

Comparison of certain radiomorphometric facial indices in different facial types of Iraqi adults using Cone Beam Computed Tomography

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ABSTRACT

Background: The human face has its special characteristics. It may be categorized into essentially three kinds in horizontal and vertical directions: short or brachyfacial, medium or mesofacial and long or dolichofacial. The aim of this study was to describe several orofacial indices and proportions of adults, according to gender in Iraqi subjects by using cone beam computed tomography .

materials and methods: This prospective study included 100 Iraqi patients (males and females) ranging from 20 to 40 years. All subjects attended the Oral and Maxillofacial Radiology Department of Health Specialist Center for Dentistry in AL Sadr city in Baghdad taking cone beam computed tomography scan for different diagnostic purposes from October 2016 to May 2017. The facial index was used for determination of facial type. Subjects were divided according to gender and then by photoshpe cs4 programe ,five variables were calculated : inferior face index, superior face index, chin-face proportion, chin proportion and mandibular proportion.

Results: The average values obtained from the subjects divided according to genders that presented significant differences were: inferior face index and superior face index for males and inferior face index, superior face index and mandibular proportion for females.

Conclusion: There were variation in some indices and proportions according to genders. In males groupe, inferior face index and superior face index had significant difference between the average of the facial types, while in female group, inferior face index, superior face index and mandibular proportion had significant difference between the average of the facial types

Key words: facial types, cone beam computed tomography CBCT, facial indices. (*J Bagh Coll Dentistry 2018; 30(2): 66-70*)

INTRODUCTION

All humans have similar features in the face. But, their proportions and relations differ from one face to another within a race or group ⁽¹⁾. The criterion for evaluation of the facial typology within ordinarieness come from the craniofacial skeleton growth process, from the resulting physical transformations and from a morphogenic process. Craniofacial growth happens through genetic characteristics of every person and facial characteristics are gotten by heredity ^(2,3).

There are several ways for evaluation of facial morphology, several authors propose anthropometry as a science that studies the measurements of various parts of the body such as weight, size and proportions, through a sequence of measurements of the head and face ^(4,5). The facial typology should be considered in studies that include anthropometry, since the measurements values may differ depending on the facial type. There are three essential facial

types: short (brachyfacial) , medium (mesofacial) and long face (dolichofacial) ^(6,7). Cone beam computed tomography (CBCT) is a three-dimensional (3D) imaging technique that permits accurate imaging of hard tissue structures. CBCT is able to supply sub-millimeter resolution, images of higher diagnostic value, with shorter scanning times and lower radiation dose than conventional CT scans during maxillofacial exposure ⁽⁸⁾. The facial indices may be more reliable and accurately determined by means of CBCT scans of seated patients with their lower jaw in rest position and relaxed lips ⁽⁹⁾.

In this study, several orofacial indices and proportions were described by utilizing CBCT images of Iraqi adult patients.

MATERIALS AND METHODS

This prospective study involved 100 Iraqi adult subjects (male and female) ranging from 20 to 40 years, who attended Oral and Maxillofacial Radiology department of Al Sader Specialized Health Center in Baghdad city. They were scanned with CBCT image for different diagnostic purpose from October 2016 to May 2017.

The patients who came to the diagnostic centre were selected after considering the inclusion criteria including: there were no pathological

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conditions, deformities, trauma, orthognathic surgery in the past and patient were with no history of orthodontic treatment, CI I skeletal relation and full dentition. All patients had informed consent for participation in this study.

The CBCT examinations were carried out for each patient with Kodak 9500/Care stream (France), full rotation scan was performed with the size of field of view 18×20.6 cm diameter and the exposure parameters of radiographic machine were : voxel size 300, MA 10, KV 90 slice thickness 1mm. The 3D image analysis was carried out using photosope CS4. By using the facial index which is the relation between the height and width of the face ,facial types were determined.The subjects were classified according to their facial type: dolichofacial (facial index 90.0 to 95 % or greater), mesofacial (facial index 85.0 to 89.9%) and brachyfacial (facial index smaller than 80.0 to 84.9%)⁽¹⁰⁾. To collect the orofacial anthropometric measurements, eight facial points were marked as reference points on 3D image. These points were me (Menton):which is the most caudal point in the outline of the symphysis, it is regarded as the lowest point of the mandible n (nasion): which is the most anterior point on the nasofrontal suture in the median plane, zi (zygomatic): which is the most lateral point of the zygomatic arch ,Point a: which is the deepest point on the concave outline of the upper labial alveolar process, in (incisal edge): which is the incisal edge of upper and lower anterior teeth, go (Gonion): which is a constructed point, the intersection of the lines tangent to the posterior margin of the ascending ramus and the mandibular base, Point b (Supramenton):which is the most posterior point in the outer contour of the mandibular alveolar process in the madian plane, cd (Condyle): which is the most lateral point on the the surface of the condyle of the mandible⁽¹¹⁾.

Next, with the aid of photosope program C4, seven anthropometric facial measures were collected including : anterior face height (n-me), posterior face height (cd-go), bizygomatic left to right distance (zi-zi), chin height (b-me), lower face height (a-me), inferior face height (in-me) and middle face height (n-in)⁽¹¹⁾.

Five variables were calculated from the obtained measurements: superior facial index (n-in /zi-zi); inferior facial index (a-me/zi-zi); chin proportion (b-me/zi-zi); chin-face proportion (b-me/n-me) and mandibular proportion (in-me/cd-go).

The accuracy and reproducibility of examiner reading was determined by means of inter-examiner calibration to compare the readings of examiner (10 randomly selected readings) with those performed by professional senior.No significant difference was found between the first

and second examiners readings when paired t-test was applied .Also,all the measurements were repeated by the same examiner after 2 weeks from the first reading (intra-examiner calibration) on randomly selected 10 subjects, comparison of two reading showed non-significant difference when paired t-test was applied. The statistical analysis was carried out by using SPSS, independent sample t-test and leven test. Furthermore, an analysis of the area under the Receiver Operating Charecteristics (ROC) curve was performed, in order to verify the possibility of establishing a way to predict facial type only from orofacial indices and proportions .In this case, the area under the (ROC) curve considered significant was greater than 0.5 and with p-value lower than 0.05.

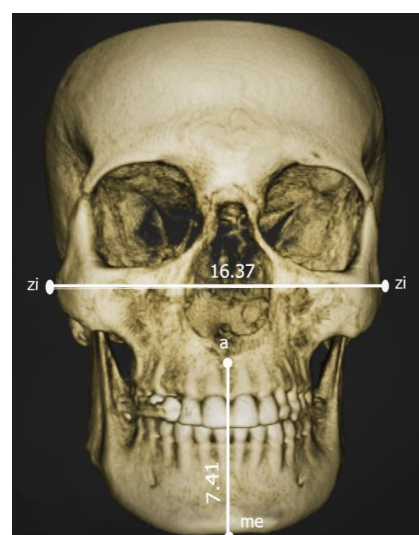


Figure 1 : inferior face index

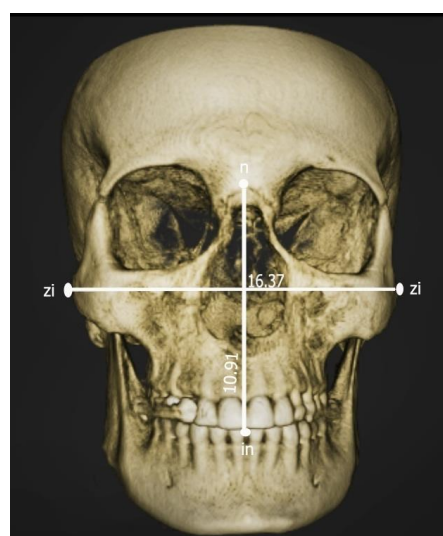


Figure 2: Superior face index

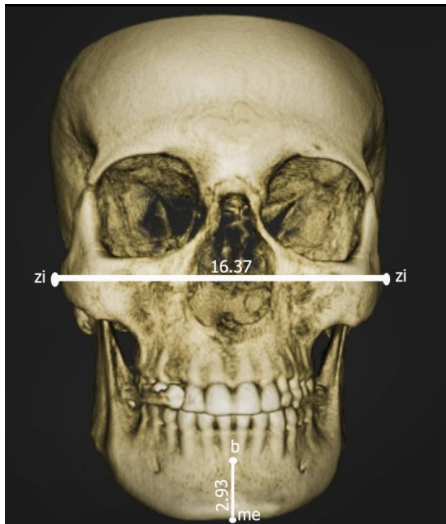


Figure 4: Chin proportion

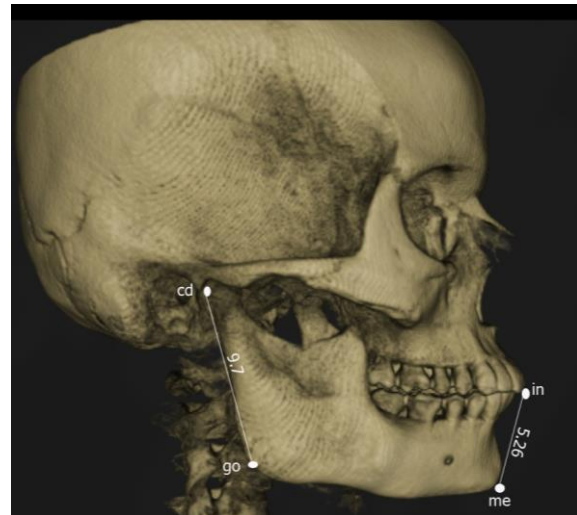


Figure 5: Mandibular proportion

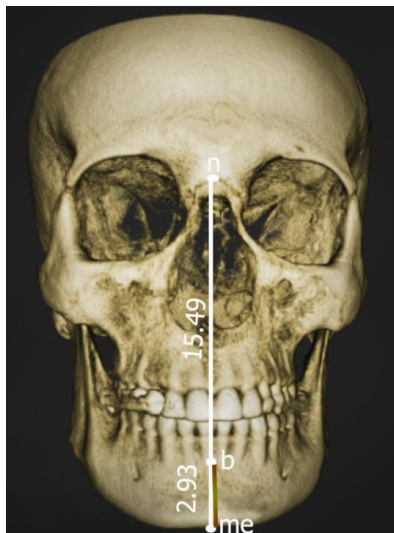


Figure 3: Chin-face proportion

RESULTS

The total studied samples composed of 100 subjects in which 36 were males and 64 were females. The most frequent facial type was dolichofacial (n=81, 81%), then mesofacial type (n=19, 19%), but there is no brachyfacial type in the total sample as shown in table 1.

The data show that two indices present significant differences between the average of the facial types in the male group: inferior face index (IFI) and superior face index (SFI) as shown in table 2. In female, inferior face index, superior face index and mandibular proportion (MP) had significant difference between the average of the facial types as shown in table 3.

Table 1: Frequency distribution of the sample

Facial types	Males	Females	Total
Dolichofacial	31(31%)	50 (50%)	81(81%)
Mesofacial	5 (5%)	14 (14%)	19 (19%)
Brachyfacial	0 (0%)	0 (0%)	0 (0%)
Total	36 (36%)	64 (64%)	100 (100%)

Table 2: Comparison between the measurements of the facial types in males group

Measurements	Facial types	Descriptive Statistics					Statistical test		
		N	Mean	S.D.	Min.	Max.	t-test	df	p-value
Inferior face index	D	31	0.510	0.041	0.447	0.581	2.549	34	0.015 (S)
	M	5	0.460	0.037	0.432	0.523			
Superior face index	D	31	0.658	0.029	0.601	0.730	5.935	34	0.000 (HS)
	M	5	0.580	0.015	0.564	0.603			
Chin-face proportion	D	31	0.200	0.024	0.162	0.246	0.755	4.069	0.492 (NS)
	M	5	0.235	0.103	0.180	0.419			
Chin proportion	D	31	0.195	0.025	0.149	0.252	0.274	4.088	0.797 (NS)
	M	5	0.206	0.094	0.156	0.374			
Mandibular proportion	D	31	0.567	0.047	0.474	0.675	0.952	34	0.348 (NS)
	M	5	0.547	0.032	0.520	0.602			

Table 3: Comparison between the measurements of the facial types in females group

Measurements	Facial types	Descriptive Statistics					Facial types Difference (d.f.=62)	
		N	Mean	S.D.	Min.	Max.	t-test	p-value
Inferior face index	D	50	0.502	0.034	0.438	0.563	6.253	0.000 (HS)
	M	14	0.441	0.027	0.379	0.480		
Superior face index	D	50	0.649	0.049	0.467	0.735	2.602	0.012 (S)
	M	14	0.613	0.025	0.563	0.641		
Chin-face proportion	D	50	0.187	0.024	0.139	0.247	0.486	0.629 (NS)
	M	14	0.191	0.021	0.158	0.221		
Chin proportion	D	50	0.179	0.025	0.127	0.246	1.584	0.118 (NS)
	M	14	0.168	0.020	0.129	0.197		
Mandibular proportion	D	50	0.602	0.071	0.451	0.755	2.700	0.009 (HS)
	M	14	0.544	0.072	0.427	0.678		

DISCUSSION

Numerous studies depended on anthropometry to determine facial type using: facial index (ratio between maximum vertical facial height and maximum horizontal face width)⁽¹²⁾, morphological face index (ratio between anterior face height and bizygomatic distance)^(13, 14), cephalic index (ratio between length and total width of the head)^(15,16).

The CBCT gives high resolution images with shorter exposure time and less radiation dose in comparison with CT, in addition to determine the distance and provide precise measurement and anatomical analysis^(17,18,19).

The most frequent facial type was dolichofacial (n= 81, 81%) followed by mesofacial type (n=19,19%), while there was no brachyfacial type in the total sample, this result disagree with Ramires et al., 2011⁽²⁰⁾ who conducted a similar study on 105 Brazilian leukoderm adult. They reported that most frequent facial type was brachyfacial (n=41, 39.1%), then mesofacial (n=37,35.2%) and the least frequent was dolichofacial (n=27, 25.7%), this variance might be attributed to difference in the ethnicity Guedes et al., (2010)⁽²¹⁾ conducted study on 39 Brazilian adolescents and found that 16 (41.03%) were dolichofacial, 13 (33.33%) were mesofacial and 10 (25.65%) were brachyfacial, this result agree with the current study dolichofacial and mesofacial types, but disagrees with brachyfacial type due to ethnicity differences.

In male group, there were significant difference between facial types (dolichofacial and mesofacial) in inferior face index and superior face index, this result agrees with Ramires et al., 2011 study. There are no significant difference between facial types in chin – face proportion and chin proportion, this result agrees with Ramires et al., 2011 result. There was no significant difference between facial types in mandibular proportion, this

result disagrees with study done by Ramires et al., 2011 who reported significant difference between facial types and mandibular proportion. This variance might be attributed to the difference in the measured sample. The study measured direct on the face while in the present study used CBCT image for adult subjects, also the difference in the ethnicity. In female group, there was significant difference between facial types in inferior face index and superior face index. This result disagrees with Ramires et al., 2011. This variance might be due to variations in the measurement between the Brazilian leukoderm adults and Iraqi adults. There were no significant difference between facial types in chin – face proportion and chin proportion, this result agrees with Ramires et al., 2011. There were high significant difference between facial types in mandibular proportion, this result is consistent with study done by Ramires et al., 2011.

CONCLUSION

The CBCT is a novel imaging modality. It provides high resolution cross-sectional images with a less radiation dose and shorter exposure time in contrast to CT, as well as determining the distance and providing accurate measurement and anatomical analysis. Some indices and orofacial proportions vary according to different facial types. These differences may be noticed in a greater number of variables in males, when compared to females.

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الخلاصة

الخلفية: الوجه الإنساني له خصائصه الخاصة. ويمكن تصنيفها بشكل أساسي إلى ثلاثة أنواع في الاتجاهين الأفقي والرأسي إلى: قصيرة، متوسطة وطويلة

الهدف الدراسة الحالية: لوصف العديد من المؤشرات الوجهية ونسب البالغين، وفقا لنوع الجنس على أساس القياسات البشرية على اشخاص عراقيين باستخدام التصوير المقطعي ذو الشعاع المخروطي.

المواد والوسائل: شملت هذه الدراسة 100 مريض عراقي (ذكور وإناث) تراوحت ما بين 20 إلى 40 سنة. وحضر جميع المشاركين لقسم الغم والوجه والفكين الأشعة في مركز التخصصي لطب الأسنان في مدينة الصدر في بغداد و وتم تصويرهم بواسطة جهاز التصوير المقطعي ذو الشعاع المخروطي من أكتوبر 2016 إلى مايو 2017 لأغراض التشخيص المختلفة وقد استخدم مؤشر الوجه لتحديد نوع الوجه، ثم تقسيم المشاركين وفقا لنوع الجنس ، ومن ثم حساب خمسة متغيرات: مؤشر الوجه السفلي، مؤشر الوجه العلوي،نسبه الذقن وجه ، و نسبه الذقن ونسبة الفك السفلي .

النتائج: متوسط القيم التي حصل عليها المشاركين مقسوما على الجنسين عرضت اختلافات معنوية هي: مؤشر الوجه السفلي ومؤشر الوجه العلوي للذكور ومؤشر الوجه السفلي، مؤشر الوجه العلوي ونسبة الفك السفلي للإناث.

الاستنتاج: هناك تباين في بعض المؤشرات والنسب حسب الجنس.

الكلمات المفتاحية: أنواع الوجه، شعاع المخروط المقطعي ، مؤشرات الوجه.