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Three dimensional cephalometric measurements of craniofacial skeleton of adolescent with Class I normal occlusion in Mosul City

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ABSTRACT

The aims of the present study were to establish the cephalometric craniofacial skeletal norms of Iraqi adolescents by means of linear and angular analyses of postero–anterior and lateral cephalometric radiographs and to reveal any correlation between the variables measured.

The sample consisted of 101 Iraqi adolescents (52 males and 49 females) aged 12–15 years with Class I normal occlusion. Postero–anterior and lateral cephalometric radiographs were taken for each adolescent, and twenty cephalometric radiographic measurements (6 angular, 10 linear and 4 ratio) were determined. Skeletal comparison between males and females showed that the angle of palatal plane inclination in relation to anterior cranial base (SN–PP) was significantly higher in females whereas the gonial angle (ArGo-Me) was significantly higher in males. For linear measurements, mandibular base length (Go–Gn) showed no significant sex differences. The remaining linear measure-ments showed significant sex differences with the males having higher values. All ratios showed no significant differences between males and females.

Key Words: Three dimensional measurements, cephalometric radiograph, normal occlusion.

الخلاصة

هدف الدراسة الحالية هو إنشاء قياسات معيارية للهيكل الجمجمي– الوجهي للمراهقين العراقيين باستخدام التحليلين الخطي والزاوي للأشعة القياسية الجبهية والجانبية للرأس وإظهار أي علاقة بين المتغيرات المقاسة.

تكونت العينة من ١٠١ مراهق عراقي (٥٢ ذكر و٤٩ أنثى) بعمر يتراوح بين ١٢–١٥ سنة من ذوي الصنف الأول للإطباق الطبيعي. آخذت لكل فرد منهم أشعة قياسية جانبية وأخرى جبهية للرأس وتم تحديد ٢٠ قياسا شعاعيا (٦ زوايا و١٠ خطي و٤ نسب) وأظهرت النتائج أن الزاوية (SN–PP) اكبر معنويا لدى الإناث منها في الذكور. بينما كانت الزاوية الفكية اكبر معنويا لدى الذكور منها في الإناث . فيما يخص القياسات الخطية، لم تظهر فروق معنوية بين الجنسين فيما يخص المسافة (Go–Gn) بينما أظهرت بقية المسافات فروقاً معنوية بين الجنسين وكان الذكور يمتلكون القيم الأعلى. لم تظهر اختلافات معنوية بين الذكور والإناث فيما يخص كل النسب.

INTRODUCTION

As the facial bones grow in three dimensions, the face should be studied in its three dimensions. The transverse dimensions of the face affect the overall determinations of the dentofacial proportion as well as the balance and harmony.[1]

Postero–anterior cephalometry can provide information in cases where the degree of transverse expansion of the arches is to be measured, relapse measurement in the transverse dimension, transverse growth rate (longitudinal) and the estimation of gender differences during growth in millimeters and/or ratios.[2]

The aims of this study were to obtain data in three dimensions by the use of both lateral and postero–anterior cephalometric radiograph of craniofacial skeleton of Iraqi adolescent with class I normal occlusion in

Mosul City.

MATERIALS AND METHODS

One hundred and one subjects (52 males and 49 females) of ages ranging from 12–15 years were selected according to the following criteria:

Full set of permanent teeth in both jaws excluding third molars, bilateral Class I molar and canine relationships based on Angle classification with normal overbite and overjet (1–4 mm), mild spacing or crowding (1–2 mm), no history of orthodontic treatment, maxillofacial surgery or extensive dental treatment, All the subjects are Iraqi in origin and living in the center of Mosul City.

The Measurement techniques for the lateral cephalometric radiographs include: Eight angles are measured to the nearest half–degree. These angular measurements are:

1.SN–PP angle: The angle of palatal plane inclination in relation to anterior cranial base which is measured between SN line and palatal plane.[3]

2.SN–MP angle: The angle represents the inclination of the mandible to the anterior cranial base.[4]

3.SNA angle: Inward angle toward the cranium, is formed by the intersection of SN and NA lines. It indicates the antero–posterior position of the maxilla in relation to the anterior cranial base.[5]

4.SNB angle: Inward angle toward the cranium, is formed by the intersection of SN and NB lines. It indicates the antero–posterior position of the mandible in relation to the anterior cranial base.[4]

5.NSBa angle: The anterior inferior angle, is formed by the intersection of SN and SBa lines. It indicates the configuration of the cranial base.[6]

6.ArGoMe (Gonial) angle: Is the angle between the posterior border of the ramus (Ar–Go) and lower border of the mandible (Go–Me). It expresses the form of the mandible and plays a role in growth prognosis.[7]

For the linear measurements, ten linear measurements are recorded to the nearest half–millimeter including:

1.Anterior facial height (N–Me): A vertical distance between point N and point Me.[8]

2.Posterior facial height (S–Go): A vertical distance between point S and point Go.[9]

3.S–N: The antero–posterior extent of the anterior cranial base.[10]

4.ANS–PNS: The extent of maxillary length.[11]

5.Go–Gn: The extent of mandibular base, it is the distance between point gonion to point gnathion.[12]

For the ratio, one ratio is measured; PFH/AFH, the ratio between the posterior and anterior facial height.[13]

While the measurement technique for the postero–anterior cephalometric radiographs, the linear measurements included:

1.GL–GL: Represents the width of the anterior cranial base, measured from left GL to right GL.[14]

2.Zy–Zy: Represents the facial width or interzygomatic distance, measured from left ZY to right ZY.[14, 15]

3.Lp–Lp: The transverse distance between lateral poles of the left and right condyles.[16, 17]

4.J–J: Represents the maxillary width, measured from left J to right J.[11, 15]

5.Go–Go: Represents the mandibular width, measured from left Go to right Go.[14, 18]

For the ratios, they included:

1.GL–GL/Zy–Zy: The ratio between the width of the anterior cranial base and the interzygomatic distance.

2.Nc–Nc/Zy–Zy: The ratio between nasal width and the interzygomatic distance.

3.J–J/Zy–Zy: The ratio between the maxillary width and the interzygomatic distance.

All the data were analyzed using Statistical Package for Social Sciences (SPSS) program loaded on Pentium IV computer. The statistical analyses used included: Descriptive statistics (mean, range and standard deviation) for all angular, linear and ratio measurements, and the significant differences of means between males and females were determined by using F–test at 5% level of significance.

RESULTS

Lateral Cephalometric Measurements

The results of angular measurements (Table 1) in this study indicated that females possessed higher value of the angle SN–PP with significant differences between males and females. While the males demonstrated larger gonial angle (ArGo-Me) than females. Concerning other angles, no significant differences exist between the males and the females. For the linear measurements (Table 2), the males possessed significantly higher values for all linear measurements except mandibular base length that showed no significant differences between the two sexes. For the ratios (Table 3), the comparison of ratio measurements between males and females indicated that there were no significant differences between the two sexes.

Table (1): descriptive statistics for angular measurements of the total sample with comparison between males and females (Lateral cephalometric measurements)

Variable*	Total Mean	±SD	Sex	Mean	±SD	Min	Max	F–value	Significance
SN–PP	6.99	3.35	M	6.25	3.15	–2.50	13.00	5.31	S
			F	7.76	3.40	0.00	13.50		
SN–MP	30.17	5.17	M	30.63	5.61	18.00	40.50	0.83	NS
			F	26.69	4.66	20.00	41.00		
SNA	81.37	3.53	M	80.90	3.73	74.00	93.00	1.89	NS
			F	81.86	3.27	74.00	91.00		
SNB	79.08	3.66	M	78.48	3.88	71.00	90.00	2.95	NS
			F	79.72	3.33	73.00	89.00		
NSBa	129.91	5.64	M	130.11	6.45	117.00	145.00	0.13	NS
			F	129.69	4.69	119.00	143.00		

M= Males (n= 52); F= Females (n= 49).
SD= Standard deviation; Min= Minimum values; Max= Maximum values.
NS= Not significant ($p > 0.05$), S= Significant ($p \leq 0.05$).
*Variables were measured in degrees.

Table (2): descriptive statistics for linear measurements of the total sample with comparison between males and females (Lateral cephalometric measurements)

Variable*	Total Mean	±SD	Sex	Mean	±SD	Min	Max	F–value	Significance
N–Me	124.70	6.45	M	126.78	6.61	115.00	142.00	12.38	S
			F	122.50	5.54	109.00	132.50		
S–Go	82.16	5.82	M	83.40	6.30	69.50	101.50	5.06	S
			F	80.84	4.99	69.00	91.00		
S–N	75.17	3.65	M	76.79	3.44	70.00	87.00	26.63	S
			F	73.44	3.04	66.00	80.00		
ANS–PNS	54.93	3.99	M	56.63	3.72	50.00	65.00	23.76	S
			F	53.13	3.48	45.00	60.00		
Go–Gn	81.56	5.24	M	81.97	6.00	68.50	96.00	0.62	NS
			F	81.14	4.32	70.50	91.00		

M= Males (n=52); F= Females (n= 49).
SD= Standard deviation; Min= Minimum values; Max= Maximum values.
NS= Not significant ($p > 0.05$), S= 3 *Variables were measured in millimeters.

Table (3): descriptive statistics for ratios of the total sample with comparison between males and females (Lateral cephalometric measurements)

Variable	Total Mean	±SD	Sex*	Mean	±SD	Min	Max	F–value	Significance
$\frac{S–Go}{N–Me}$	0.659	0.039	M	0.658	0.043	0.57	0.77	0.071	NS
			F	0.660	0.034	0.58	0.73		

M= Males (n= 52); F= Females (n= 49).
SD= Standard deviation; Min= Minimum values; Max= Maximum values.
NS= Not significant ($p > 0.05$).

Postero–anterior Cephalometric Measurements

The comparison of linear measurements between males and females (Table 4) indicated that the males, in general, were significantly larger than females in all linear measurements. Concerning the ratios (Table 5), the results indicated that there was no significant differences existed between the male and female groups.

Table (4): descriptive statistics for transversal linear measurements of the total sample with comparison between males and females

Variable*	Total Mean	$\pm$SD	Sex	Mean	$\pm$SD	Min	Max	F–value	Significance
GL–GL	102.75	4.66	M	104.89	4.35	99.00	117.00	28.92	S
			F	100.47	3.86	92.00	107.00		
Zy–Zy	136.35	5.85	M	138.67	4.90	128.00	151.00	20.06	S
			F	133.88	5.81	120.50	149.00		
Lp–Lp	128.80	5.92	M	130.77	5.38	120.00	145.00	13.43	S
			F	126.70	5.78	113.00	139.00		
J–J	67.83	3.77	M	68.96	3.74	58.00	78.00	10.53	S
			F	66.63	3.45	58.50	72.00		
Go–Go	99.40	5.33	M	101.37	5.71	89.00	117.00	17.05	S
			F	97.30	3.97	86.00	105.00		

M= Males (n= 52); F= Females (n= 49).
SD= Standard deviation; Min= Minimum values; Max= Maximum values.
Significant ($p \leq 0.05$).
*Variables were measured in millimeters.

Table (5): descriptive statistics for ratios of the total sample with comparison between males and females (Postero–anterior cephalometric measurements)

Variable	Total Mean	$\pm$SD	Sex	Mean	$\pm$SD	Min	Max	F–value	Significance
GL–GL / Zy–Zy	0.754	0.030	M	0.757	0.034	0.703	0.826	0.988	NS
			F	0.751	0.025	0.664	0.810		
Nc–Nc / Zy–Zy	0.247	0.017	M	0.247	0.017	0.221	0.304	0.001	NS
			F	0.247	0.017	0.215	0.285		
J–J / Zy–Zy	0.497	0.023	M	0.497	0.023	0.417	0.573	0.019	NS
			F	0.498	0.024	0.437	0.552		
J–J / AG–AG	0.772	0.045	M	0.775	0.046	0.656	0.896	0.408	NS
			F	0.769	0.044	0.668	0.845		

M= Males (n= 52); F= Females (n= 49).
SD= Standard deviation; Min= Minimum values; Max= Maximum values.
NS= Not significant ($p > 0.05$).

DISCUSSION

Lateral Cephalometric Measurements

The angular measurements in this study showed that there was significant sex differences seen in the SN–PP angle with the females having higher value, while Woodworth *et al.*,[19] on their study on Northwest European sample, concluded that the females have higher value than males in regard to this angle but statistically not significant. The SN–MP angle in this study showed no significant differences between both sexes with the males having higher value. This result comes in agreement with the result of Bishara and Fernandez [20] and Bishara *et al*.[21] This study showed no significant differences between males and females in regard to SNA angle with the females having the larger value. This comes in agreement with the results of Woodworth [19] and Afifi.[22] The SNB angle showed no significant sex difference with the females having the larger value which comes in agreement with Argyropoulos and Sassouni[23] and Bishara *et al*.[24] The cranial base angle (NSBa) showed no significant sex differences that come in agreement with the result obtained by Lewis and Roche.[25] The gonial angle (ArGoMe) mean value showed significant sex difference with the males having higher value and thus indicating a tendency to a more posterior growth rotation in males. This comes in contrast to that obtained by Sinclair and Little.[9] The linear measurements in this study showed that there was a significant difference in the total anterior facial height between the two sexes with the males having the larger value which come in agreement with the results obtained by Woodworth *et al*.,[19] Bishara and Fernandez,[20] and Bishara *et al*.[24] The posterior facial height in this study showed statistically significant sex differences with the males having higher value. This finding comes in agreement with Sinclair and Little,[9] Bishara *et al*.[24] and Bishara *et al*.[26] The anterior cranial base length (S–N) mean value showed significantly sex differen-ces with the males having higher value. This comes in accordance with Afifi[22] and Taylor *et al*.[27] A Significant differen-ce was seen between the two sexes for the maxillary base length with the males hav-ing the larger values. This comes in accor-dance with Woodworth *et al*.[19] and Taylor *et al*.[27] For ratios, the antero–posterior plane (Ba–A/Ba–N and Ba–S/Ba–N) sho-wed no significant sex differences. The ratio of middle face depth to cranial base length was nearly similar to that of Chris-tie.[15] While the ratio of posterior cranial base to cranial base depth in this study was slightly higher than that of Christie.[15] No significant sex difference was seen betw-een both sexes for PFH/AFH ratio, which comes in agreement with that of Bishara *et al*.[24]

Postero–anterior Cephalometric Measurements

For the linear measurements, the widths of the anterior cranial base showed statistically sex differences with the males having higher value. This comes in agreement with Basyouni and Nanda.[1] The facial width showed significant sex differences with the males having higher value. This comes in agreement with the result obtained by Woods.[28] A significant sex difference was shown in regard to maxillary width with the males having higher value. This comes in agreement with Basyouni and Nanda[1] and Snodell *et al*.[29] The bigonial width was significantly higher in males than in females. This comes in accordance with Basyouni and Nanda[1] and Woods.[28] For the ratios, as the bizygomatic distance is the largest measurements, so that three transversal measurements were taken in proportion to it and showed no significant sex differences between both sexes indicating the presence of harmonious growth between males and females.

CONCLUSIONS

Three–dimensional craniofacial skele-tal data for Iraqi adolescents with normal class I occlusion in Mosul City were obt-ained using lateral and postero–anterior cephalographs.

There was a significant difference in SN–PP and gonial angles between males and females with the greater values for the females in the former angle and for the males in the later one. Other angles showed no significant differences between both sexes.

All linear measurements were significantly larger in males than in females, mandibular base length showed no significant sex differences.

For the ratios, no significant sex differences were seen between males and females, which indicated relatively harmonious ratios between each gender face.

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