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Lateral Cephalometric Norms for Adult Emirate according To Steiner analysis

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Abstract:*The ideaof this study was to determine the cephalometric norms of typical Emirateyoung adult with class I molar relationship and well-balanced face and to compare these norms with Caucasians cephalometric norms according to Steiner's analysis.*
Lateral cephalometric of 71 Emirate adults (37males age 20-25) (34female age 20-25) were traced and digitized using Dolphin imaging software program according to Steiner's analysis.
Advance maxilla and retruded mandible observed in Emirates sample and showed greater mean and standard deviation in SNA and ANB angles (p<0.001) and less SNB angle than Caucasians.
More proclination in upper and lower incisor teeth according to (U1/NA, L1/NA) angles observed in the sample, also the mean value of MP/SN was higher (P<0.001) showing more vertical growth and increase in lower facial height. Greater horizontal growth observed in Emirate sample according to average value ofSN/OP angle when compared to the Steiner values (P<0.001).
There are some fundamental ethnic differences in the craniofacial and skeletal measurements between Emirates and Caucasians young adult and theses variations support the ideaof a single standard for facial aesthetics should not be applied and used to all racial and ethnic groups.
The results of this study showed that the Emirates' Maxilla was more protruded, whilethe mandible was more retruded than the standard group. Moreover both occlusal SN/OP and mandibular planes MP/SN were also higher.

Keywords:*Cephalometric, Steiner analysis, Emirates norms, ethnic difference*

I. Introduction

Populations show significant difference in their character, size, growth, and shape. These differences result from two factors; genetic and environmental factors.
Categorized Races according to geographical location, historical origins, culture, or language were usually subsumed into three major racial groups: Asiatic or (Mongoloid), Black (or Negroid), and White(Or Caucasian). Each group has its own characteristics, which in general serve to distinguish them from each other.[1]

It is well established that standard cephalometric values provide useful guidelines in orthodontic diagnosis and treatment planning. However, it is possibly incorrect to make these standard values as an average or reference for every individual and used as a guide for treatment goals. Furthermore, it has been suggested that an analysis will give misleading results if it is applied to a patient of different race[2].

The need for lateral cephalometric analysis is essential in orthodontic to achieve accurate diagnosis and treatment plan. The principle is that the radiographic measurements of each patient are compared with normative Values. Small differences between the patient's measurements and the reference norms are considered as a normal variation, while significant differences indicate large deviations. A systematic comparison of the actual and normative values of each measurement allows the orthodontic to determine whether the malocclusion is to deviations in position of the teeth and the alveolar processes or whether discrepancies exist in size and position of the jaws. The analyses will refer to the necessary changes for achieving ideal morphologic results and help the orthodontist to decide whether the patient need extraction or not as well as the decision whether or not to perform orthognathic surgery as part of the treatment.

Using Two-dimensional lateral cephalometric analysis in orthodontic treatment is essential to identifying the problem sources If it skeletal and/or dental in origin .we largely depend on the

Cephalometric analysis as a technology to try to achieve an ideal patient profile. However the short come of this technology which was developed in the West, depends on Euro-American Caucasian normative databases and used it as a reference to characterize craniofacial morphology in patients.[3]

The differences in Cephalometric norms and measurements in different Ethnic and racial groups have been presented in many studies (Basciftci et al., 2004)[4] (Hwang et al., 2002; Ioi et al., 2007)[5]'[6]. And these

studies have focused on ethnic Differences, including Japanese (Miyajima et al., 1996)[7], Jordaian (Hamdan and Rock, 2001)[8], Saudi (Hassan, 2006)[9], and Turkish (Uysal et al., 2009)[10]Proposed norms must reflect the acceptable ranges of measurements collected from a specific group of subjects to be standards value for comparison

Many studies tries to find cephalometric norm of Middle East subjects with Class I and/or Class I appearance and to show the morphological differences between Arab and Caucasian populations. In Saudi samples, (Hassan)[9], and (Al-Jasser) [1]studies found greater proclination and protrusion of incisors compared to a Caucasian sample. However very few studies considered finding cephalometric norm of Emirate population (*Tayseer Al Zain)*[3]*(Huda M. Abu-Tayyem)*[11]

Two well-known and commonly usedCaucasians normal databases for comparison are from the Steiner and Down samples based upon Class I normal faces and occlusions.[3]

According to Steiner and Downs analyses, the norms they obtained from Caucasianpopulation were to be used only as guides and not as a reference for every patient. With thisconcept, they emphasized there was a huge variety of skeletal and dental variations within a particular Racial group. Therefore, we can only use the established datafor Caucasians as a guide for comparison withthe expected variations within the subgroups. But is difficult to use these data for other racial group.

For this reason the present studyfocused on an ethnic group for which little cephalometric Information was available, the Emirates.

II. Material and Method

The sample comprised 71subjects; 34 females and 37 males obtained from Ajman University of Science and Technology and Dubai Hospital with permission from Dubai health authority DHA. This study adhered to the tents of the declaration of Helsinki. Informed consent was obtained from the patients who participated in the study.

For this comparative study all Subjects selected according to following criteria: ethnic Emirates with Emirates grandparents, age from 20 to 25 years old, balanced and acceptable facial profiles, normal skeletal Class I relation, normal upper and lower dental arches with fully erupted permanent teeth, no history of previous orthodontic or prosthodontic treatment, no history of any kind of surgery, no any craniofacial abnormalities and no history of trauma or TMJ disorder

Digital lateral cephalometric radiograph were made with Dolphin Imaging program for each patient with the teeth in centric Occlusion. (10) Anatomic landmarks were traced and digitized according to Steiner analysis.

1) SNA (82°): anteroposterior position of the maxilla (apical base) relative to the anterior cranial base
2) SNB (80°): measuring the anteroposterior position of the mandibular base in relation to the cranium.
3) ANB (2°): the difference between SNA and SNB angles, and defines the mutual relationship, in the sagittal.
4) U1/L1 (130°) (Inter-incisal angle): the angle between long axes of the upper and lower central incisors.
5) U1/NA (22°): the angle formed between the long axis of upper central incisor and the NA line. It represents the degree of the inclination of upper incisors rela-tive to the anterior limit of the maxillary base.
6) U1-NA (4mm): the linear perpendicular distance from the incisal tip of the most protruded upper central incisor and the N-A line. It represents the degree of the protrusion of upper incisors relative to the anterior limit of the maxillary base.
7) L1/NB (25°): the angle between long axis of lower central incisor and NB line. It represents the degree of the inclination of lower incisors relative to the mandibular base.
8) L1-NB (4mm): the linear perpendicular distance from the incisal tip of the most protruded lower central incisor and the N-B line. It represents the degree of the protrusion of lower incisors relative to the anterior limit of the mandibular base.
9) SN/OP (14°) Inclination of occlusal plane to anterior cranial base.
10) MP/SN (32°): angle between the SN plane and the mandibular plane (MP).It represents the inclination of the mandibular base to the cranium

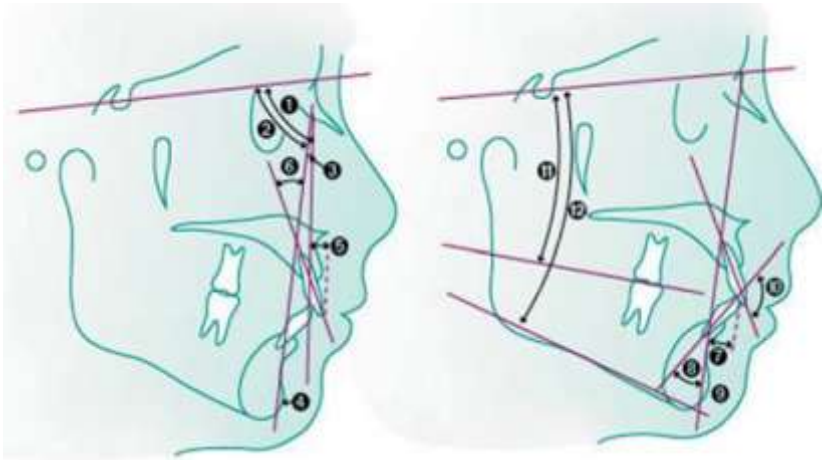

Figure 1. Steiner's analysis reference points 1. SNA 2. SNB 3. ANB
4. SND 5.U-NA 6. U/NA° 7. L-NB 8. L/NB° 9. Po-NB 10.U/L 11. SN/OP 12.MP/SN.

To locate the errors related to the radiographic measurements, 20 radiographs were selected and traced again using same cephalometric software after two weeksfollowing the first measurement. It wasfound that the difference between the first and second measurements was insignificant.

III. Results

The level of significance in current study is at $p < 0.05$. $p < 0.001$ considered as highly significant .The statistical analysis of all lateral cephalometric radiographs for two linear measurements and eight angular measurements for the entire sample (147 subjects) for both genders of Emirate samples presented in Tables 1. For each variable, mean, standard deviation (SD), median, maximum and minimum were obtained.

The p-values for of the Emirates measurements compared to the Caucasian were statistically significant which were less than 0.05 ($p<0.001$ highly significant). The means, median, and maximum values for SNA and ANB were higher than Steiner values while the SD for both parameters less than it. However all variables of SNB of the Emirati sample were less than the standard. All dental angular measurement mean (U1/L1, U1/NA, and L1/NB) are higher among the Emirati group compared to Steiner Standard. On the contrary the remaining two linear parameters (U1-NA, L1-NB) were higher among Caucasian group compared to the Emarati group. The mean for both angles SN/OP, MP/SN were higher in Emirate group

The significant level between the genders in the same ethnic group shows no difference because P value more than 0.05. However the p value for all parameters showed highly significant difference between the Steiner cephalometric norms and the studied group as shown in Table1, 2&3.

IV. Discussion:

In the current study, we focused on the comparison of cephalometric landmarks of Emarates and Caucasian adults. The Emirati sample in this study had a balanced facial profile and class 1 molar relationship. All selected subjectswere older than 20 years old, untreated to avoid the effects of orthodontic treatment on structures and morphology of the face. To obtain more accurate cephalometric normsvalue the data were separated according to gender

This research showed differences in the skeletal and dental characteristic between the two groups. However, there were insignificant gender differences in the Emirati sample.

The Emirati sample in the study was only chosen from United Arab Emirates, which geographically located in gulf region Therefore, the results of these subjects provides a reasonable representation of the Gulf population.

The anteroposterior relationship of both jaws in relation to the Nasion was measured by SNA, SNB and ANB. The SNA of the Emirati group was higher than that of Caucasian group which indicates that the maxilla is more advanced forward when compared to the standards. While the SNB was lower than that of the Caucasian and that refer to retruded mandible. ANB represent the difference between SNA and SNB, giving anteroposterior relationship for both jaws together which was also significantly higher in the studied group. This indicates that the Emirates with normal molar class1 relationship skeletally has protruded maxillaand retruded mandible with more convex profile compared to the standard group. These findings consistent with results from previous studies that tried to find Emirate Cephalometric norms as (**Huda M. Abu-Tayyem et al)** [11] (***Tayseer Al Zain and Donald J. Ferguson)***[3]. The mean for Interincisal U1/L1 angle was 122.61° and for the Caucasian is127° and with less inter incisal which is refer to more incisor proclination present in the Emirate

group. U1/NA was 25.28° for the Emirate and The L1/ NB angle was 26.48° so both angles higher than Steiner analysis norms that shows Significant difference in all angular measurements (P <0.05). From these result, it is so clear that the Emirate show more proclined upper and lower incisors in relation to both the NA and NB planes resulting in acute interincisal angle of 122.61° as compared with 127° found among the Caucasian.

The U1-NA and L1-NB linear measurement showed also significant difference between the Caucasian and the Emirate.

There was highly significant difference (P<0.0001) between the two ethnic groups regarding MP/SN (the relationship between the cranial base and mandibular plane) Emirate showed higher angle with mean of 33.39 ° compared to standard with 31.7° and also showed that the Emirate have increased vertical growth (Hassan 2006)[9], more backward rotation mandibular growth and increased lower facial height, (Al-Barakati and Talic 2007)[12].

Also SN/OP angle (The angle between cranial base and the occlusal plane) for the Emirate (Mean 15.60°) was higher than that of the Caucasians (14.0°). These findings suggest that the Emirate sample show more downward growing mandibles with more horizontal growth and retruded chin. The contrasting results of the two groups could be due to the posterior growth of the ramus, vertical height and position of tuberosity region of the maxilla (Riolo et al., 1979)[13].

In the current study, the difference between the two groups was statistically significant. The skeletal and dental measurements in the studied group were higher than those in Caucasians except SNB and U1/L1 angles were higher in Caucasians. While there was no significant difference between genders within the same group.

V. Conclusion

In this study, it is clear that there are some fundamental ethnic differences in the craniofacial and skeletal measurements between Emirate and Caucasians young adults according to Steiner analysis and theses variations support the idea that a single standard in facial aesthetics should not be applied and used to all racial and ethnic groups. Considering these differences to obtain better diagnosis and treatment plane for any Emirate patients crucial for optimum results. The results of this study showed that the Emirati's Maxilla was more protruded than causations. While the mandiblemore retruded.

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Table 1: Comparison of Cephalometric values (Mean, Standard deviation Median, Minimum, Maximum values) between Steiner and Emirates Sample

Parameters	**variables**	**Steiner Values**	**Emirates**	p
	N		71	
SNA	Mean/SD	82.0/3.9	84.35/1.89	<0.0001
	Median	82.0	84.20	
	Min/Max	78.1/85.9	81.00/88.00	
SNB	Mean/SD	80/3.6	79.81/1.90	<0.0001
	Median	80.0	79.80	
	Min/ Max	76.4/83.6	75.20/84.00	
ANB	Mean/SD	2.0/1.8	4.53/1.45	<0.0001
	Median	2.0	4.20	
	Min/Max	0.2/3.8	2.70/8.30	
U1/NA	Mean/SD	22/N/A	25.28/2.76	<0.0001
	Median	22	24.80	
	Min/Max	N/A	20.50/30.80	
U1-NA	Mean/SD	4mm/N/A	0.05/0.04	<0.0001
	Median	4mm	0.03/0.02~0.06	
	Min/Max	N/A	0.01/0.20	
L1/NB	Mean/SD	25/N/A	26.48/3.79	<0.0001
	Median	25	26.53	
	Min/Max	N/A	19.80/32.06	
L1-NB	Mean/SD	4mm	0.06/0.16	<0.001
	Median	4mm	0.03	
	Min/Max	N/A	0.01/1.00	
U1/L1	Mean/SD	127/N/A	122.61/7.07	<0.0001
	Median	127	134.50	
	Min/Max	N/A	120.20/156.52	
SN/OP	Mean/SD	14/N/A	15.59/2.28	<0.0001
	Median	14	15.60	
	Min/Max	N/A	10.20/20.20	
MP/SN	Mean/SD	31.7/N/A	33.39/5.56	<0.0001
	Median	31.7	32.20	
	Min/Max	N/A	19.47~39.20	

* p <0.05 significant ***p <0.001 highly significant

Table 2. Comparison of Cephalometric values Between Emirati male sample and Caucasian male of Steiner analysis

Parameters	**variables**	**Caucasian Male**	**Emirati Male**	**p**
	N		37	
SNA	Mean/SD	82.0/3.9	84.35/1.89	<0.0001
	Median	82.0	84.20	
	Min/Max	78.1/85.9	81.00/88.00	
SNB	Mean/SD	80/3.6	79.81/1.90	<0.0001
	Median	80.0	80.20	
	Min/Max	76.4/83.6	75.20/84.00	
ANB	Mean/SD	2.0/1.8	4.53/1.45	0.0005
	Median	2.0	4.20	
	Min/Max	0.2/3.8	2.70~8.30	
U1/NA	Mean/SD	22/N/A	25.28/2.76	<0.0001
	Median	22	24.80	
	Min/Max	N/A	20.50~30.80	
U1-NA	Mean/SD	4mm/N/A	0.05/0.04	0.3174
	Median	4mm	0.03(0.02~0.06)	
	Min/Max	N/A	0.01/0.20	
L1/NB	Mean/SD	25/N/A	26.48/3.79	0.0094
	Median	25	26.53	
	Min/Max	N/A	19.80~32.06	
L1-NB	Mean/SD	4mm	0.06/0.16	0.3091
	Median	4mm	0.03	
	Min/Max	N/A	0.01/1.00	
U1/L1	Mean/SD	127/N/A	122.61/7.07	<0.0001
	Median	127	134.50	

	Min/Max	N/A	120.20/156.52	
SN/OP1	Mean/SD	14	15.59/2.28	<0.0001
	Median	14	15.60	
	Min/Max	N/A	10.20/20.20	
MP2/SN	Mean/SD	31.7	31.39/5.56	<0.0001
	Median	31.7	32.20	
	Min/Max	N/A	19.47/39.20	

* p <0.05 significant ***p <0.001 highly significant

Table 3. Comparison of Cephalometric values Between Emirati female sample and Caucasian female of Steiner analysis

Parameters	**variables**	**Caucasian Female**	**Emirati Female**	**p**
	N		34	
SNA	Mean/SD	82.0/3.9	83.03/1.99	<0.0001
	Median	82.0	83.35	
	Min/Max	78.1/85.9	79.80/87.60	
SNB	Mean/SD	80/3.6	79.44/1.63	<0.0001
	Median	80.0	79.75(78.5~80.3)	
	Min/Max	76.4/83.6	75.20/82.50	
ANB	Mean/SD	2.0/1.8	3.58/1.54	<0.0001
	Median	2.0	3.30	
	Min/Max	0.2/3.8	1.20/6.60	
U1/NA	Mean/SD	22/N/A	25.27/2.67	<0.0001
	Median	22	24.90	
	Min/Max	N/A	20.20/30.20	
U1-NA	Mean/SD	4mm/N/A	0.05/0.04	0.2658
	Median	4mm	0.04(0.02~0.06)	
	Min/Max	N/A	0.01/0.20	
L1/NB	Mean/SD	25/N/A	26.00/2.99	0.1935
	Median	25	26.52	
	Min/Max	N/A	20.50/30.50	
L1-NB	Mean/SD	4mm	0.06/0.17	0.2272
	Median	4mm	0.03(0.02~0.04)	
	Min/Max	N/A	0.01~1.00	
U1/L1	Mean/SD	127/N/A	122.61/5.86	<0.0001
	Median	127	134.35	
	Min/Max	N/A	120.36/145.40	
SN/OP1	Mean/SD	14	15.60/2.28	<0.0001
	Median	14	15.70	
	Min/Max	N/A	10.20/20.20	
MP2/SN	Mean/SD	31.7	31.91/5.41	<0.0001
	Median	31.7	32.75	
	Min/Max	N/A	20.20/39.20	

* p <0.05 significant ***p <0.001 highly significant