FORENSIC NORMS OF FEMALE AND MALE LEBANESE ADULTS

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ABSTRACT

Patients born to Lebanese parents and grandparents, visiting two private practice orthodontic clinics, with normal occlusion and no need for any kind of orthodontic treatment during a six month period and satisfying inclusion criteria, were asked permission to include their lateral cephalometric radiographs in this study. Sixty three individuals met the inclusion criteria. Sixteen cephalometric measurements were taken (seven linear and nine angular) were analyzed on each radiograph. Measurements were compared between genders using student's t-test.

The study population included 31 females and 32 males with a mean (±SD) of 21.6 (±4.0) and 21.3 (±3.9) years for males and females respectively. Men had significantly larger skeletal linear measurements: the mandibular base menton to gonion (Me-Go) ($p = 0.027$), the total mandibular length of condylon to gnathion (Co-Gn) ($p = 0.009$) and significantly larger angular measurements: sella to nasion to subspinal point (S-N-SS) ($p = 0.006$), and sella to nasion to supramental point (S-N-Spm) ($p = 0.009$).

The results of this study demonstrated that male skeletal linear and angular measurements are significantly larger in

Lebanese adult males compared to Lebanese adult females.

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Keywords: forensic norms, cephalometric analysis, gender, linear measurement, angular measurement

INTRODUCTION

Forensic norms have been set up for many ethnic and racial groups in many studies; differences among races and ethnic groups have been proven, and standard norms have been developed.[1,2] These studies have supported the assumption that normal measures for one attempt have been made to identify the differences in facial features of various ethnic groups including Africans, African-Americans,[3,4] Brazilians,[5] Japanese,[6] Puerto Ricans,[7] Saudi Arabians[2], Turkish[8,9], Hungarians[10] and Russians.[11] Standard norms for each ethnic group are critical for forensic medicine.[12]

Information on cephalometric norms for a population has tremendous value in forensic dentistry. Cephalometric standards allow identification of race and gender of victims using simple measurements.[10,12-14] Craniofacial measurements and dentofacial models of different ethnic groups and their cephalometric norms are useful in planning and estimating impact of orthodontic treatment on hard and soft tissue.[13,15-17]

Since no forensic norms are yet available for Lebanese population, the purpose of this study is to establish forensic norms to use for forensic purposes using 16 cephalometric measures obtained on a lateral cephalometric radiography. In addition, identification of gender differences was also investigated.

MATERIALS AND METHODS

Inclusion criteria

Sixty-three patients visiting two private practice orthodontic clinics for routine checkups, who had had a normal occlusion with no need at all for any orthodontic treatment during a six month period met the study criteria, and were asked for permission to include their cephalometric radiographs in this study:

1. Aged 17 to 26.
2. Lebanese citizens with both parents and both grand parents on both sides Lebanese as well.
3. Class I molar and/or canine relationship (normal occlusion).
4. Normal height and weight for age with no significant medical history; normal growth pattern.
5. No history of trauma.

6. No previous orthodontic or prosthodontic treatment and no actual need for such kind of treatment.
7. No previous maxillofacial or plastic surgery.
8. Good facial symmetry determined clinically.
9. All teeth present except third molars.
10. No significant medical history.

Individuals who were noted not to satisfy any of the ten criteria above after taking radiographs, such as need of any kind of therapeutic intervention to adjust their occlusion or orthodontic profile, missing teeth or evidence of trauma or surgery, were excluded.

Lateral cephalograms were obtained in a standard position with the teeth in centric position and with lips relaxed for all 63 individuals using the same radiographs apparatus (Planmeca, Helsinki, Finland) and standardized mandibular orientation and exposure parameters. Sixteen measurements (seven linear and nine angular) were analyzed on each radiograph. Arithmetic mean and standard deviation were calculated for each measurement.

The same researcher performed the tracing of the cephalometric radiograph of each subject; one researcher took all measurements, and two other researchers reviewed them.

Cephalometric variables

A. Landmarks

The landmarks used for cephalometric analysis were defined based on Fricker guidelines (Fig. 1).[1,18-20] In addition Sella (S), S', which is the projection of S on the plane of Frankfort was likewise used. As well, Co' which is the projection of Condylon (Co) on the plane of Frankfort as used by Russians was similarly used.[11]

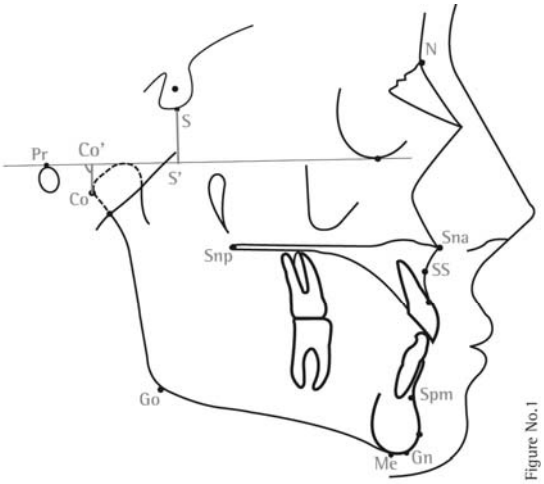

Fig. 1:
Landmarks used for cephalometric analysis: N, S, Me, Gn, Go, SS, Spm, Sna, Snp, Co, Co', Pr, S'.

B. Planes

The used planes as described by Fricker namely palatal plane or bispinal (Ps), mandibular plane (Pm), mandibular ramus plane (Pr), axis of the maxillary incisor (Pis) and axis of the mandibular incisor (Pii).[18] (Fig. 2)

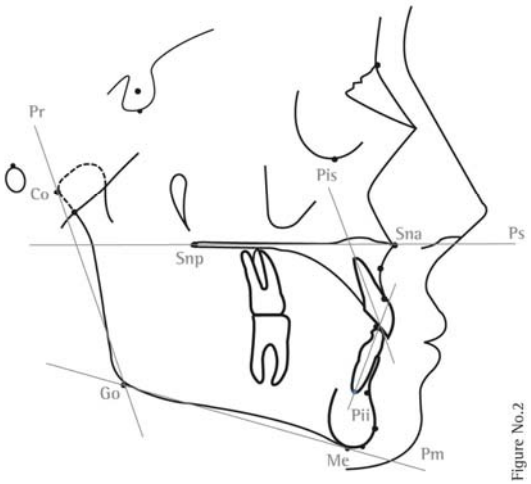

Fig. 2:
Planes used for cephalometric analysis: Ps, Pm, Pr, Pis, Pii.

C. Linear measurements

The linear measurements calculated by millimeters are the following.[18] (Fig. 3)

1. N-S: Anterior cranial length: describes the length of the anterior cranial base.

2. Sna-Snp: Palatal plane length: indicates contribution of the maxilla to horizontal dimension. extend
3. Me-Go: menton-gonion: The extent of the mandibular base (Sassouni).
4. N-Sna: Midfacial anterior height: vertical dimension between nasion to anterior nasal spine.
5. Sna-Me: Lower anterior face height: vertical dimension between anterior nasal spine to menton.
6. Co-Gn: Describing the total mandibular length: condylon to gnathion.
7. S'-Co': Dimension measured on Frankfort horizontal plane between the projection of sella and condylon.

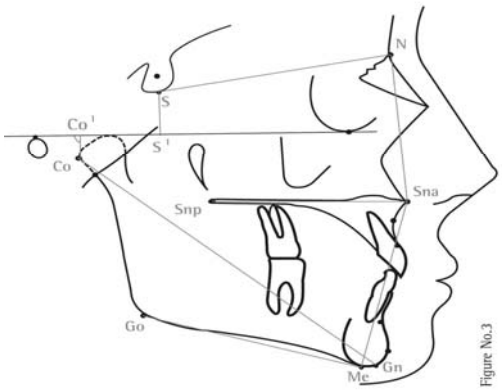

Fig. 3:
Linear measurements calculated by mm are seven: N-S, Sna-Snp, Me-Go, N-Sna, Sna-Me, Co-Gn, S'-Co'.

D. Angular measurements

Angles calculated in degrees, are the following:[14,18,21] (Fig. 4)

1. S-N-SS: (SNA) describes the horizontal position of the maxilla to the cranium (Steiner).
2. S-N-Spm: (SNB) indicates the position of the mandible to the cranial base.
3. ANB: Magnitude of the horizontal skeletal jaw discrepancy between the maxilla and the mandible, obtained by subtracting SNB from SNA.
4. Pm/Pr: Gonial angle, the angle between the mandibular plane and the mandibular ramus plane.
5. Pis/Ps: The maxillary central incisor to the maxillary plane; U1 to the palatal plane.
6. Pii/Pm: The mandibular central incisor to the mandibular plane; L1 to the mandibular plane.
7. Pis/Pii: The interincisial angle; U1 to L1.
8. Ps/Pm: The palatal plane to the mandibular plane.
9. N-Sna-Me: The facial angle-angle convexity.

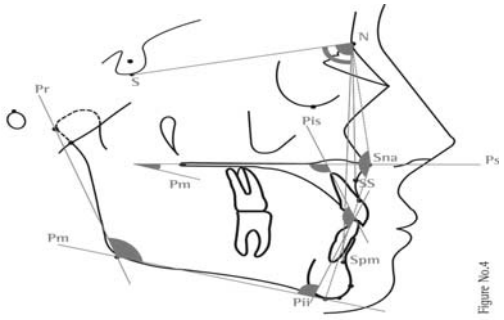

Fig. 4:
The nine angles calculated in degrees: S-N-SS; S-N-Spm; ANB; Pm/Pr; Pis/Ps; Pii/Pm; Pis/Pii; Ps/Pm; N-Sna-Me.

Statistical Analysis

Arithmetic means and standard deviations (±SD) were calculated for age, linear and angular measurements for both males and females. As all our variables were numerical continuous, so student t test was performed to compare these variables among males and females. Significance was set at a p value of 0.05.

RESULTS

Gender comparison

Sixty-three participants entered into final data analysis; 31 females and 32 males. The average age of the group was 21.6 (±4.0) years for males, and 21.3 (±3.9) years for females.

Table 1 shows the results of all the measured variables, and it compares the average values of men and women. Men had significantly larger measurements of two linear and two angular skeletal parameters: Me-Go, Go-Gn, S-N-SS and S-N-Spm ($p < 0.05$). However, all other parameter differences were non-significant between the two genders.

The significant skeletal differences were seen in the antero-posterior position of the maxilla and the mandible to the cranial base: SNA (S-N-SS), SNB (S-N-Spm) ($p = 0.006$ & 0.009 respectively), the total mandibular length (Co-Gn) ($p = 0.009$) and the extent of the mandibular base (Me-Go) ($p = 0.027$).

In dental relationships and dental measurements, no statistically significant sexual dimorphism was found. The mean (±SD) of Pis/Ps angles among males was 111.87º (±6.57º) whereas 111.48º (±8.69º) among females. Thus, the mean value was greater than 107º. The measurements of this angle are relative to the norms of Downs and Tweed.

Furthermore, the Lebanese norms were 94.13º (±16.84º) for men and 96.42º (±6.58º) for women for the Pii/Pm showing greater norms than those of Tweed 90º and Downs 91.4º (±3.8º).

DISCUSSION

To our knowledge this is the first descriptive study about male and female Lebanese adults establishing forensic norms. The results of this study on a sample of adult Lebanese population indicated that some linear and angular measurements are significantly different between male and female adult Lebanese.

Two linear values; Me-Go appraising the length of the mandibular corpus, Co-Gn evaluating the total mandibular length and two angular values S-N-SS and S-N-Spm demonstrated a significant difference between both Lebanese adult genders. Our population presented with normal occlusion and orthodontic profiles to the two orthodontic clinics where a check-up was the main purpose of their visits,and neither occlusal nor orthodontic treatment was needed or applied.

In accordance to the craniofacial structure of Anatolian Turkish adults.[8] Caucasoid young adults [10] and two adolescent populations from Iowa and Northern Mexico, the Lebanese men have significantly larger measurements than Lebanese women.[16]

As the mean values for measurements of one racial group could not be considered normal for others, the rationale to conduct this study and obtain these norms was crucial. Numerous studies have shown that differences between racial groups could exist.[2,3,6,8,22] Lebanese are currently considered a subgroup of Caucasians, descendants of the Phoenicians/Canaanites. However, in the modern biological model, variations occur and are not perceived as unnatural within the same race or/and ethnic group. In reality, attempts to achieve perfection for all individuals are seen as unnatural; therefore, each different racial subgroup would best be treated according to its individual characteristics in order to achieve proper forensic norms. The measurements of Pis/Ps for men and women were relative to the norms of Downs and Tweed. However, the Lebanese norms for the Pii/Pm were greater than the norms of Tweed and Downs.

It is notable that the Russian norms apply different landmarks than other populations' norms by using the projection of the sella point (S) on the Frankfort horizontal plane (S'), instead of the sella point itself (Fig. 1), as a landmark. The same concept is also applied to the condylon (Co) landmark, using its projection on the Frankfort horizontal plane (Co') (Fig. 1). We liked to use these two reference points with the purpose to conduct a further study in the near future comparing the Russian norms and the Lebanese norms, including a larger sample size in order to assess if there is any difference among these two sub-groups of the Caucasian race, as they are the only using these two points in their norms.

A major limitation of this study was the sample size due to limited financial resources. Further studies with larger sample size are recommended.

In conclusion, our results are useful for the Lebanese adults among both genders in forensic dentistry for identification purposes. The present study also supports the view that males have larger standards of linear and angular facial measurements, previously established among various racial and ethnic groups.

Table 1: *Comparison of male and female cephalometric measurements of a sample of Lebanese adults. (N=63).*

	Measurement unit	Male		Female		T test	P-value
		Mean	SD	Mean	SD		
AGE	Years	21.60	4.03	21.32	3.94	-0.270	0.788
N-S	mm	74.00	6.32	72.88	4.47	-0.816	0.418
Sna Snp	mm	61.01	4.02	60.26	3.82	-0.760	0.450
Me-Go	mm	75.68	5.41	72.80	4.70	-2.260	0.027
N-Sna	mm	53.94	3.90	53.30	5.50	-0.537	0.594
Sna-Me	mm	71.10	6.71	69.25	6.33	-1.120	0.267
Co-Gn	mm	118.70	5.98	114.74	5.73	-2.685	0.009
S'-Co'	mm	18.03	4.50	17.00	3.75	-0.995	0.324
S-N-SS	deg	79.50	4.18	76.71	3.63	-2.825	0.006
S-N-Spm	deg	75.44	4.09	72.74	3.74	-2.716	0.009
ANB	deg	4.03	2.61	3.55	2.83	-0.672	0.504
Pm-Pr	deg	119.66	7.16	119.26	10.64	-0.161	0.873
Pis-Ps	deg	111.87	6.57	111.48	8.69	-0.201	0.841
Pii-Pm	deg	94.13	16.84	96.42	6.58	0.718	0.477
Pis-Pii	deg	129.20	7.62	127.10	10.24	-0.916	0.363
Ps-Pm	deg	23.87	7.94	25.06	5.61	0.711	0.480
N-Sna-Me	deg	160.20	6.63	159.19	7.57	-0.544	0.588

mm: millimeters; deg: degrees; $p < 0.05$ was considered significant.

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