EVALUATION OF SKELETAL AND DENTAL CHANGES CONCURRENT TO USE Of HAAS AND HYRAX RME IN VERTICAL AND SAGITTAL DIRECTION

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Abstract:

Aim: The main goal of this research was to evaluate the sagittal and vertical effects of Hyrax (tooth born) and Haas(tooth-tissue born) rapid palatal expanders on dentoskeletal structures of patients with maxillary constriction characterized by bilateral posterior cross bite .

Materials and methods: A nonrondomized clinical trail of 22 patients 12 to 14 years old (mean age 12.5 years) with maxillary constriction ,who were divided into two groups, was undertaken . Group-I consisted of 11 patients who received treatment by Hyrax type rapid palatal expander (RPE) . Group- II composed of 11 patients who received treatment by Haas RPE.Two lateral cephalograms were taken, one before and the other after the palatal cusps of the upper posterior teeth reached the buccal cusps of lower posteriors consequent to expansion . The activation period lasted from 12-16 days with a mean value of 13.5 days. On each lateral cephalogram 8 linear and 10 angular parameters were measured, recorded and compared to a nearest of 0.5 mm and 0.5 degree respectively. Statistical analyses were performed using Kolomogrov-smirnov and paired t-test . A student t-test was used for comparison of two group.

Results : In both groups significant increases in lower anterior facial height were observed. The value (ANS-ME) was increased 1.30mm in Hyrax (P=0.009) and 1.80mm in Haas group (P=0.032) .Statistically neither of the appliances showed a significant effects on sagital position of the maxilla.The mandible was rotated downward and backwards. SNB angle decreases 0.65 and 0.43 degrees in Hyrax and Haas group respectively. ANB angle was increased by means of 0.60 degree (p= 0.030) in Hyrax and 0.53 degree (p=0.08) in Haas group.

Conclussion: The maxilla kept its position sagitally, pre to post treatments, but showed inferior displacement in both groups . The mandible displayed a tendency to rotate downward and backward in both groups .Upper anteriors tipped palatally. (IJO 2006; 1: 61 - 65)

Key Words: Rapid maxillary expansion; Haas, Hyrax ,dentofacial structure
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INTRODUCTION

Rapid maxillary expansion (RME) induce a laterally directed force against the teeth or palatal mucosa or both, which causes a widening of the midpalatal suture [1].As a matter of fact , the RME appliance originated in united state by Angell in1860 who introduced and used this appliances for treating patients with maxillary constriction [2]. Since then, various types of rapid palatal expanders fabricated, tried and some discarded because of their adverse effects on dentofacial structures. The only two appliances which still are in common use by orthodontists are Haas and Hyrax rapid palatal expanders. The RME as described by Haas is a tooth- tissue borne fixed split acrylic maxillary expansion appliance [3]. The Hyrax or Biederman appliance is a tooth borne device which consists of a screw with heavy wire extensions that are soldered to the palatal aspects of the bands on the first molars and premolars [4].Because the RME appliances commonly produces orthopeadic forces in the range of 3 to 10 pounds [5], the expansion was deemed to be skeletal and, therefore, more stable.

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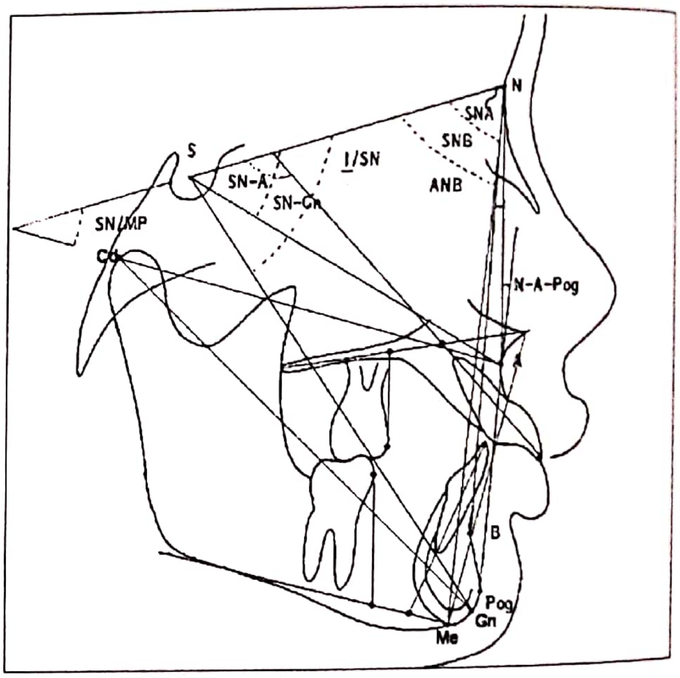
It has been reported that opening of the midpalatal suture during expansion,causes bending of the alveolar structures and buccal tipping of the posterior maxillary teeth which leads to posterior rotation of the mandible, open bite, and an increased vertical face height as direct effect of vertical displacement of maxilla [3,6,7,8,9,10,11]. Haas (1970) stated that once the mid-palatal suture opens, the maxilla always moves forward and downward, and this causes a downward and backward rotation of the mandible and increases the vertical dimension of the lower face [10]. In contrast Hicks [12] found only minor changes in the position of maxillary implants in sagittal and vertical direction and in the mandibular plane too .Wertz and Dreskin [13] found no significant changes in the alteration of the maxilla with rapid palatal expansion in antero posterior direction but drops down consistently. This was later confirmed by da Silva et al. [9], who found that the maxilla did not show any statistically significant alterations in the anteroposterior position over the 14-16 days of appliance activation. Velàzquez et al. [14] in a long-term study regarding the effects of RPE reported that the modest, but potentially unfavourable changes induced by the RPE device, such as an open bite or mandibular posterior rotation, are reversible. They found that, following termination of orthodontic treatment, these undesirable effects were almost completely resolved .McNamara [15] in a study of the effects induced by a RPE appliance observed that widening the maxilla lead to a spontaneous correction of patients with tendency towards a class II malocclusion which occure during the time that the maintenance plate is being worn. . To date ,however , the number of studies that have been conducted on lateral cephalogram to evaluate the effects of RPE appliances in vertical and sagittal dimenssion are very limited. In fact relatively little has been published concerning the specific cephalometric alterations induced by these appliances. The present study was undertaken to investigate the vertical and sagittal effects of the Hyrax and Haas type rapid palatal expanders on the cranio facial complex .

MATERIALS AND METHODS

22 patients with bilateral posterior cross bite divided into two groups . Group-I included 11 patient (6females and 5 males) received treatment by Hyrax rapid palatal expander (RPE) . Group -II composed of 11 patients (7 females and 4 males) received treatment by Haas type RPE .The age range of the samples in both group was 12 to 14 years with mean age of 11.5 years. For all subjects two lateral cephalogram were taken one before treatment(T1) , and the second immediateley after the palatal cusps of the upper posterior teeth were reached on buccal cusps of lower posteriors consequent to expansion (T2) . All pre and post lateral cephalograms were taken in one center ,and in standard position in such a way that the source to midsagittal plane distance was 60 inches , and midsagittal plane to film distance was 15 inches [24] .The appliance was activated with one-fourth turn twice a day in all subjectes. The activation period lasted from 12-16 days with a mean value of 13 days depending primarily on the degree of maxillary constriction . Patients and parents were advised to discontinue expansion if pain or tissue swelling was felt or seen .The amount of expansion was ranged between 6 to 8 mm (mean value of 6.5 mm) in both groups . On each lateral cephalogram 8 linear and 10 angular parameters were measured, recorded and compared to a nearest of 0.5 mm and 0.5 degree respectively (fig-1) .

FIGURE .1. Cephalometry tracing illlustrating 8 linear and 10 angular measurments.
1 : SNA°, 2 : SNB°, 3 : ANB°, 4- S-A mm, 5 : Cd-A mm , 6 : S-Gn mm, 7: SN-Gn° , 8 : NA-Pog° , 9 :NSA° , 10: SN-GoGn° 11 : PP-GoGn° ,12 : N-ME mm, 13 : ANS-ME mm, 14 : IS-PP, 15 : UI-SN°, 16: UMC-PP mm, 17 : LI-MP°, 18 : L MC- MP mm



Statistical method :

Descriptive statistics including mean and standard deviation. We used a non-parametric test because the studied variables were not normally distribuited. The mean differences in cephalometric measurements at T1 and T2 were examined with kolmogrove-smirnov- test and if the calculated data were normal then parametric pair t- test were used to compare T1 and T2 . A student t-test was used for comparison of the groups.

RESULTS

All patients demonstrated sutural opening, which was confirmed by median diastema between the central incisors developed during treatment, and no problems were reported

by any of the patients in either group.
Differences between pre and post treatment effects of hyrax expander are shown in Table- 1. SNA ,SNB ,S-A ,S-Gn ,N- A-Pog values showed reduction during treatment , however this reduction was significant only in N-A-POG parameter (p=0.024). In contrast, an increase in ANB ,Cd-A ,NSA ,Y-AXIS ,IS-PP ,UI-SN, UMC-PP ,LI-MP ,LMC-MP ,SN-GoGn , PP-GoGn were observed. This increase in ANB(p=0.030) ,N-ME (p=0.024) and ANS-ME(p=0.009) values were statistically significant (Table -1).

Differences between pre and post treatment effects of Haas expander are shown in table- 2. SNA ,SNB ,Cd-A , PP-GoGn ,UI-SN ,LI-MP , measurments were reduced , but this reduction was not statistically significant in all obove variables . An increase in values of S-A , S-Gn ,NSA , ANB ,Y-AXIS , SN-GoGn ,N-A-Pog ,N-ME ,ANS-ME ,IS-PP ,UMC-PP , LMC-MP were observed . However only the changes in N- ME (p=0.026) and ANS-ME(p=0.032) was statistically significant (Table-2) .
However in some of the variable there was a significant difference from pre to posttreatment values within the groups, but no statistical significant variation were observed when two groups compared to each other (Table-3).

Table.1. Changes and Comparisons of Pre and Posttreatment Values Within the Group - I (hyrax) .

	Group I						
	Pretreatment (T1)		Posttreatment (T2)		Difference (T2-T1)		
	Mean	SD	Mean	SD	DIFF	P-V	SIGNIFICANT
1 SNA°	66.90	7.11	65.55	8.42	-1.35	0.60	NS
2 SNB°	77.45	3.08	76.80	4.63	-0.65	0.191	NS
3 ANB°	3.00	2.52	3.60	2.39	+0.60	0.030	S
4 S-Amm	85.40	3.66	85.30	3.97	-0.10	0.83	NS
5 S-Gnmm	13.80	6.66	13.66	7.08	-0.15	0.766	NS
6 Cd-Amm	91.60	4.81	91.70	6.00	+0.10	0.88	NS
7 NSA	42.30	3.09	42.70	2.46	+0.40	0.393	NS
8 N-A-Pog°	175.75	4.72	174.20	5.29	-1.55	0.024	S
9 SN-GoGn°	33.72	5.21	34.22	4.63	+0.50	0.675	NS
10 PP-GoGn°	25.15	5.25	25.65	6.33	+0.50	0.372	NS
11 Y-AXIS°	69.50	3.20	70.10	3.80	+0.60	0.181	NS
12 N-MEmm	126.75	7.06	128.25	8.07	+1.50	0.024	S
13 ANS-MEmm	73.85	5.96	75.15	6.38	+1.30	0.009	S
14 IS-PPmm	29.70	3.71	30.25	2.78	+0.55	0.214	NS
15 UI-SN°	105.65	5.64	104.40	6.38	-1.25	0.153	NS
16 UMC-PPmm	32.00	6.80	33.45	6.94	+1.45	0.158	NS
17 LI-MP°	96.80	6.53	97.30	7.27	+0.50	0.680	NS
18 LMC-MP mm	30.45	2.41	30.65	2.46	+0.20	0.373	NS

S : significant
NS : nonsignificant

DISSCUSION

Reports concerning the effect of RME on dentofacial complex are focused mainly in transverse direction , in this study from the lateral cephalogram of 22 subjects aged between 12-14 years. These effects were evaluated on sagittal and vertical direction. while considering the position of the maxilla sagitally, we observed that the SNA angle , S-A and CD-A distance were not changed significantly. In both groups position of point A was not changed significantly in anteroposterior direction .These findings were in line with Wertz et al. [13] , Gabriel da Silva [9] Sarver et al. [20] Byrom et al. [21] . However this finding was not in accordance with Haas [16] ,Davis et al. [19] , who reported anterior movements of point A consequent to the use of RME . Many investigators have reported that RME results in a downward movement of the maxilla, more at ANS than at PNS, [3,17,18] .In our study, we also noted that the values of NSA angle (the angle between points N-S-A) were increased in both groups .RME separates the external walls of the nasal cavity laterally and causes lowering of the palatal vault and straightening of the nasl septum more in anterior than posterior part Haas [11].

The decreases in SNB angle occurred in both groups, reflecting the downward and backward rotation of the mandible. However this reduction was more in Haas than Hyrax group but there was no statistical differences between the groups at the end of expansion. This finding was in accordance with

Table.2. Changes and Comparisons of Pre and Posttreatment Values Within the Group - II (Haas).

		Group II Pretreatment (T1)		Posttreatment (T2)		Difference (T2-T1)		
		Mean	SD	Mean	SD	DIFF	P-V	SIGNIFICANT
1	SNA°	66.89	10.28	66.33	9.39	-0.56	0.325	NS
2	SNB°	74.02	11.57	69.72	13.96	-4.30	0.197	NS
3	ANB°	6.19	8.55	6.72	8.61	+0.53	0.08	NS
4	S-Amm	82.87	56.5	83.33	5.12	+0.56	0.508	NS
5	S-Gnmm	114.83	37.88	116.39	39.56	+1.56	0.141	NS
6	CD-Amm	89.83	4.42	89.33	4.87	-0.50	0.648	NS
7	NSA	42.06	3.06	42.38	2.96	+0.31	0.598	NS
8	N-A-Pog°	158.28	56.60	156.78	55.75	-1.50	0.087	NS
9	SN-GoGn°	41.75	13.72	42.00	13.9	+0.25	0.665	NS
10	PP-GoGn°	31.50	5.47	31.39	5.00	-0.11	0.849	NS
11	Y-AXIS°	69.83	3.39	70.49	3.50	+1.11	0.128	NS
12	N-MEmm	123.50	9.09	126.50	9.26	+3.00	0.026	S
13	ANS-MEmm	72.94	6.09	74.13	6.42	+1.89	0.032	S
14	IS-PPmm	33.56	9.78	32.72	10.65	+0.17	0.700	NS
15	UI-SN°	93.67	27.65	92.17	27.00	-1.50	0.396	NS
16	UMC-PPmm	31.33	8.03	32.44	7.68	+1.13	0.180	NS
17	LI-MP°	89.78	13.10	89.50	13.37	-0.28	0.792	NS
18	LMC-MPmm	29.67	4.76	30.00	4.67	+0.33	0.708	NS

S : significant
NS: nonsignificant

Table.3. Comparisons of Pre and Post treatment Values between the groups.

VARIABLES	HYRAX-POST	HAAS-POST	P-VALUE	SIGNIFICANT
ANB°	3.60 ± 2.39	6.72 ± 8.61	1.16	NS
N-A-Pog	174.20 ± 5.29	156.78± 55.75	1.036	NS
N-MEmm	128.25 ± 8.07	126.50± 9.29	0.47	NS
ANS-MEmm	75.15 ± 6.38	74.1 ± 6.42	0.37	NS

those findings of Sarver et al. [20] Byrom et al. [21], Valazquez et al. [22], and Akkaya sevil et al. [23].This changes can be atributed to downward and backward rotation of mandible which itself is the results of downward movement of the maxilla, palatal bending of alveolar structures and buccal tipping of the posterior maxillary teeth [3,18].

In this study, increase of ANB was in accordance with, Sarver and Johnston [20] Haas [3,16] and Wertz [13]. However it was significant only in Hyrax group. ANB increases could be related to posterior rotation of the mandible.

Considering the anterior facial height, both the anterior total facial height (N-Me), and lower anterior facial hieght (ANS-ME) were increased significantly in both groups. Our finding was in agreement with Akkaya sevil et al. [23] Sarver et al. [20] Byrom et al. [21]. Extrusion of the posterior anchor teeth and downward displacement of the maxilla has been suggested as a possible mechanism for clockwise rotation of the mandible and an increased anterior facial height [3,16].

In our study, U1-SN angle was decreased in both groups, this finding was in line with previous reports [7,18]. Using RME results in a lowered position of the tongue ,and the stretched circum -oral musculature caused this tipping.

CONCLUSIONS

- The maxilla moved downward but was not displaced forward in both groups.
- Both groups demonstrated significant increase in vertical dimension.
- Consequent to clockwise rotation of maxilla the upper incisors were tipped palatally in both groups.

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