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McNAMARA'S CEPHALOMETRIC NORMS OF EGYPTIAN CHILDREN

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ABSTRACT

Objective: To establish McNamara Cephalometric Analysis normative data for Egyptian children.

Materials and Methods: Twenty boys and forty girls (mean age 9.37, SD 1.60) of Egyptian ethnicity were selected based on the following criteria: Class I molar relationship, lack of crossbite or scissor-bite, adequate amount of space in dental arches, no visible asymmetry, and good facial proportions. Eleven selected variables from McNamara's cephalometric method were digitally traced and analyzed on the lateral cephalograms of each subject.

Results: McNamara's skeletal and dental variables were assessed and statistically significant inter-gender differences were noted in both effective midface length (condylion to point A) and effective mandibular length (condylion to gnathion).

Conclusions: Young Egyptian boys had a lengthier midface and mandible than girls. The Upper incisors to point A vertical and lower incisor to A-PO line were slightly more pronounced in girls.

INTRODUCTION

The key into successful orthodontic treatment is proper diagnosis. This depends on obtaining specific data from various craniofacial records to establish a clear overall picture of the presented case. W.A.Price was the first to state the value of radiography as diagnostic aid in orthodontics in 1900, only 5 years after the discovery of x-rays. Many skeletal and dental measurements were not even possible until 1931 when Broadbent first introduced cephalometric radiography after which it was used as an essential diagnostic aid in orthodontics.[1,2]

Different cephalometric analyses were devised by clinicians and researchers over the years,[3,4] none of which were assumed as sufficient or complete up to this date because, "If one system of analysis was absolutely superior to all the others, then it is likely

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that every responsible, knowledgeable orthodontist would have decided to use this method exclusively."[4] Most methods of cephalometric analyses were acknowledged before the idea of skeletal alteration was even considered possible. Thereupon, different treatment possibilities for skeletal discrepancies such as orthognathic surgery and functional therapy answered the necessity of yet another analysis to address new craniofacial elements.[5]

More than three decades have eloped since McNamara first described his method in cephalometric analysis. Nevertheless, it is still in use because it addressed the relationship of the teeth to one another, teeth to jaws, each jaw to one another and the jaw elements to the cranial base in addition to soft tissue and airway parameters.[5]

It is known that unless the normal is stated, abnormality could be consequently noted and evaluated; this is applicable to cephalometric norms as well, taking into account the fundamental variations existing between different ethnic groups, gender and age.[3,6-9] With that in mind, several studies were conducted to establish the McNamara cephalometric norms in the Caucasian[5,6] (American, European), Turkish[10], Asian (Chinese[9], Japanese[6], Nepalese[8]), Indian (Bangladeshi)[11] and African[12] populations.

General cephalometric analyses studies were conducted on different Arabs nation using different analyses.[7,13-17] Specifically, only two studies aimed to establish McNamara's cephalometric norms, one for Saudi[18] and another most recently for Lebanese[19] populations, none of which was for subjects younger than 18 years of age.

With the rising dental health awareness, more parents are seeking orthodontic treatment for their young children. This called for a study to obtain norms for this age group. At present no Egyptian norms of McNamara's analysis has been published yet. Hence, the current study aims to determine cephalometric norms for a sample of young Egyptian children using McNamara's method.[5]

MATERIALS AND METHODS

Lateral cephalometric radiographs of young Egyptian patients between the ages of 6 and 12 years were selected from our private practice. Sixty subjects divided into 40 girls and 20 boys, were selected based on the following specific criteria: normal occlusion, pleasant soft tissue profiles, well-aligned upper and lower dental arches, no anterior and/or posterior crossbites, normal dentofacial structures, no history of trauma and no previous orthodontic treatment.

The standardized lateral cephalograms were taken by the same X-ray unit* and the same technician, provided that each subject was oriented by positioning ear rods of the cephalostat in ear holes maintaining natural head position, this position was fixed with the forehead clamp positioned at Nasion with the teeth in centric occlusion and the lips relaxed. All radiographs were digitally** traced by the authors and a sample of 10 radiographs were randomly picked and retraced for intra-examiner consistency.

Tracing was done in a systemic manner. The major references; landmarks, lines and angular measurements of the McNamara analysis were traced and measured as shown in Figure 1 & 2 and Table1 A and B. Table 2 shows the specific definitions of McNamara's measurements that were obtained and then compared for inter-gender differences between male and female subjects.

*SOREDEX, serial No. SE150114, Tuusula, Finland.
**Onyx ceph™ , version 2.7.70, Chemnitz, Germany.

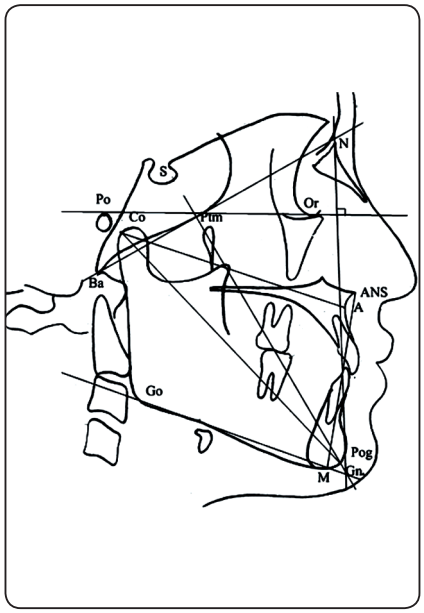

Fig. (1) Major landmarks and lines used in McNamara's analysis

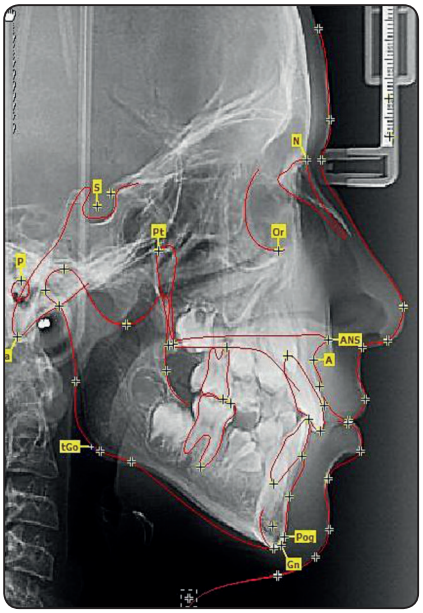

Fig. (2) Digital Cephalometric tracing of McNamara's measurements using Onyx ceph™

TABLE (1) A) Points and B) Lines constructed for McNamara cephalometric tracing[5,20]

A) Points	
Anterior nasal spine (ANS)	Spinous process of the maxilla forming the most anterior projection of the floor of the nasal cavity.
Pogonion (Pog)	Most prominent point on the anterior aspect of symphysis of the mandible.
Menton (Me)	The most inferior point on the symphysis of the mandible.
Gonion (Go)	Most posterior inferior point on ramus of the mandible.
Porion (Po)	Superior aspect of external auditory meatus.
Orbital (Or)	Lowest point on the inferior bony margin of the orbit.
Pterygomaxillary Fissure (PTM)	Posterior superior aspect of Pterygomaxillary Fissure.
Gnathion (Gn)	Intersection of Facial Plane and Mandibular Plane.
Condylion (Cd)	The highest point of superior curvature of the condyle of the mandible
Point A	The deepest point on the curved bony outline between the anterior nasal spine (ANS) and prosthion (Pr).
B) Lines	
PnA (mm)	Anteroposterior orientation of the maxilla to the cranial base is assessed by the linear distance between nasion perpendicular and point A. An anterior position of point A is a positive value and a posterior position of point A is a negative value.
Cd-A(mm)	Mid facial length is measured from condylion to Point A
Cd-Gn(mm)	The length of the mandible is measured from condylion to gnathion.
1U-Avert (mm)	The anteroposterior distance from maxillary incisor to point A.
1L-Avert	The anteroposterior position of the mandibular incisors, is determined by measuring the distance between the edge of the incisor and a line drawn from point A to Pog.

TABLE (2) The Definitions of McNamara's eleven variables measured in the study.

Measurements	Definition
Pn-A	Distance from Subspinale to the nasion-vertical
SNA	Determines the anterior-posterior relationship of the maxilla to the anterior cranial base (S-N), formed by connecting the Sella-Nasion Plane to A point.
Cond-A	Effective length of maxilla.
Cond-Gn	Effective length of mandible.
Max-Mand	Maxilla-mand. Difference, difference between effective maxillary and mandibular length
ANS-Me	Determines the length of the lower part of the anterior facial height
SpP-GoMe	Angle between the palatal plane and the mandibular plane, formed by the lines ANS-PNS and Go-Me (or ANS-PNS and Me-Im acc. to Schwarz).
NBa-PtG	Facial axis, determines the direction of growing of the chin or mandible respectively. Expresses the ratio of facial height to depth, formed by the reference lines N-Ba and Pt-G.
Pn-Pog	Distance from Pogonion to nasion-vertical
1u-Avert	Distance from the incisal edge of the most prominent upper incisor to a vertical to Frankfort Horizontal through point A
1l-APog	Ante-or Retroposition of lower incisors. Distance from the incisal edge of the most prominent lower incisor to the line A-Pog. Determines the position of the lower incisors.

Descriptive statistics

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp). Mean and standard deviation were calculated for all measured variables. Student t-tests and Mann Whitney test were performed to assess the inter-gender differences. Significance of the obtained results was judged at the 5% level.

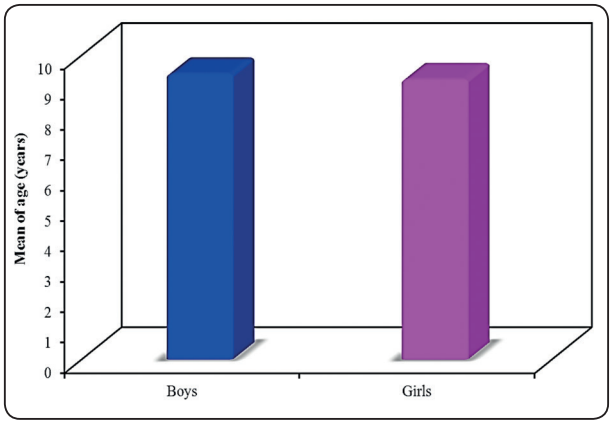

Fig. (2) Age difference of the sample group (years)

RESULTS

All the Cephalometric measurements of the participating subjects were carefully assessed and interpreted regarding the age and gender. Normative data were presented in the tables.

TABLE (3) Age difference of the sample group.

Gender	Number (n)	Age in years			
		Minimum	Maximum	Mean	SD
Boys	20	6	11.75	9.39	1.60
Girls	40	5.9	12	9.21	1.57

Test of significant: t=0.418. P value 0.677.

No statistically significant age differences between the sample groups were observed as shown in both Table 3 and Figure 2.

Inter-gender comparison of McNamara's eleven variables of Egyptian children is expressed in Table 4, Figure 3(A & B). Both Effective Mandibular Length **Cd-Gn** (mean=100.15) and Effective Midface Length **Cd-A** (mean=76.80) were significantly larger amongst the boys ($p \leq 0.05$). As general, all other linear and angular variables were statistically insignificantly larger in the male group than in the female group.

However, an exception of the two linear dental variables; Antero-posterior distance from maxillary incisor to point A, **1U-Avert** (mean=3.18) and anteroposterior distance from mandibular incisor to line A-Pog, **1L-Avert** (mean=3.10) were found to be slightly and insignificantly larger in the girls group.

Table (4) Comparison of McNamara's variables between Egyptian boys and girls

Variables	Boys	Girls	Test of Sig.	P value
PnA (mm)				
Min. – Max.	-6.0 – 6.0	-8.0 – 6.0	U= 379.5	0.747
Mean ± SD.	-0.40 ± 3.78	-0.05 ± 3.47		
SNA (degree)				
Min. – Max.	73.0 – 88.0	8.0 – 87.0	t= 1.015	0.314
Mean ± SD.	81.20 ± 4.26	78.42 ± 11.81		
Cd-A (mm)				
Min. – Max.	69.0 – 85.0	64.0 – 90.0	t= 2.095*	0.041*
Mean ± SD.	76.80 ± 5.15	73.55 ± 5.90		
Cd-Gn (mm)				
Min. – Max.	86.0 – 114.0	82.0 – 116.0	t= 2.072*	0.043*
Mean ± SD.	100.15 ± 7.14	96.18 ± 6.94		
Max-Mand (mm)				
Min. – Max.	16.0 – 31.0	17.0 – 31.0	t= 0.714	0.478
Mean ± SD.	23.35 ± 4.58	22.58 ± 3.62		
ANS-Me (mm)				
Min. – Max.	52.0 – 68.0	50.0 – 68.0	t= 1.478	0.145
Mean ± SD.	59.90 ± 4.61	58.05 ± 4.55		
SpP- GoMe (degree)				
Min. – Max.	22.0 – 37.0	19.0 – 90.0	U= 360.0	0.529
Mean ± SD.	28.75 ± 4.48	31.25 ± 11.21		
NBa-PtGn (degree)				
Min. – Max.	78.0 – 92.0	79.0 – 101.0	U= 335.5	0.310
Mean ± SD.	87.80 ± 3.99	86.98 ± 4.98		
Pn-Pog (mm)				
Min. – Max.	-25.0 – 7.0	-25.0 – 7.0	U= 390.0	0.875
Mean ± SD.	-6.80 ± 8.76	-7.35 ± 7.39		
1u-Avert (mm)				
Min. – Max.	-3.0 – 10.0	-4.0 – 11.0	U= 372.5	0.664
Mean ± SD.	2.75 ± 3.39	3.18 ± 3.16		
1L-Avert. (mm)				
Min. – Max.	-2.0 – 6.0	-2.0 – 9.0	U= 382.5	0.781
Mean ± SD.	2.80 ± 2.28	3.10 ± 2.37		

: Statistically significant at p ≤ 0.05

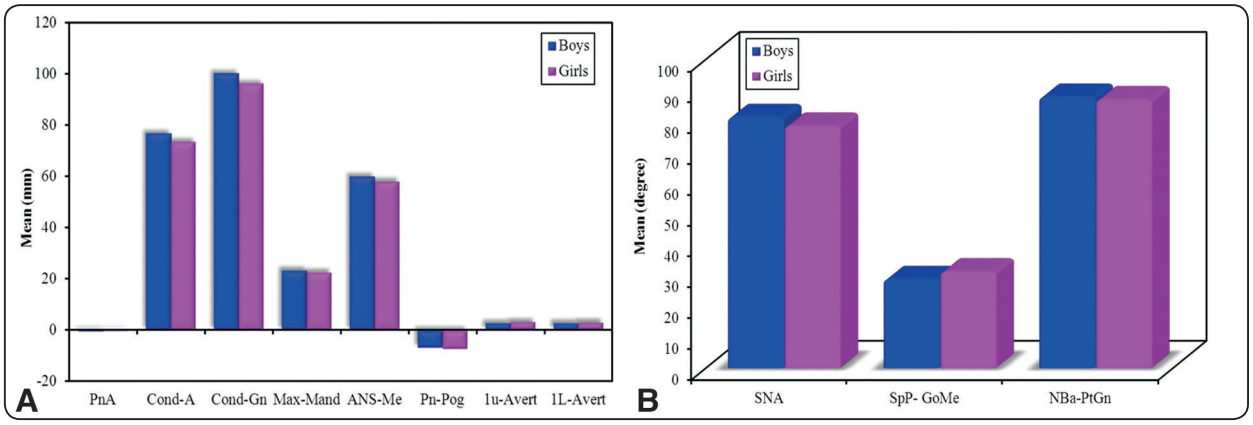

Fig. (3) A and B: Inter-gender comparison of McNamara's 11 parameters.

DISCUSSION

The current investigation established the cephalometric norms of untreated male and female Egyptian children using McNamara's analysis.[5] The sample was picked from dental patients attending our practice with the age group between 6 and 12 years of age. The sample size in this study was 60 subjects (20 boys and 40 girls). The criteria upon which the subjects were selected in this study was harmonious to other similar studies[6,10,18,21] with normal/acceptable occlusion and pleasing profile as the inclusion criteria.

In their cephalometric comparison study between Egyptian and American adolescents back in 1990, Bishara et al. found that the boys were larger in the linear dimensions of the cranial base and face heights than the girls in both ethnic groups.[7]

In agreement to this general cephalometric finding, the inter-gender significant differences noted in our study were positive to certain extent with that of the Chinese[9] and Turkish[10] McNamara studies that were conducted on a rather younger age group (10 – 14 years) and (11-16 years) respectively compared to the other McNamara studies found in the literature. Both the effective mandibular length Cd-Gn, and the effective midface length Cd-A, were significantly larger in the adolescent male subjects of both the Chinese[9] and the Turkish study[10]. However, only the study conducted on Lebanese adult subjects were consistent to our finding regarding a slightly protrusive incisors in the female counterpart.[19]

On reviewing other comparable studies a general tendency to emphasis sexual dimorphism or inter-gender difference was always observed. Nepalese[8] and Bangladeshi[11] males were found to have significantly larger midfacial length, mandibular length, also a longitudinal study on Swedish subjects concluded that the craniofacial distances were constantly larger in males than females.[22] Other variables showed no statistical differences between genders.

CONCLUSION

The small, but statistically significant, gender differences in mandibular and midfacial lengths may not be clinically significant. Considering the ethnic facial features, regarding age and gender of the patients, play a critical role in setting objectives for successful orthodontic treatment.

Thereby, a single set of Egyptian norms for the McNamara analysis may be advisable and practical in orthodontic diagnosis.

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