare change in Soft tissues facial angle, nose prominence, skeletal profile convexity and H angle. P-value≤0.05 was kept as significant.

RESULTS

Patients enrolled in the study were aged 10 - 15 years showing the mean age of 12.60 ± 1.31 years. Majority of the subjects i.e. 32 (53.33%) had 10-12 years age range. Table 1

Distribution of subjects according to laterality is also shown in Table 1.

TABLE 1: DEMOGRAPHICS OF SUBJECTS (N=60)

Age (in years)	Frequency	%age
10-12	21	53.33
13-15	19	46.67
Mean age	12.60 ± 1.31	
Gender		
Male	27	45%
Female	33	55%
Laterality		
Right	36	60.0%
Left	24	40.0%

TABLE 2: COMPARISON OF BASELINE AND POST-EXPANSION SOFT TISSUE MEASUREMENTS FOR MANAGEMENT OF POSTERIOR CROSS BITE

Soft tissue measurements	Baseline	Post-expansion	Change	p-value
	Mean ± SD	Mean ± SD		
Soft tissue facial angle	87.05 ± 1.60	85.90 ± 1.40	1.15 ± 0.48	0.0001
Nose prominence	15.59 ± 0.09	15.70 ± 0.07	0.11 ± 0.06	0.0001
Skeletal profile convexity	1.94 ± 0.09	2.51 ± 0.10	0.57 ± 0.15	0.0001
H angle	12.65 ± 0.17	14.45 ± 0.18	1.79 ± 0.22	0.0001

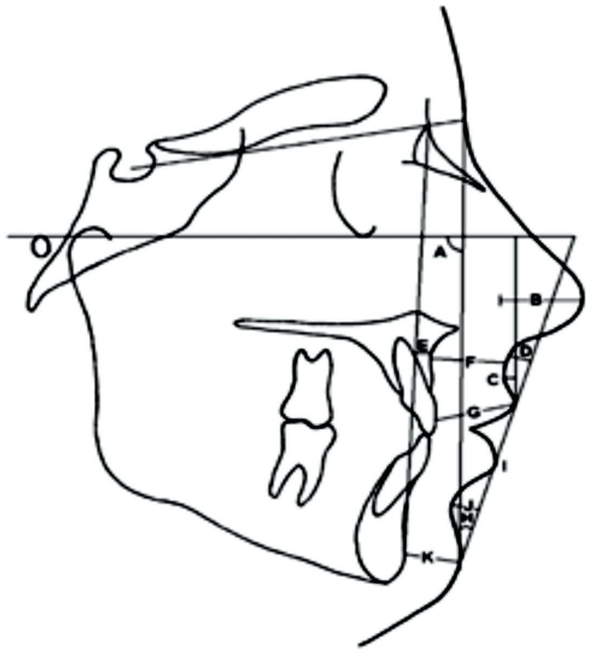

Fig 1: Holdaway soft tissue measurements A, soft tissue facial angle; B nose prominene; C, superior sulcus depth; D, soft tissue subnasale to H line; E skeletal profile convexity; F, basic upper lip thickness; G, upper lip thickness; H, H angle; I, lower lip to H line; J, inferior sulcus to H line; K, soft tissue chin thickness; F-G, upper lip strain measurement.

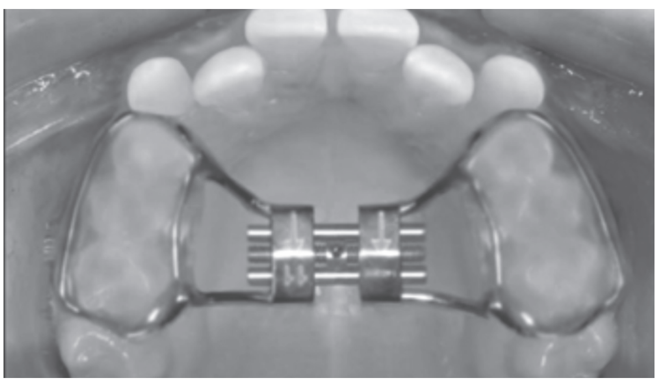

Fig 2: Palatal expander-bonded design

The change in soft tissue measurements i.e. soft tissues facial angle, nose prominence, convexity in skeletal profile and H angle after RME were found to be significant (P-value≤0.05) (Table-2).

DISCUSSION

RME is routinely used to treat the transverse discrepancy during the development of maxilla and is recognized as first phase of complex orthodontic therapy. There are variable methods to examine the impact of RME.[10, 11] We have conducted this study and observed the mean change in soft tissue facial angle was 1.15 ± 0.48°, nose prominence was 0.11 ± 0.06 mm, skeletal profile convexity was 0.57 ± 0.15 mm and H angle was 1.79 ± 0.2°. The changes in the measurements of soft tissues i.e. facial angles, skeletal profile convexity, nose prominence and H angle after this procedure was observed as significant (P-value ≤ 0.05).

There was a significant decrease in soft tissue facial angle following expansion. This can be explained by the downward and backward rotation of mandible observed in the subjects in our study. There was a significant increase in H angle. The increase in the angle may occur due to forward movement of upper-lip, clockwise rotation of mandible, or both. We also observed the backward and downward movement of mandible in our study, this may explain the increase in the H angle. These findings are consistent with the study conducted by Kilic.[10]

In another study conducted by Kilic[9], it was found that with rapid maxillary expansion (n=18), mean change in Soft tissue facial angle was 1.15±0.21°, mean change in nose prominence was 0.12±0.06mm, mean change in skeletal profile convexity was 1.6±0.05mm and mean change in H angle was 1.7±0.71°.[9] These values are in accordance with our study.

Karaman et al[11], investigated the modifications in soft tissues profile after RME treatment via cephalograms and reported concomitant lip adaptations to forward movement of maxilla. He also observed that nose tip followed the anterior movement of maxilla. He observed the average forward movement of nose tip to be 2.53 mm after RME therapy. We also observed a forward movement of nose tip; however, it was relatively less i.e. 0.12 ± 0.06mm

There was also a significant increase in skeletal profile convexity following RME in our study. This could be attributed to the forward movement of point A along with the clockwise rotation of mandible. This finding is in agreement with previous studies[12] conducted in this regard.

Karaman also observed the forward movement of the bridge of the nose in addition to the tip but we have not included the changes in the bridge of the nose in our study.

CONCLUSION

This study concluded that after RME, there was:

- Significant decrease in facial soft tissue angle.
- Significant increase in skeletal profile convexity, H angle and nose prominence.

Hence, rapid maxillary expansion affects Holdaway facial soft tissues assessment. Therefore, the effects of RME on facial soft tissues should always be taken into consideration in order to achieve better functional and esthetic results.

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