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PALESTINIANS NORMS OF STEINER CEPHALOMETRIC ANALYSIS

Aim: To find the cephalometric norms for Palestinian population according to Steiner cephalometric analysis. **Methods:** Lateral cephalograms of 76 dental students (51 females and 25 males, mean age 20.4 ± 2.1 years) were collected from their files at the American University in Jenin, Palestine. They were scanned and analyzed following Steiner measurements. Means and standard deviations for all variables were calculated. Differences between the mean of the variables for both sexes were calculated using the independent t test. **Results:** Females had a smaller interincisal angle, more proclined mandibular incisors, and a shorter anterior cranial base than males in the Palestinian population. **Conclusion:** When the Palestinian sample population was compared to Steiner norms, similar skeletal patterns were found, but the anterior teeth were more proclined and protruded. World J Orthod 2010;11:e5–e9.

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Since its introduction in the early 1930s,^{1,2} cephalometric radiography has served as a useful tool for the prediction of growth changes, diagnosis and treatment planning, and evaluation of orthodontic treatment changes.^{3–7} Several cephalometric analyses, such as Downs analysis,^{8,9} Steiner analysis,¹⁰ and Tweed analysis,¹¹ were developed for orthodontic diagnosis and treatment planning. However, Steiner analysis is most commonly used in the United States and the Nether-

lands.^{12,13} Several studies were made to set cephalometric norms. However, studies in different countries of different populations showed significant differences among these cephalometric norms depending on the ethnic backgrounds for each population, sex, and age.^{14–16}

The aim of this study was to find the cephalometric norms for a sample of the Palestinian population according to the Steiner analysis and to compare them with the norms of other populations.

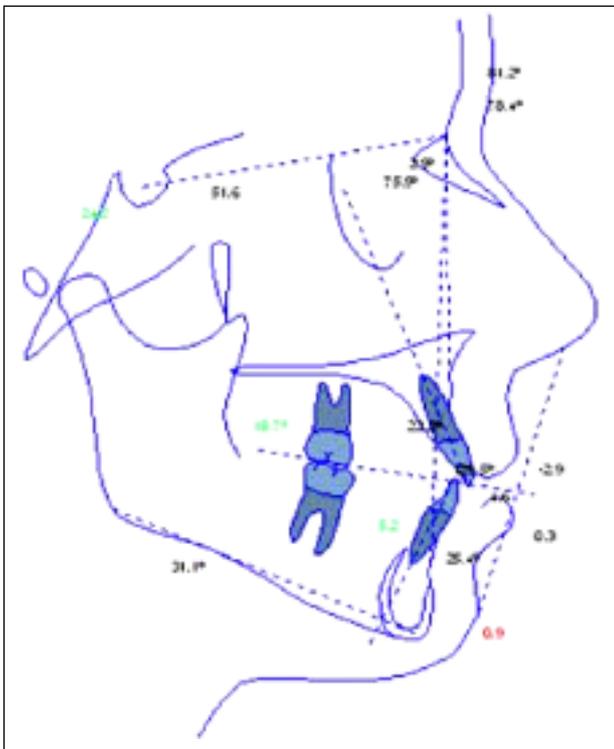


Fig 1 The Steiner landmarks and reference lines for one of the lateral cephalograms included in the study.

METHOD AND MATERIALS

The sample consisted of 76 lateral cephalograms (51 females and 25 males, mean age 20.4 ± 2.1 years) collected from the files of the dental students at the American University in Jenin. All of those students had normal pleasing profiles, Class I molar relationships, and no history of orthodontic treatment. All these students had complete set of permanent teeth with no history of tooth extractions. All lateral cephalograms were taken in a standardized way following the recommendation of the cephalostat manufacturer (Sirona). Teeth were in occlusion, and lips were in a relaxed position.¹⁷

Lateral cephalograms were scanned and analyzed following the Steiner measurements by one of the authors (E.H.) using Nemotec software for cephalometric analysis.

The Steiner landmarks and reference lines, as well as linear and angular measurements, are shown in Fig 1.

Statistical analysis

Means and standard deviations (SD) for all variables were calculated using SPSS 15.0 (SPSS). Differences between the means of the variables for each sex were calculated using the independent Student *t* test. The means of all the variables for the Palestinians were compared with those of the Saudi Arabians¹⁸ and African-Americans¹⁶ using the independent Student *t* test. Statistical significance was set at $P \leq .05$.

Method error

The method error was calculated with the Dahlberg formula. The errors for linear and angular measurements were not statistically significant and did not exceed 0.4 mm for the linear variables or 0.5 degrees for the angular variables.

Table 1 Means and SD of the measured variables for each sex, the entire sample, and the difference between the two

Variable	Mean \pm SD males	Mean \pm SD females	Mean \pm SD total	Mean \pm SD difference
SNA (degrees)	82.7 \pm 3.9	81.5 \pm 3.5	81.9 \pm 3.7	1.2
SNB (degrees)	80.1 \pm 3.3	78.8 \pm 3.6	79.2 \pm 3.6	1.3
ANB (degrees)	2.6 \pm 1.9	2.7 \pm 1.7	2.7 \pm 1.8	-0.1
SND (degrees)	77.8 \pm 3.2	76.3 \pm 3.7	76.8 \pm 3.6	1.5
Interincisal (degrees)	130.2 \pm 8.3**	125.0 \pm 7.9**	126.6 \pm 8.5	5.2*
Occl-SN (degrees)	16.4 \pm 3.7	17.2 \pm 4.0	17.0 \pm 3.9	-0.8
GoGn-SN (degrees)	29.3 \pm 4.9	31.8 \pm 5.3	31.7 \pm 9.3	-2.5
U1-NA (degrees)	23.1 \pm 5.7	24.6 \pm 4.9	24.0 \pm 5.2	-1.5
U1-SN (degrees)	105.9 \pm 5.4	106.1 \pm 5.6	105.9 \pm 5.5	-0.2
L1-NB (degrees)	23.9 \pm 5.7*	27.8 \pm 5.1*	26.5 \pm 5.6	-3.9**
U1-NA (mm)	6.9 \pm 2.6	6.9 \pm 1.9	6.9 \pm 2.2	0.0
L1-NB (mm)	7.2 \pm 1.7	7.0 \pm 1.7	7.1 \pm 1.7	0.2
Pog-NB (mm)	2.9 \pm 1.6	2.3 \pm 0.9	2.5 \pm 1.2	0.6
L1-NB/Pog-NB	4.6 \pm 2.8	4.8 \pm 2.2	4.7 \pm 2.4	-0.2
SL	61.0 \pm 7.2***	53.8 \pm 8.1***	56.1 \pm 8.4	7.2***
SE	23.3 \pm 3.1	22.4 \pm 3.4	22.7 \pm 3.3	0.9

* = $P \leq .01$, ** = $P \leq .05$, *** = $P \leq .001$. SD = standard deviation.

RESULTS

Means and standard deviations (SDs) of all variables for the total sample are shown in Table 1.

The interincisal angle and length of the anterior cranial base (SL) were significantly larger in males than in females ($P < .05$ and $P \leq .001$, respectively). Significant difference was found in the inclination of mandibular central incisor (L1 to NB) in relation to NB line, with a larger angle in females ($P < .01$). The means and standard deviations of the investigated variables for the Palestinians, Saudis,¹⁸ and African-Americans¹⁶ are shown in Table 2. The variables of the latter two groups, which differed significantly from the Palestinian group, are indicated in the table.

The SNA angle was significantly smaller in Palestinian group than Saudi and African-American samples ($P < .05$ and $P < .001$, respectively). The SNB angle showed a smaller value in the Palestinian group than Saudi and African-American samples ($P < .01$).

ANB was significantly smaller in the Palestinian group than in African-Americans ($P < .001$).

The interincisal angle was significantly smaller in the African-American group than the Palestinian group ($P < .001$). No difference was found between the Palestinian and Saudi groups.

The occlusal plane to SN angle and the distance from the maxillary incisor to NA line (U1-NA) were significantly smaller in the Saudi group than Palestinian group ($P < .001$). No significant difference was found between the Palestinian and African-American groups.

The inclination of mandibular incisors to the NB line (L1-NB angle) was significantly higher in the African-Americans than the Palestinian group ($P < .001$). No difference was found between the Palestinian and Saudi groups.

The distance between the mandibular incisors and the NB line (L1-NB distance) was significantly larger in African-Americans ($P < .001$) and smaller in the Saudi group than the Palestinian one ($P < .01$).

The pogonion point was situated in a more anterior position to the NB line (Pog-NB distance) in the Palestinian group than in the Saudi and the African-American groups ($P < .001$).

Table 2 Comparison among the means of Steiner's variables for Palestinian, African-American, and Saudi samples

Variable	Palestinian Mean \pm SD n = 75	African-American Mean \pm SD n = 80	Saudi Mean \pm SD n = 60	Steiner Mean n = not available
SNA (degrees)	81.9 \pm 3.7	85.3 \pm 3.5***	83.6 \pm 4.3**	82
SNB (degrees)	79.2 \pm 3.6	80.9 \pm 3.0*	81.0 \pm 3.7*	80
ANB (degrees)	2.7 \pm 1.8	4.4 \pm 2.0***	2.6 \pm 2.11	2
SND (degrees)	76.8 \pm 3.6	77 \pm 3.3	—	77
Interincisal (degrees)	126.6 \pm 8.5	119.1 \pm 9.6***	124.8 \pm 6.9	131
Occl-SN (degrees)	17.0 \pm 3.9	16 \pm 3.6	13.3 \pm 4.3***	14
GoGn-SN (degrees)	31.7 \pm 9.3	32.5 \pm 4.6	31.0 \pm 5.1	32
U1-NA (degrees)	24.0 \pm 5.2	22.5 \pm 5.1	24.8 \pm 5.6	22
UI-NA (mm)	6.9 \pm 2	7.4 \pm 1.9	5.3 \pm 2.6***	4
L1-NB (degrees)	26.5 \pm 5.6	33.9 \pm 6.7***	27.8 \pm 4.3	25
L1-NB (mm)	7.1 \pm 1.7	10.1 \pm 3.0***	6.1 \pm 2.1*	4
Pog-NB (mm)	2.5 \pm 1.2	-0.3 \pm 1.7***	1.1 \pm 1.6***	—
SL	56.1 \pm 8.4	55.1 \pm 7.5	—	51
SE	22.7 \pm 3.3	23.1 \pm 3.4	—	22

* = $P \leq .01$, ** = $P \leq .05$, *** = $P \leq .001$. SD = standard deviation.

DISCUSSION

The aim of this study was to determine Palestinian cephalometric norms according to the Steiner values since very little research has been done in the area.^{18,19} However, a statistical comparison between the Palestinian norms and Steiner values was not possible since the sample size and standard deviation of the original Steiner values were not available.²⁰ Accordingly, our values were compared with African-American and Saudi norms.^{16,18} However, comparing cephalometric data obtained from independent studies can be problematic, especially when linear measurements are concerned. Differences in the methodology of taking cephalograms could lead to magnification errors and obscure comparison between linear measurements.

The SNA and SNB in the Palestinian group were comparable to original values of Steiner for Caucasians but less than those in the African-American and Saudi samples, indicating a more orthognathic profile in the Palestinian group. Additionally, the ANB angle was similar for the Palestinians, Saudi, and Steiner samples but significantly larger in African-Americans. Similar results have been reported regarding African-Americans.^{21,22}

In our sample, interincisal angle was significantly higher in males than females, indicating a more upright position of both maxillary and mandibular incisors. African-American children and Saudi adults exhibited no difference between males and females. However, African-American children showed significantly smaller interincisal angles than Saudis and Palestinians, displaying more proclined maxillary and mandibular anterior teeth and reflecting the features of bimaxillary proclination. Bimaxillary proclination has been reported as a common feature of Africans and African-Americans.^{21,22}

Maxillary and mandibular incisors in Palestinians had a slightly higher inclination compared to Steiner's Caucasian sample. They were also in a more protruded position. Several studies reported similar results for different populations.^{18,23} On the other hand, some other studies reported significantly more proclination and protrusive position of the incisors, especially the mandibular ones.¹⁶ Such information would be very helpful during treatment planning to determine where the incisors should be at the completion of the treatment. Following the exact recommendations of Steiner regarding the position of maxillary and mandibular incisors might lead to more straight profiles and more extractions in our treatment plans.

The pogonion point was situated in a more anterior position to the NB line (Pog–NB) distance in the Palestinian group than in the African-American, Saudi, and Mexican American populations,^{16,18,23} indicating a more developed chin in the Palestinian sample. To some extent, this difference in chin prominence can be explained by the fact that the African-American group consisted of children, whereas the Palestinian and Saudi groups comprised adults.

CONCLUSIONS

From this study, the following three conclusions were made:

- Skeletally, Palestinians tend to have harmonious profiles and orthognathic faces similar to those of Caucasian norms reported by Steiner.¹⁰
- Dentally, the Palestinian group exhibited a more protruded and proclined position, resulting in a smaller interincisal angle than the Steiner group.
- The chin was more developed in the Palestinian group than the Steiner group.

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