Cranial Parameters Assessment of Open Bite with Short Upper Anterior Facial Height

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الخلاصة

الأهداف: لتقييم أبعاد القاعدة الجمجمية للارتفاع الوجهي الأمامي الأعلى القصير لحالات إطباق العضة المفتوحة ومقارنتها بحالات الأطباق الطبيعي. **ألمواد وطرائق العمل:** إن مجمل عينات هذه الدراسة كان ٤٨ حالة، تم تقسيمها إلى ١٢ حالة لكل حالة إطباق ولكلا الجنسين. تراوح أعمار المرضى بين ١٣–١٥ سنة وقد تم أخذ أشعة رأسية لكل الحالات وتم تحليل جميع الصور الإشعاعية لتقييم أبعاد القاعدة الجمجمية وأبعاد الارتفاع الوجهي الأعلى. كل البيانات خضعت للتحليل الإحصائي باستخدام Student t–test لتمييز أهم الاختلافات. **النتائج.** أظهرت نتائج الدراسة عدم وجود أي اختلاف معنوي بين حالات الإطباق الطبيعي وحالات اطباق العضة المفتوحة ماعدا الاختلاف في القياس الخطي (S–Ar) وقياس الزوايا(N–S–Ba, N–S–Po and N–S–Co) بين الذكور وقياس الزوايا (N–S–Ba and N–S–Po)بين والإناث. **الاستنتاجات:** الارتفاع الوجهي الامامي الاعلى القصير لحالات اطباق العضة المفتوحة له تاثير محدد على تطور القاعدة الجمجمية خاصة على (S–Ar, N–S–Ba, N–S–Po, N–S–C).

ABSTRACT

Aims: The aims of this study are planned to evaluate the cranial base parameters of the short upper anterior facial height of open bite occlusion and compare them with the normal occlusion. **Materials and Methods:** The total sample of this study was 48 cases, divided into 12 case for each male and female of the normal class 1 molar occlusion and short upper facial height with open bite cases. The age of the patients was ranged between 13-15 years. A lateral cephalometric radiograph film was taken. All the cephalometric x-rays were analyzed to evaluate the cranial parameters and the upper anterior facial height. The data subjected to statistical analysis by using student *t*-test to distinguish the significant differences at 0.05 level for the short upper anterior facial height and to record the cranial parameters of the sample. **Results:** The comparison of the cranial parameters between the normal and open bite occlusions , the male expressed no significant difference (at 0.05 level) in the parameters except the liner (S-Ar) and the angular (N-S-Ba, N-S-Po and N-S-Co).While the female displayed no significant difference (at 0.05 level) in parameters except (N-S-Ba and N-S-Po angles). **Conclusions:** The short upper anterior facial height with anterior open bite case has influences on the cranial base development especially on (S-Ar, N-S-Ba, N-S-Po and N-S-Co).
Key word: Open bite, Facial height, Cranial parameters.

INTRODUCTION

Anterior open bite is a malocclusion characterized by a deviation in the vertical relationship between the maxillary and mandibular dental arches, with absence of contact between the incisal edges of the maxillary and mandibular teeth in the vertical plane.[1-3] It may be a disturbance in skeletal development,[4] or only malpositioning of the anterior teeth, caused by thumb or pacifier sucking, infantile swallowing, speech disturbances and/or tongue thrusting.[5-8]

Open bite is a multifactorial phenomenon and no single factor can account for this malocclusion.[9] Etiology plays an im-

portant role in diagnosis,[10] it can be broadly described as being either dental or skeletal in origin.[11-12] Skeletal anterior open bite is a complicated malocclusion characterized mainly by overgrowth of the maxillary,[13] and mandibular posterior dentoalveolar heights, resulting in a longer vertical facial dimension and a steeper mandibular plane.[14] Anterior open bite is a complex clinical entity that entails a combination of different 3-dimensional dental and skeletal components.[15] There is a possible association between a large cranial base angle and open bite.[16] Any change in flexure could affect the relationships of the maxilla and mandible and in-

fluence the type of malocclusion.[17] Growth studies have generally shown that an increased angulation of the cranial base is associated with increased vertical dimension.[18] The aims of this study were to evaluate the cranial base parameters of the short upper anterior facial height with open bite occlusion and compare them with the normal occlusion.

MATERIALS AND METHODS

The sample of the control group included 24 cases of normal Class 1 molar occlusion, divided into 12 case for each gender. The dental criteria of the normal Class 1 molar occlusion are: has no crowding or spacing with over- bit and over- jet (2-4mm) .The sample of open bite cases was 42 case, only 24 case of short upper anterior facial height was selected after achieving the comparison with the normal occlusion depending upon the linear length N-ANS (nasion- anterior nasal spine), using student *t*- test at 0.05 significant level. (Table 1, Figures 1 and 2).

Table (1): Explore the significant difference between the upper anterior facial height of the normal occlusion and open bite cases.

Variable	Sex	Occlusion	No	Mean*	SD	*t*-test	Significance
N-ANS	Male	Normal	12	58.12	3.42	3.12	S
length		Open bite	12	49.82	2.86		
N-ANS	Female	Normal	12	52.64	2.69	2.68	S
length		Open bite	12	46.88	2.74		

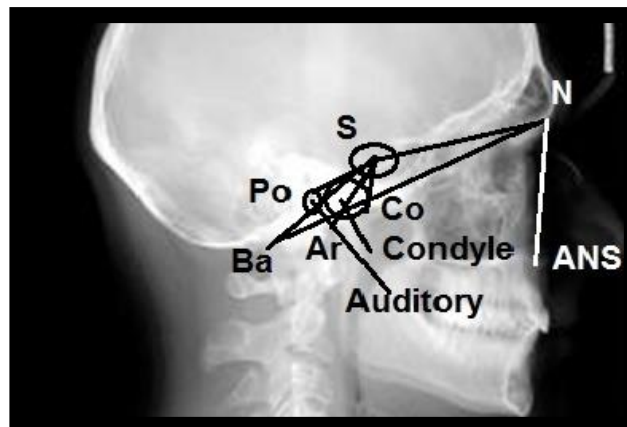N :Nasion, ANS: Anterior nasal spine,*Mean in millimeters, S:Significant difference.

Figure (1): Upper anterior facial height N-ANS(Nasion-anterior nasal spine) and cranial parameters of normal occlusion case.
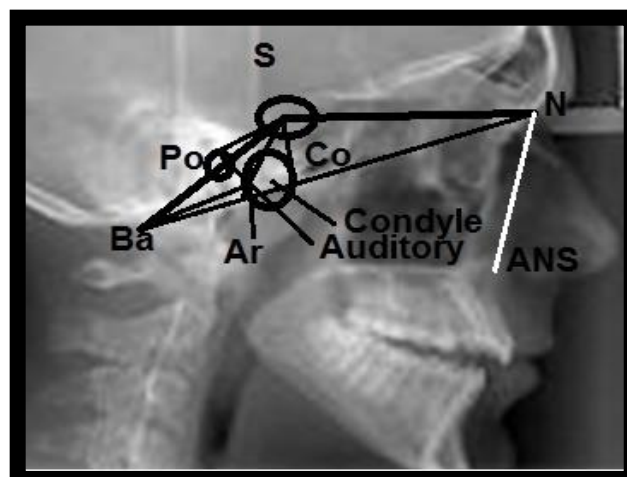

Figure (2): Upper anterior facial height N-ANS(Nasion-anterior nasal spine) and cranial parameters of open bite occlusion case.

The short upper anterior facial height with open bite cases were consisted of 12 case for each gender. The age of patients was 12-15 years. Lateral cephalometric radiograph films (Agfa, belgum) were taken via digital planmeca dimax PRO radiograph machine (W.H., Filend) for all the patients with the same standardized method according to instructions of the company. All the cephalometric x rays were analyzed to evaluate the following cranial parameters: 1-Anterior cranial length (N-S). 2-posterior cranial length (S-Ba). 3-Total cranial length (N-Ba). 4-Nasion-Articular length (N-Ar). 5-Sella-Porion length (S-Po). 6- Sella- Condylion length(S-Co). 7-Cranial angle (N-S-Ba). 8-Basal angle (S-Ba-Ar). 9-Nasion-Sella-Porion angle (N-S-Po). 10-Nasion-Sella-Condylion angle (N-S-Co). The cranial parameters of the normal and open bite occlusion cases (Fig 1 and 2), were subjected to statistical analysis using student t-test to distinguish the significant differences at 0.05 level for the short upper anterior facial height occlusion and to record the cranial parameters of the sample. Table (1), shows the significant decrease of the facial height of the open bite cases at 0.05 level as compared with the normal cases.

RESULTS

The descriptive analysis of the cranial parameters of the normal and open bite occlusion cases (tables 2 and 3), explored that the males of normal occlusion have greater liner and angular means value than female. The same in the open bite cases, the males displayed more mean value than females in all parameters except the linear parameter (S-Ar).

Table (2): Descriptive analysis of the cranial parameters of male and female normal occlusion.

Variables	Sex	Mean value	S.D	Maximum value	Minimum value
N-S length	Male	70.26	3.64	74.68	62.54
	Female	67.44	3.22	71.38	58.86
S-Ba length	Male	46.36	2.82	48.23	40.22
	Female	43.38	3.45	46.88	35.63
N-Ba length	Male	99.76	3.21	89.21	84.86
	Female	97.48	3.63	102.14	92.62
S-Po length	Male	33.65	4.29	38.93	28.48
	Female	30.12	3.56	36.34	26.74
S-Co length	Male	31.88	3.83	96.68	88.92
	Female	29.08	2.82	32.78	24.96
S-Ar length	Male	35.78	2.34	39.23	29.54
	Female	34.32	3.12	38.12	27.75
N-S-Ba angle	Male	130.82	3.62	122.87	112.60
	Female	127.39	4.35	120.22	108.37
N-S-Po angle	Male	137.92	3.82	122.11	108.26
	Female	135.48	3.66	118.48	106.74
N-S-Co angle	Male	116.64	3.84	121.98	107.16
	Female	113.56	3.83	118.88	105.33
S-Ba-Ar angle	Male	99.32	2.66	104.86	88.92
	Female	97.88	3.37	98.58	84.78

N: Nasion, S: Sella, Ba: Basion, Po: Porion, Co: Condylion, Ar: Articular ,Length: in millimeter, Angle: in degree.

Table (3): Descriptive analysis of the cranial parameters of male and female open bite with short upper anterior facial height occlusion.

Variables	Sex	Mean value	S.D	Maximum value	Minimum value
N-S length	Male	68.15	2.16	78.43	58.82
	Female	66.51	3.42	68.28	57.54
S-Ba length	Male	44.25	3,64	53.29	42.74
	Female	42.45	3.26	54.18	38.16
N-Ba length	Male	97.65	3.65	98.65	81.36
	Female	96.45	2.32	98.48	86.26
S-Po length	Male	33.54	3.61	39.93	26.78
	Female	29.19	2.62	39.63	25.82
S-Co length	Male	32.19	2.74	30.44	24.38
	Female	28.15	2.82	35.54	24.96
S-Ar length	Male	31.58	2.36	39.23	26.54
	Female	33.39	2.68	40.23	26.47
N-S-Ba angle	Male	126.71	3.18	132.87	112.60
	Female	122.46	4.31	120.22	108.37
N-S-Po angle	Male	134.81	3.83	122.11	108.26
	Female	131.55	3.65	118.48	106.74
N-S-Co angle	Male	112.53	2.84	121.98	107.16
	Female	114.63	3.86	118.88	105.33
S-Ba-Ar angle	Male	96.21	2 .63	104.86	88.92
	Female	98.95	3.39	98.58	84.78

N: Nasion, S: Sella, Ba: Basion, Po: Porion Co: Condylion, Ar: Articular, Length: in millimeter, Angle: in degree.

The comparison of the cranial parameters between the normal and open bite occlusions (Table 4), the male expressed no significant difference at 0.05) in the parameters except the liner (S-Ar) and the angular (N-S-Ba, N-S-Po and N-S-Co). While the female displayed no significant difference (at 0.05) in parameters except (N-S-Ba and N-S Po angles) (Table 5).

Table (4): *t*-test analysis of the cranial parameters of male normal occlusion and open bite cases.

Variables	Occlusion	Mean	± S.D	t-test	Significance
N-S length	Normal	70.26	3.64	1.22	N*
	Open bite	68.15	2.16		
S-Ba length	Normal	46.36	2.82	1.31	N*
	Open bite	44.25	3.64		
N-Ba length	Normal	99.76	3.21	1.12	N*
	Open bite	97.65	3.65		
S-Po length	Normal	33.65	4.29	1.26	N*
	Open bite	31.54	3.61		
S-Co length	Normal	31.88	3.83	1.23	N*
	Open bite	33.19	2.74		
S-Ar length	Normal	35.78	4.34	3.28	S**
	Open bite	31.58	3.96		
N-S-Ba angle	Normal	130.82	4.62	3.31	S**
	Open bite	126.71	4.18		
N-S-Po angle	Normal	137.92	3.82	3.16	N*
	Open bite	134.81	3.83		
N-S-Co angle	Normal	116.64	4.84	3.27	S**
	Open bite	112.53	4.84		
S-Ba-Ar angle	Normal	99.32	2.66	1.14	N*
	Open bite	96.21	3.39		

N: Nasion, S: Sella, Ba: Basion, Po: Porion, Co: Condylion, Ar: Articular, Length: in millimeter, Angle: in degree, N*: No significance, S**: Significant at 0.05 level.

Table (5): *t*-test analysis of the cranial parameters of female normal occlusion and open bite cases.

Variables	Occlusion	Mean	S.D	t-test	Significance
N-S length	Normal	67.44	3.22	1.32	N*
	Open bite	66.51	3.42		
S-Ba length	Normal	43.38	3.45	1.18	N*
	Open bite	42.45	3.26		
N-Ba length	Normal	97.48	3.63	1.21	N*
	Open bite	96.45	2.32		
S-Po length	Normal	30.12	3.56	1.28	N*
	Open bite	29.19	2.62		
S-Co length	Normal	29.08	2.82	1.08	N*
	Open bite	28.15	2.82		
S-Ar length	Normal	34.32	3.12	1.06	N*
	Open bite	33.39	2.82		
N-S-Ba angle	Normal	127.39	4.35	3..23	S**
	Open bite	122.46	4.31		
N-S-Po angle	Normal	135.48	3.66	3..18	S**
	Open bite	131.55	4.31		
N-S-Co angle	Normal	113.64	3.83	0.42	N*
	Open bite	114.63	3.86		
S-Ba-Ar angle	Normal	97.88	3.37	1.26	N*
	Open bite	98.95	3.39		

N: Nasion, S: Sella, Ba: Basion, Po: Porion, Co: Condylion, Ar: Articular, Length: in millimeter, Angle: in degree, N*: No significance, S** : significant.

DISCUSSION

In normal and open bite occlusion cases, the males showed greater mean value than female, this finding is expected for the reason that males have more incremental growth duration than females. Alex F. *et al*[19] reported that the Prepubertal growth rate of elongation were considerably greater in male than female.

The comparison of the cranial parameters between the normal and open bite occlusions for males generally displayed that male had no significant difference at 0.05 level except (S-Ar, N-S-Ba, N-S-Po and N-S-Co); this could be due to the open bite that could cause certain growth modification on spheno-occipital syncondrosis that affect the above mentioned parameters.

Louis M. *et al*[20] indicated that the posterior cranial base angle has a statistically significant negative correlation to the skeletal facial angle. The linear length S-Ba demonstrated statistically negative correlations to the facial angle. Whereas the female open bite occlusion clarified that only the (N-S-Ba and N-S-Po angles) had significant decrease at 0.05 level. This finding could be due to that decrease in the upper anterior facial height which affected the posterior arm of the cranial base through the late growth stage of spheno-occepital syncondrosis.

Zuleyha *et al*[21] stated that N and Ptm points were the most variable points both in the horizontal and vertical directions along follow-up periods. The stability of S and Ptm points was somewhat questionable, especially in the long follow-up period. Efisio *et al*[22] concluded that a more acute cranial base flexion has a tendency to a more retruded maxilla.

CONCLUSIONS

The short upper anterior facial height with open bite cases have certain influence on the cranial base development especially on (S-Ar, N-S-Ba, N-S-Po, and N-S- Co).

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