Cephalometric evaluation of craniofacial variation in normal Saudi population according to Steiner analysis

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ABSTRACT

Objective: The objective of this study was to describe the craniofacial pattern of Saudi ethnic groups and to compare it with accepted standards for the caucasian population according to Steiner analysis.

Methods: Lateral cephalometric radiographs of 87 Saudi students (74 male and 13 females) with balanced harmonious faces and clinically acceptable permanent occlusion, aged 21-27 years old were used. A computer-aided cephalometric analysis was performed, and the mean values and standard deviations for the various cephalometric variables were obtained.

Results: A comparison of the results with the Steiner standards showed that the Saudis have relatively similar skeletal relationship and dentally there was a tendency toward bimaxillary protrusion. Further, there was a decrease in the lower facial height.

Conclusion: It was evident that even in the Saudi ethnic groups with so-called well-balanced faces, there were some fundamental variations in the craniofacial structure of the Saudi Arab when compared with Steiner norms.

Keywords: Cephalometric evaluation, population, Steiner analysis, ethnic variation.

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As Ricketts pointed out, a society must already enjoy the basic necessities of life such as food and shelter before it can consider provisions for art, beauty and comfort.[1] With increased communication and the desire for social acceptance, interest has increasingly become focused on the face and the jaws. As a result, physical anthropology as a scientific discipline has emerged to study the human face form. In classical anthropometry, the use of cephalometric studies was introduced,[2] and is today being constantly used in the evaluation of craniofacial variations.[3-9] Several researchers[3-7] developed cephalometric standards for an "ideal" face or occlusion; but their samples consisted solely of white North Americans. Then it became apparent that craniofacial variations occur among individuals of different racial origin. If these differences are to be properly studied and understood, their cephalometric standards must be known and adhered to. Consequently, cephalometric standards were gradually established for different racial groups, and it was indeed found that there was no universal cephalometric standard; but that cephalometric norms differ for different ethnic groups. In this way, a workable clinical cephalometric analysis can be utilized to define a beautiful or normal face in a population. Results of the evaluation may depend on the racial group being examined and on the

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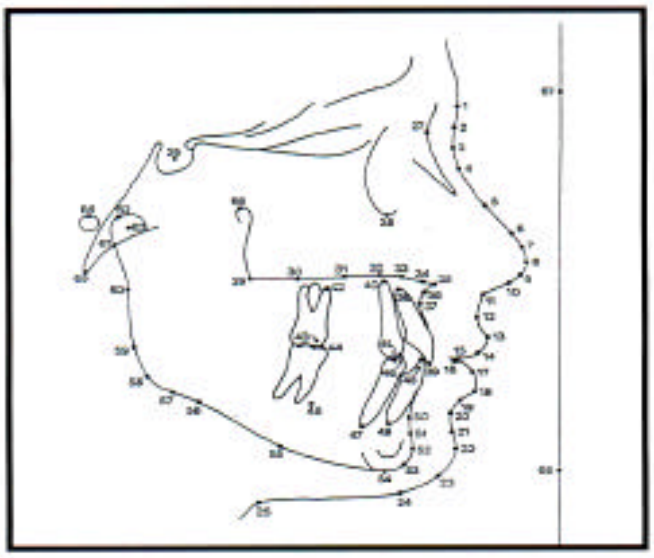


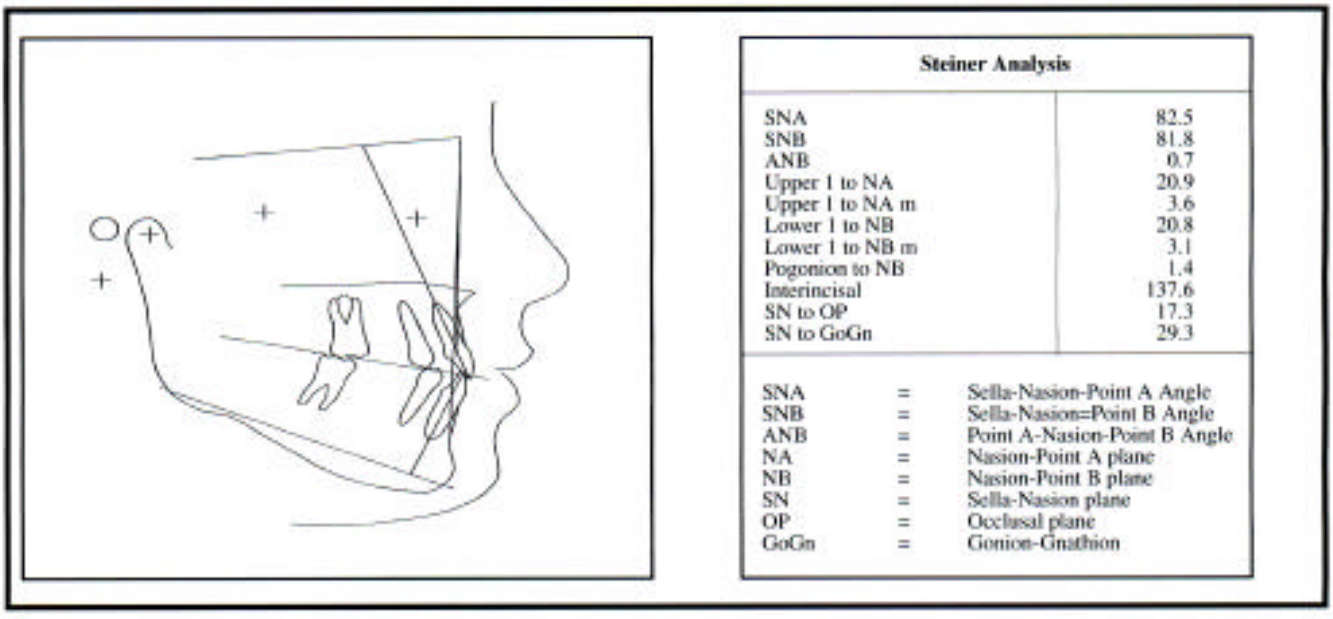
Figure 1 - Reference points used in the present study. These are predefined digitizing regimen for the landmarks, planes and angles measured in the selected Saudi students using the Dentofacial Planner™ Plus.

researcher. Several investigations have been carried out for various racial sub-groups, and information concerning cephalometric findings in the Caucasian,[5] Japanese,[10-11] Chinese,[12-13] African Americans[9,14,15] and Nigerians[16] is available.

Many procedures performed on the face today rely on these established standards. There is paucity of such standards for the Saudi population. Within each racial group there is a balance of facial features that are considered pleasing[17] and people seem to share a common basis for aesthetic judgment regardless of nationality, age, sex or occupation.[18,19]

Al-Yami[20] has described various methods of measuring facial aesthetics and has pointed out that these seem to be subjective measurements that depend on many variables. There does not appear to be any one method that completely removes subjectivity. The cephalometric measurements may reduce subjectivity in the assessment of the aesthetically pleasing face, or indeed of the need for orthodontic surgical intervention. Interventions on the jaws and facial skeleton can alter the facial appearance. With the increasing number of Saudis seeking professional treatment from orthodontists, maxillofacial surgeons or plastic and reconstructive surgeons, it has become apparent that there is the need to determine what constitutes a pleasing or normal face for the Saudi population. A comprehensive and accurate diagnostic assessment of any orthodontic patient involves the comparison of the patient's cephalometric findings with the norms of his or her ethnic groups. Treatment plans and clinical procedure should not be freely switched without consideration of the racial group involved and without thorough understanding of the differences between races and their ranges of normal. Therefore, the purpose of the present study was to describe the cephalometric data of a selected Saudi population, using the Steiner[6] analysis, and to compare the data obtained with standards established for a white North American population by Steiner.

Methods. Eighty seven Saudi dental students (74 males and 13 females) were selected according to the



Steiner Analysis

SNA	82.5
SNB	81.8
ANB	0.7
Upper 1 to NA	20.9
Upper 1 to NA m	3.6
Lower 1 to NB	20.8
Lower 1 to NB m	3.1
Pogonion to NB	1.4
Interincisal	137.6
SN to OP	17.3
SN to GoGn	29.3

SNA	=	Sella-Nasion-Point A Angle
SNB	=	Sella-Nasion=Point B Angle
ANB	=	Point A-Nasion-Point B Angle
NA	=	Nasion-Point A plane
NB	=	Nasion-Point B plane
SN	=	Sella-Nasion plane
OP	=	Occlusal plane
GoGn	=	Gonion-Gnathion

Figure 2 - Example of printout of a tracing for one of the students showing the values obtained compared to Steiner norms for each value.

Table 1 - Means, standard deviations and minimum and maximum for cephalometric values for the Saudi students.

Present Study					
Parameters	**N**	**Minimum**	**Maximum**	**Mean**	**Standard Deviation**
SNA	87	75.1	95.9	82.702	3.969
SNB	87	69.0	89.3	79.824	3.614
ANB	87	-0.3	9.5	2.877	1.895
Upper 1 to NA	87	10.4	41.0	23.621	5.400
Upper 1 to NA m	87	-0.7	14.6	4.871	2.533
Lower 1 to NB	87	12.7	39.1	28.298	5.033
Lower 1 to NB m	87	-0.8	14.0	5.783	2.590
Interincisal	87	107.8	144.2	125.289	7.908
NS to OP	87	2.4	28.7	14.039	5.666
SN to GoGn	87	16.5	42.0	30.451	4.732

SNA = Sella-Nasion-Point A angle; SNB = Sella-Nasion-Point B angle; ANB = Point A-Nasion-Point B angle; NA = Nasion-Point A plane; NB = Nasion-Point B plane; SN = Sella-Nasion plane; GoGn = Gonion-Gnathion; NS = Nasion=Sella; OP = Occlusal plane

following criteria: 1) Have pleasing and harmonious face. 2) Age 21 to 27 years old. 3) Angle class I molar relationship. 4) All permanent teeth present. 5) No history of orthodontic treatment. A cephalometric radiograph was taken for each of the participants in a standard position with the teeth in centric position and with lips relaxed. These were taken on a Broadbent Bolton cephalometer at the College of Dentistry of the King Saud University in Riyadh, Saudi Arabia. Study casts were made for each subject. The radiographs were then digitized using the Dentofacial Planner in the Dental College. A total of 68 landmarks were digitized for each individual by means of an electronic cursor and the data passed into the computer (Figure 1). A print out was then prepared for each tracing which reproduced the traced points according to Steiner analysis (Figure 2). The data from the 87 students were statistically analyzed to obtain the mean values, range, standard deviation. There was no separation into sexes since the number of female students, thirteen (15%) was low in comparison to the 74 (85%) male students.

Results. The means, standard deviations, minimum and maximum values, for the 87 Saudi students were shown in Table 1. Table 2 presents the comparison between the result of the present study and Steiner result.

Table 2 - Comparison between the present study result and Steiner study.

Present Study						Steiner Study		
Parameters	**N**	**Minimum**	**Maximum**	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**	**p - value**
SNA	87	75.1	95.9	82.702	3.969	82.01°	3.89	NS
SNB	87	69.0	89.3	79.824	3.614	79.97°	3.60	NS
ANB	87	-0.3	9.5	2.877	1.895	2.04°	1.81	NS
Upper 1 to NA	87	10.4	41.0	23.621	5.400	22.0°	-	**
Upper 1 to NA m	87	-0.7	14.6	4.871	2.533	4mm	-	**
Lower 1 to NB	87	12.7	39.1	28.298	5.033	25.0°	-	****
Lower 1 to NB m	87	-0.8	14.0	5.783	2.590	4mm	-	****
Interincisal	87	107.8	144.2	125.289	7.908	127.0°	-	*
NS to OP	87	2.4	28.7	14.039	5.666	14.0°	-	NS
SN to GoGn	87	16.5	42.0	30.451	4.732	31.73°	5.19	*

SNA = Sella-Nasion-Point A angle; SNB = Sella-Nasion-Point B angle; ANB = Point A-Nasion-Point B angle; NA = Nasion-Point A plane; NB = Nasion-Point B plane; SN = Sella-Nasion plane; GoGn = Gonion-Gnathion; NS = Nasion=Sella; OP = Occlusal plane
* = $p < 0.05$; ** = $p < 0.01$; *** = $p < 0.001$; **** = $p < 0.0001$

Discussion. Several statistically significant differences were noticeable in the result of the present study when the cephalometric mean values for the selected Saudi population were compared to the norms suggested for the white Caucasian population by Steiner.[6] The angular norm values found in the current investigation have several clinical implications.

The result of the present study showed that the Saudis have slightly high mean value but not statistically significant for Sella-Nasion-Point A angle (SNA) while the Sella-Nasion-Point B angles (SNB) was relatively similar to the mean value reported by Steiner.[6,21] Also, the same was observed for the Point A-Nasion-Point B angle (ANB) (the inclination of the occlusal plane to cranial base (NS-OP) and Nasion-Sella (NS) to Occlusal plane (OP). However, the upper incisors to NA (Nasion-Point A plane) line and the lower incisor to NB (Nasion-Point B plane) line indicates a bimaxillary protrusion with a decreased inter-incisal angle. The lower jaw inclination indicates that there was slightly anteriorly inclined mandible than the Steiner value. The result of the present study was in agreement with the result obtained by Shalhoub et al[22] who did a study among adult Saudi males and females and compared his result with the American White. Also the result of the present study is in agreement with what Barakati[23] reported and in partial agreement with the result obtained by Nashashibi et al[24] in Saudi population.

It must be pointed out that there are certain limitations arising from the method of sample selection of the present study. Although the selection has been made from university students coming from all regions of the Kingdom of Saudi Arabia and thereby encompassing the entire ethnic groups; the data from these selected individuals provide information on cephalometric values of so-called well-balanced faces. However, the selection is subjective, and depends on the researcher. Nevertheless, such data is still valuable in orthodontic diagnosis and treatment planning, especially with the present-day increase in the numbers of Saudis seeking orthodontic care or surgical correction of their jaw anomalies. It must not be regarded as a numbers game in which angles must conform to an "ideal" norm, as it is not practical, neither is it wise to subject every individual to one set of measurements. The data reported in the present study were the findings based on cephalometric computer-generated analysis. They are descriptive and cannot be interpreted to indicate any biological craniofacial variation. As any other cephalometric analysis of skeletal, dental and soft tissues, they merely add to the diagnostic armamentarium in diagnosis and treatment of dentofacial deformities. To obtain a complete clinical judgment they should be correlated with study models, photographs and visual impressions. The results of the present study urge for further investigation where a large sample from the different parts of the Kingdom drawn. Such an investigation will help in providing solid and strong conclusions which will be of great help in diagnosis and treatment planning.

In view of the findings of the current study, it was evident that even in the Saudi ethnic groups with so-called well-balanced faces, there are some fundamental variations in the craniofacial structure of Saudi Arabs when compared with Steiner norms. These should be established to serve in diagnosis and treatment of Saudi patients. The result of the present study also supports the view that a single standard of facial esthetics should not be applied to all racial and ethnic groups.

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