Normal Craniofacial Features of Saudi Boys in Western and Central Regions

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Abstract. Previous cephalometric studies among Saudi boys in both the western and central regions have shown discrepancies in craniofacial features. The purpose of the study was to compare normal craniofacial cephalometric features for Saudi boys living in both regions. Standard lateral skull cephalometric radiographs of 40 Saudi boys living in the western region and 35 Saudi boys living in the central region were randomly selected. The age range was from 10-12 years old. The subjects were classified as normal occlusion with Class I skeletal relationship, competent lips and acceptable profile with no previous orthodontic treatment. Modified Steiner's method of analysis was used to establish cephalometric comparison. Mean values, standard deviations, and independent t-test were used to compare the two samples. Results: western region boys have a steeper mandibular plane angle (37.7°) than boys in the central region (33.9°); significant at $p < 0.001$. Western region boys have more reclined and retruded upper incisors (103.9°, 23.6° and 4.38 mm) than central region boys (108.3°, 26.9° and 5.6mm); significant at $p < 0.0001$, $p < 0.05$ and $p < 0.05$, respectively. Saudi boys in both regions have similar craniofacial features, except that western region boys show steeper mandibular plane angle and reclined and retruded upper incisors.

Keywords: Normal craniofacial cephalometric features, Saudi boys, Comparison.

Introduction

Few cephalometric studies conducted among Saudis showed discrepancies in the results; especially in boys[1-3]. However, these previous studies have shown that Saudis have distinct craniofacial features as compared to Caucasians. Sarhan and Nashashibi[1] compared cephalometric radiographs of Saudi boys living in Riyadh (9 to 12 years) with a similar British sample. They found that Saudi boys have slightly more prognathic faces, more protruded incisors and low Gonial and saddle angles. Using the same sample, Nashashibi *et al.*[2] studied the norms of Saudi boys in Riyadh and observed that they have bimaxillary dental protrusion and more anterior position of maxillary apical base as compared to Caucasians. This was also found by Jones[3] and confirmed by Hassan[4] who carried out a study on normal Saudi children and reported that they tend to have an increased skeletal jaw discrepancy in antero-posterior plane ANB° = (4.10 ± 1.7), more convex profile (NA-APog° = (7.70 ± 4.5) and a steeper mandibular plane (37.2 ± 5.00) compared to Caucasians. In addition, he reported that upper and lower incisors are more proclined and more protruded in Saudi children compared to European, American and Caucasians[5].

The null hypotheses have no differences between Saudi boys living in the Western region (WR) and Saudi boys living in the Central region (CR) with regard to craniofacial cephalometric features of normal occlusion[6-8]. The aim of the present study was to compare normal craniofacial cephalometric features of these boys living in the WR with their counterparts living in the CR.

Materials and Methods

The Ethical Committee of the Faculty of Dentistry, King Abdulaziz University (KAU), approved this study. Forty lateral cephalometric radiographs of Saudi boys living in the WR with age range 10-12 years old were randomly selected from dental records at the Faculty of Dentistry, KAU, Jeddah. This data was previously used by Hassan[4]. Thirty-five lateral cephalometric radiographs of Saudi boys living in the CR were collected from dental patients visiting the College of Dentistry, King Saud University (KSU), Riyadh.

Criteria: The subjects had acceptable profiles, competent lips, minimum overbite and overjet, no or minimal crowding or spacing < 2 mm, normal transverse and vertical relationships and Class I skeletal and normal dental pattern[6] with no previous orthodontic treatment. All selected subjects were male Saudis living in both regions. The cephalostat used for both groups was ″Siemens E10 Orthopantomograph″, where X-ray source to the subjects' midsagittal plane was 5 feet. The distance from midsagittal plane to the cassette was 15 cm. Each cephalometric radiograph was traced onto a sheet of acetate paper using 0.3 mm tracing pencil. Cephalometric landmarks were located, identified and marked. Seventeen angular and linear measurements (Steiner modified[7-9]) were chosen, traced and analyzed for the two groups (Fig. 1 and Table 1). The mean value, standard deviation of each variable was calculated using Statistical Package for the Social Sciences Inc. (SPSS) Version 10 (Chicago, IL). Independent sample *t*-tests were used to compare the two groups.
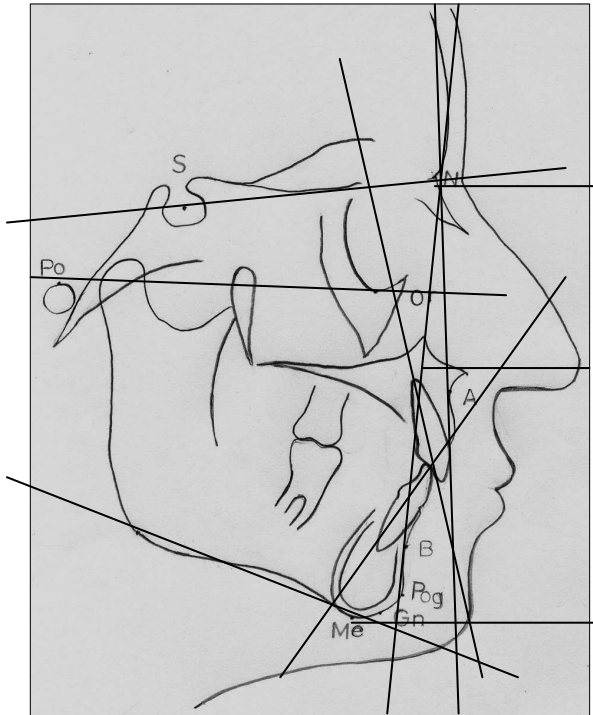

Fig. 1. Cephalometric landmarks – linear angular measurement.

Table 1. List of variables used and Intra-examiner error of the 17 variables.

No.	Variable	Variable definition	Dahlberg (Me)
1	NPg-FH°	The facial angle: Intersection between nasion-pogonion and Frankfort horizontal plane.	0.81
2	NPg-SN°	The facial angle: Intersection between nasion-pogonion and sella-nasion plane.	0.73
3	SNA°	The antero-posterior relation of maxillary apical base to anterior cranial base.	0.56
4	SNB°	The antero-posterior relation of mandibular apical base to anterior cranial base.	0.55
5	ANB°	The discrepancy between maxillary and mandibular apical base in anteroposterior plane.	0.39
6	NA-APg°	Angle of convexity of the face.	0.68
7	GoGn-SN°	Mandibular plane angle to the anterior cranial base.	0.61
8	SGn-FH°(Y axis)	Intersection of sella-gnathion and Frankfort horizontal plane.	0.49
9	U1-SN°	Intersection of the long axis of the upper central incisor to anterior cranial base.	0.42
10	U1-NA°	Upper incisor to Nasion-Subspinale line (in degrees.)	0.46
11	U1-NAmm	Upper incisor to Nasion-Subspinale line (in millimeter).	0.35
12	U1-L1°	Inter-incisal angle at junction of the long axis of upper central incisor to lower central incisor.	0.51
13	L1-MP°	Intersection of the long axis of the lower central incisor to Go-Gn plane.	0.45
14	L1-NB°	Angular measured at intersection of long axis of lower central incisor with NB plane.	0.47
15	L1-NBmm	Linear distance measured in millimeter from the incisal edge of lower central incisor perpendicular to NB plane.	0.31
16	Pg-NBmm	Linear distance measured in millimeter from the pogonion of the chin perpendicular to NB plane.	0.34
17	LFH%	Percentage of lower face height: Anterior nasal spine-Menton mm related to Nasion-Menton mm X100.	0.38

To assess intra-examiner tracing errors, 10 lateral cephalometric radiographs were retraced and re-measured with an interval of two

weeks. The level of significance was at 5%. The error of the method was calculated using Dahlberg's formula of error = $\sqrt{\sum (d^1 - d^2)^2 / 2N}$. The maximum error in linear measurements was 0.38 mm. and the minimum was 0.31 mm. The maximum error for the variables in angular measurement was 0.81° and the minimum was 0.42° (see Table 1).

Results

Table 2 presents the mean values of each variable, and the *t*-values and the p value for each variable between the two groups. In addition, the results revealed that there were no significant differences between the two groups in 80% of the variables. Boys living in the WR scored steeper mandibular plane angles (GoGn-SN° = 37.7°) as compared to those living in the CR (GoGn-SN° = 33.9°) p < 0.001. Moreover, the results showed that boys in the WR demonstrated more retroclined and retruded upper incisors (U1-SN° = 103.9°, U1-NA° = 23.6°, and U1-NA mm = 4.38 mm) compared to boys in the CR where they scored (U1-SN° = 108.3°, U1-NA° = 26.9° and U1-NA mm = 5.6 mm). The p-values were significant at p < 0.0001, p < 0.05 and p < 0.05, respectively. In addition, results revealed that the boys of WR had relatively higher mean value than boys of CR in lower face height (LFH = 55% *vs.* 54%), angle of convexity (NA-APog = 8° *vs.* 7°) and axial inclination of lower incisor (L1-NB° = 31° *vs.* 28°) p > 0.05. While SNB value was marginally lower in WR boys than CR boys (76° *vs.* 77°) with p > 0.05.

Table 2. Mean, standard deviation, *t*-value and p-value for central and western region.

Variables	Central region Boys N = 35		Western region Boys N = 40		Comparison		
	Mean	SD	Mean	SD	T	p	Sig.
NPog-FH°	86.3929	2.657	86.494	3.392	−0.120	0.905	NS
NPog-SN°	77.6071	2.935	76.446	3.317	1.689	0.096	NS
SNA°	80.3929	2.501	80.250	4.226	0.175	0.861	NS
SNB°	76.9643	1.551	76.026	3.517	1.367	0.176	NS
ANB°	3.4643	7.526	4.218	2.024	−1.839	0.070	NS
NA-APog°	6.8571	4.700	8.180	5.129	−0.829	0.412	NS
GoGn-SN°	33.8929	3.496	37.676	3.803	−3.643	0.001	†
SGn SN°	68.7500	3.667	69.212	3.161	−0.560	0.578	NS
U1-SN°	108.3214	4.513	103.938	5.838	3.6992	0.000	‡

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Table 2. Contd.

Variables	Central region Boys N = 35		Western region Boys N = 40		Comparison		
	Mean	SD	Mean	SD	T	p	Sig.
U1-NA°	26.8929	5.432	23.684	6.488	2.331	0.023	*
U1-NAmm	5.6786	2.109	4.382	2.976	2.237	0.028	*
U1-L1°	121.8214	8.250	121.168	10.969	0.297	0.767	NS
L1-MP°	96.8210	5.722	97.238	7.717	–0.271	0.787	NS
L1-NB°	28.1786	4.578	31.034	5.233	–1.968	0.053	NS
L1-NBmm	6.1071	1.617	6.286	1.677	–0.462	0.646	NS
Pog-NBmm	1.3214	1.334	0.871	1.097	1.459	0.151	NS
LFH%	54.33%	2.656	54.794	2.718	–0.719	0.475	NS

(NS = Not significant, *p < 0.05; †p < 0.001; and ‡p < 0.0001)

Discussion

The present study was the first to compare craniofacial cephalometric features of boys living in the main two regions of Saudi Arabia (the CR and the WR). The boys living in the WR are characterized by their multi-ethnicity due to the immigration of Arabs and Muslims (Caucasian, Africans, Indians and Indonesians) from all over the world since the early Islamic period. This is not common in the CR of Saudi Arabia. The results of the present study, demonstrated that 13 variables out of 17 showed no differences between the two groups; the remaining 4 variables showed different levels of significance. This could be attributed to the settlement of different races and their intermarriages with native Arabs, which may influence the mandibular ramal height. The results of this study showed that Saudi boys living in the WR have a steeper mandibular plane angle (GoGn-SN) when compared to those living in the CR. This is in agreement with the study of Nashashibi *et al.*[2], in which the mandibular plane angle was (33.8°) compared well to the present study (33.9°) for the CR sample. While for the WR sample (GoGn-SN) the angle was (37.67°) which is high compared to Nashashibi *et al.*[2]. In contrast, Hassan[4] found that this angle was (38.0°), confirming the finding of this study. This is an important point since the steepness of the mandibular plane represents a critical variable in facial height to be considered during orthodontic diagnosis and

treatment planning. In addition, the increase in mandibular plane angle may reflect the slight increase in lower face height of WR children.

With regard to upper incisor to SN (U1-SN°), upper incisor to NA angle (U1-NA°) and upper incisor to NA distance (U1-NA mm), these parameters showed significant differences when compared to the CR sample ($p < 0.0001$, $p < 0.05$ and $p < 0.05$), respectively. The (U1-SN°) variable was in agreement compared to the study of Hassan[4]. However, the values of the U1-SN° and U1- NA mm were lower than Nashashibi *et al*.[2], which confirm the findings of the present study, that the WR boys have more retrusive and retroclined upper incisors than the boys of the CR.

Furthermore, when comparing the result of the present study of WR boys to previous studies carried out in cephalometric normal values of other ethnic groups, the mandibular plane angle is lower than that of African Americans[10,11], but it is higher than Caucasian Americans[8,9] the Japanese[12] and Iranians[13]. The upper incisor angle (U1-NA°) and upper incisor distance (U1-NA mm) were lower than that of African Americans[10,11], Japanese[12], and Iranians[13], and more than that of Caucasian Americans[8,9]. However, the recent studies on cephalometric norms confirmed the significant racial differences. Furthermore, these differences may be apparent within the same ethnic group[5,14-16]. In view of that, the current study confirms that conclusion; therefore, the results of the present study are of great help to orthodontists in diagnosis and treatment planning. Notably, some variables had some discrepancies, but with no statistically significant differences between the two groups. However, this may be crucial in diagnosis and treatment planning. The WR boys', however, had a relatively higher mean value of lower facial height (LFH = 55% *vs*. 54%) and this difference may be the result of the increased mandibular plane angle and the percentage value of LFH in both groups which are very low compared to Caucasians[5,16].

Axial inclination of the lower incisor (L1-NB = 31° *vs*. 28°) was comparable to that of Japanese[12] and Iranians[13], and higher than Caucasians[14]. The SNB angle was marginally lower than the CR group (76° *vs*. 77°) and comparable to the Japanese[12,14], but lower than that of Caucasians and African Americans[14-16], indicating a recessive mandible among the WR and CR groups.

Conclusion

In conclusion, boys living in the WR have almost similar craniofacial features to those living in the CR of Saudi Arabia with the exception of a steeper mandibular plane and more retroclined and retruded upper incisors. A further study with a larger sample is required to include normal craniofacial features of other regions of Saudi Arabia to verify possible cephalometric variation within normal craniofacial features.

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دراسة إشعاعية سيفالومترية للمركب القحفي الوجهي للأولاد السعوديين في كل من المنطقتين الوسطى والغربية

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المستخلص. أوضحت الدراسات السابقة للقياسات الشكلية للمركب القحفي الوجهي على عينة طبيعية من الأولاد السعوديين فروقات واضحة في كل من المنطقتين الغربية والوسطى.

والغرض من هذه الدراسة هو إجراء مقارنة بين بعض تلك القياسات في فئة عمرية عند إعداد الخطة العلاجية للمريض.

تم اختيار وقياس خمس وثلاثين صورة إشعاعية للمنطقة الوسطى، وأربعين صورة إشعاعية للمنطقة الغربية، تتراوح أعمارهم بين ١٠–١٢ سنة من ذوي الإطباق السني والعظمي الأول. أظهرت نتيجة الدراسة أن الفك السفلي أكثر انحدارًا، بالإضافة إلى رجوع في ميلان القواطع الأمامية في أولاد المنطقة الغربية، مقارنة بأولاد المنطقة الوسطى.

دلت الدراسة أيضًا على أن المركب القحفي الوجهي للأولاد السعوديين بالمنطقة الغربية والوسطى متشابهان تقريبًا، عدا تميز أولاد المنطقة الغربية بزيادة زاوية انحدار الفك السفلي، وميلان أقل للقواطع الأمامية عن نظرائهم في المنطقة الوسطى.