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Correlation between Facial Type and Certain Radiomorphometric Facial Indices according to Gender Differences in Each Type among Iraqi Adult using Cone Beam Computed Tomography

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Abstract: ***Background**: The human face, with its bone and muscle structures, presents its special characteristics. It may be categorized into essentially three kinds in the horizontal and vertical directions. One form of categorization, which takes into account the vertical plane of the face separates it into: short or brachyfacial, medium or mesofacial and long ordolichofacial. The aim of the current study to describe several orofacial indexes and proportions of adults, according to gender difference and to verify the possibility of establishing a form of facial classification based on anthropometry in Iraqi subjects by using CBCT . **Material 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 CBCT 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 facial type, and then calculated five variables: inferior face index, super or face index, chin-face proportion, chin proportion and mandibular proportion. **Results**: The subjects divided according to facial type that presented significant differences were:chin –face proportion, chin proportion and mandibular proportion for dolichofacial type and superior face index for mesofacial type. To predict facial types, the following parameters was considered significant : inferior face index and superior face index for the dolichofacial type for males and the inferior face index, superior face index and mandibular proportion for the dolichofacial type for females. **Conclusion**: There are variation in some indexes and proportions according to gender differences .The variables in the current study are not good predictors for facial types determination.*

Keywords: facial types, cone beam computed tomography CBCT, facial indice

1. Introduction

Facial typology is the variance of the craniofacial skeleton, which is made up of skeletal and muscular structures. Diagnosis of the facial type is significant, since every type has its self characteristics according to facial harmony, dental occlusion, or ofacial musculature, and also the configuration and shape of craniofacial structures. These features effect directly the functions of swallowing, voice, chewing, speech and breathing . Therefore determining the face type of the persons is basic for professionals like facial orthopedists, orthodontists, oral maxillofacial surgeons, plastic surgeons and speech therapists [1]. 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 like weight, size and proportions, through a sequence of measurements of the head and face[2, 3]. Anthropometry can be direct, obtain the measurement directly on the face of the subject, or indirect, from radiographs (cephalometry), two or three dimensional photographs[4].The facial typology should be considered in studies that include anthropometry, since the measurements values may differ dependent on the facial type. There are three fundamental facial types: short or brachyfacial, medium or mesofacial and long face or dolichofacial [5, 1].

Cone beam computed tomography (CBCT) is a radiographic imaging technique that permits accurate, three-dimensional (3D) imaging of hard tissue structures. CBCT is capable of supplying sub-millimeter resolution, images of higher diagnostic value, with shorter scanning times (~60 s). Radiation exposure dose from CBCT is 10 times less than from conventional CT scans during maxillofacial exposure [6].

2. Materials and Method

A prospective study of CBCT scan for (100) Iraqi adult patients (female and male) with age between (20-40) years attending Oral and Maxillofacial Radiology department of Al Sader Specialized Health Center for dental treatment in Baghdad city who underwent CBCT scans for different purposes since October 2016 to May 2017.

The patients who visited a diagnostic centre were selected after considering the inclusion criteria which are: age range (20 - 40 years), there are nopathological conditions, deformities, trauma, orthognathic surgery in the past and patient with no history of orthodontic treatment. All patients had their CBCT scans taken for other purposes and they had informed consent for participation in this study.

All patients had their CBCT scans taken for other purposes and they had informed consent for participation in this study. The CBCT examinations were carried out for every

patient withKodak 9500/Care stream (France), full rotation scan was performed with the size of field of view will be 18× 20.6cm diameter and the exposure parameters of radiographic machine include: voxel size 300, KV 90, MA 10.The analysis was conducted using photoshope C4. All images were obtained with volume 1 (high-resolution) and high-contrast options. The statistical analysis was made by using SPSS to make the statistical analysis. A paired T test and Levene test. Furthermore, an analysis of the area under the ROC curve was performed, in order to verify the possibility of establishing a way to predict facial type only from orofacial indexes and proportions .In this case, the area under the Receiver Operating Characteristics (ROC) curve considered significant was greater than 0.5 and with p-value lower than 0.05. Using the facial index to determine the facial types, the subjects were classified according to their facial type: dolichofacial (facial index 90.0 to 95 % or greater), mesofacial (facial index85.0 to 89.9%) and brachyfacial (facial index smaller than 80.0 to 84.9%). The facial index is the relation between the height and width of the face[**7**].To collect the orofacial anthropometric measurements, eight facial points were marked as reference on3d image. These points were n (nasion): The most anterior point on the nasofrontal suture in the median plane,me (Menton): it is the most caudal point in the outline of the symphysis, it is regarded as the lowest point of the mandible, zi (zygomatic):the most lateral point of the zygomatic arch,Point a: is the deepest point on the concave outline of the upper labial alveolar process, in (incisal edge):Is the incisal edge of upper and lower anterior teeth,Point b (Supramenton):it is the most posterior point in the outer contour of the mandibular alveolar process in the madian plane, go (Gonion): a constructed point, the intersection of the lines tangent to the posterior margin ofthe ascending ramus and the mandibular base, cd (Condylin): the most lateral point on the surface of the condyle of the mandible [**8**].

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

Five variables were calculated from the obtained measurements: inferior facial index (a-me/zi-zi)figure1; superior facial index (n-in /zi-zi) figure 2; chin-face proportion (b-me/n-me) figure 3; chin proportion (b-me/zi-zi) figure 4 ; and mandibular proportion (in-me/cd-go) figure 5.

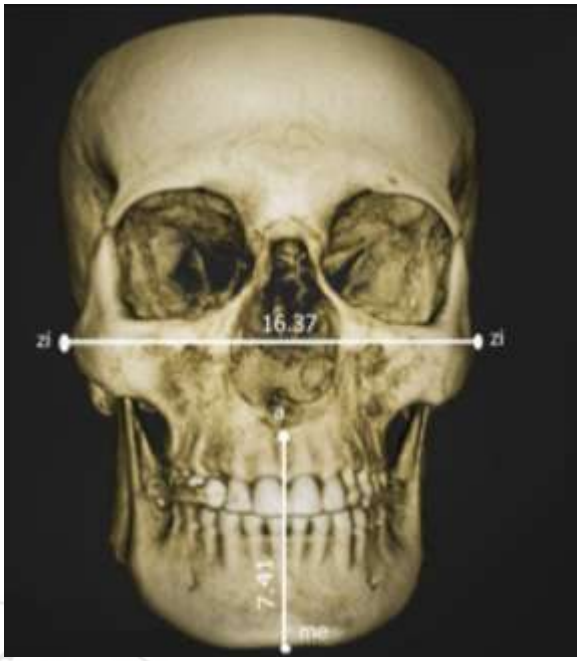

Figure 1: Inferior face index

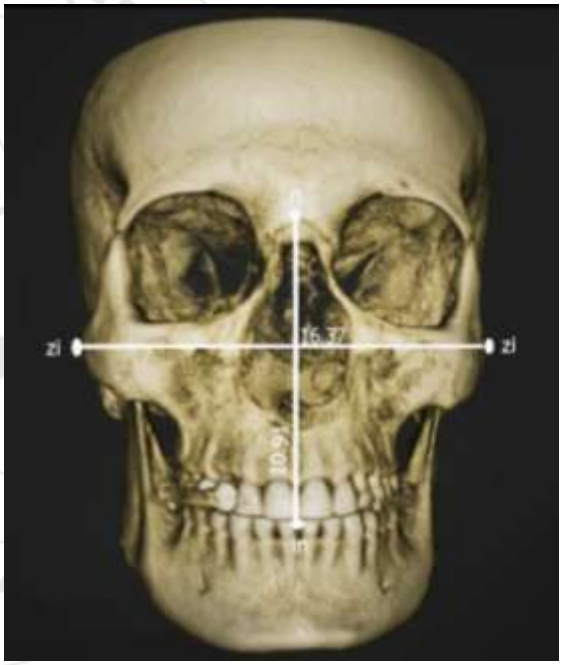

Figure 2: Superior face index

Figure 3: Chin-face proportion

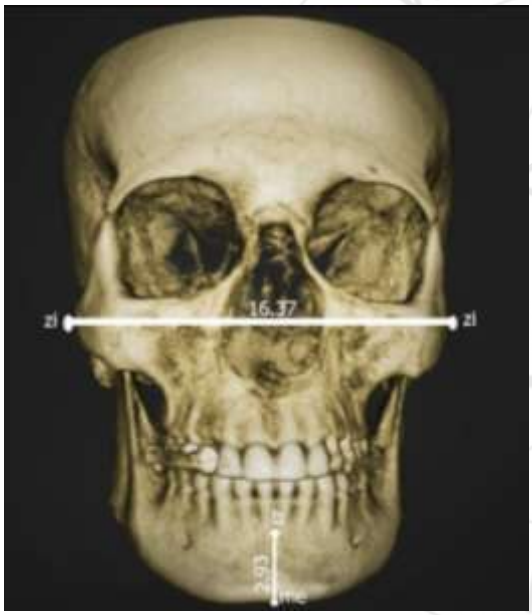

Figure 4: Chin proportion

Figure 5: Mandibular proportion

3. Results

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.

The data show that three proportions present significant differences between genders in the dolichofacial type :chin-face proportion (CFP), chin proportion(CP) and mandibular proportion (MP)shown in table 1. In mesofacial type only superior face index (SFI) had significant difference between genders as shown in table 2.

The predictive ability of the indexes and facial proportions for defining facial type was calculated. Formales, the variables considered good predictors of determining dolichofacial type were: superior face index (area under the ROC curve=0.994, p=0.000) and inferior facial index (ROC=0.845, p=0.014) as shown in table 3 . In regards to females, inferior facial index (ROC= 0.926, p=0.000), superior face index (ROC= 0.803, p= 0.001) and mandibular proportion (ROC=0.703, p=0.021) were considered a good predictor for dolichofacial type as shown in table 4.There were no variables predictors for determining mesofacial type in both males and females.

According to the data, both the chin-face proportion (b-me/n-me) and chin proportion (b-me/zi-zi) were not considered good predictors for any facial types, in both genders.

Table 1: Gender differences in dolichofacial group

Measurements	*Genders*	*Descriptive Statistics*					*Statistical test*		
		N	Mean	S.D.	Min.	Max.	t-test	df	p-value
Inferior face index	Males	31	0.510	0.041	0.447	0.581	0.850	79	0.398 (NS)
	Females	50	0.502	0.034	0.438	0.563			
Superior face index	Males	31	0.658	0.029	0.601	0.730	0.942	79	0.349 (NS)
	Females	50	0.649	0.049	0.467	0.735			
Chin-face proportion	Males	31	0.200	0.024	0.162	0.246	**2.389**	**79**	**0.019 (S)**
	Females	50	0.187	0.024	0.139	0.247			
Chin proportion	Males	31	0.195	0.025	0.149	0.252	**2.779**	**79**	**0.007 (HS)**
	Females	50	0.179	0.025	0.127	0.246			
Mandibular proportion	Males	31	0.567	0.047	0.474	0.675	**2.688**	**78.594**	**0.009 (HS)**
	Females	50	0.602	0.071	0.451	0.755			

Table 2: Gender diffrernces in mesofacial group

Measurements	*Genders*	*Descriptive Statistics*					*Statistical test*		
		N	Mean	S.D.	Min.	Max.	t-test	df	p-value
Inferior face index	Males	5	0.460	0.037	0.432	0.523	1.232	17	0.235 (NS)
	Females	14	0.441	0.027	0.379	0.480			
Superior face index	Males	5	0.580	0.015	0.564	0.603	2.859	17	0.011 (S)
	Females	14	0.613	0.025	0.563	0.641			
Chin-face proportion	Males	5	0.235	0.103	0.180	0.419	0.960	4.116	0.390 (NS)
	Females	14	0.191	0.021	0.158	0.221			
Chin proportion	Males	5	0.206	0.094	0.156	0.374	0.911	4.136	0.412 (NS)
	Females	14	0.168	0.020	0.129	0.197			
Mandibular proportion	Males	5	0.547	0.032	0.520	0.602	0.061	17	0.952 (NS)
	Females	14	0.544	0.072	0.427	0.678			

Table 3: Prediction of facial types by facial measurements in males

Facial type	*Variables*	*Area under the curve*	*Cutt off point*	*Sensitivity%*	*% Specificity*	*PP value %*	*NP value %*	*P*
Dolichofacial	IFI	0.845	0.4545	93.5	80	82.4	92.5	0.014
	SFI	0.994	0.6106	96.8	100	100	96.9	0.000
	CFP	0.510	0.1892	64.5	60	61.72	62.83	0.945
	CP	0.703	0.1800	77.4	80	79.5	77.97	0.150
	MP	0.671	0.5424	71	80	78.9	73.40	0.225
Mesofacial	IFI	0.155	0.5174	20	64.5	36.03	44.64	0.014
	SFI	0.006	1	0	100	0	50	0.000
	CFP	0.490	0.2012	40	61.3	50.83	50.54	0.945
	CP	0.297	0.3130	20	100	100	55.56	0.150
	MP	0.329	0.5987	20	80.6	50.76	50.19	0.225

Table 4: Prediction of facial types by facial measurements in female

Facial type	Variables	Area under the curve	Cutt off point	Sensitivity%	% Specificity	PP value %	NP value%	P
Dolichofacial	IFI	0.926	0.4715	80	92.9	91.85	82.3	**0.000**
	SFI	0.803	0.6367	66	92.9	90.3	73.2	**0.001**
	CFP	0.436	0.1878	52	42.9	47.66	47.2	**0.470**
	CP	0.610	0.1723	60	57.1	58.31	58.8	**0.211**
	MP	0.703	0.5574	72	64.3	66.9	69.7	**0.021**
Mesofacial	IFI	0.074	1	0	100	0	50	**0.000**
	SFI	0.197	0.5944	78.6	12	47.18	35.93	**0.001**
	CFP	0.564	0.1922	57.1	62	60.04	59.10	**0.470**
	CP	0.390	0.1825	35.7	64	49.79	49.88	**0.211**
	MP	0.297	0.6079	28.6	56	39.39	43.96	**0.021**

4. Discussion

Several studies depend themselves on anthropometry to determine facial type using: facial index (relation between maximum vertical facial height and maximum horizontal face width) [9],morphological face index (relation between anterior face height and bizygomatic distance)[10,11], cephalic index (relation between length and total width of the head)[12,13].The CBCT supply high resolution images with a less radiation dose and shorter exposure time in contrast to CT, as well as determine the distance and supplying accurate measurement and anatomical analysis [14,15,16].

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, this result disagree with Ramires et al., 2011 [17] which make the study on 105 Brazilianleukoderm adult which report the 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 attributed to difference in the ethnicity.

Guedes et al., (2010) [18] make 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 come in agreement with current study only on dolichofacial and mesofacial types, but disagree with brachyfacial type due to ethnicity differences.
In regards to gender difference in dolichofacials type, there are no significant difference between genders in inferior face index and superior face index. But, there are significant difference between genders inchin-face proportion, chin proportion and mandibular proportion.

In mesofacial type, there were no significant difference between genders in inferior face index, chin-face proportion, chin proportion and mandibular proportion. While there was significant difference between genders insuperior face index . As Iraqi sample, it's the first time these indicies are studied and may be it will be a reference for future studies.

Regarding the possibility of using only indexes and facial proportions to determine facial types, superior face index consider good predictor of determining dolichofacial male,

the study done by Ramireser al., 2011 agree with the current study.

Inferior face index consider good predictor of determining dolichofacial male, this result incompatible with Ramireser al., 2011 study, this difference may be due to fact that either the used method is different or ethnicity difference. In the existing study, there were no variables consider predictor of determining mesofacial male and female, this result agree with Ramireser al., 2011.In female inferior face index and superior face index were consider good predictor for dolichofacial, these result be dissimilar with Ramireser al., 2011.

Ramireser al., in 2011 reported that mandibular proportion was considered a good predictor for dolichofacial female, these result come in agreement with the present study. Each of chin –face proportion and chin proportion were not considered good predictors for any facial types in both genders, these result similar with Ramireser al., 2011 .

References

[1] Ramires RR, Ferreira LP, Marchesan IQ, Cattoni DM, Andrada e Silva M .Facial typology applied to Speech Therapy: literature review. Rev Soc Bras Fonoaudiol. 2010; 15 (1): 140-5.
[2] Farkas LG, Katic MJ, Forrest CR.Anthropometric proportion indices in the craniofacial regions of 73 patients with isolated coronal synostosis forms. Ann Plast Surg.2005; 55 (5): 495-9.
[3] Cattoni DM.The use of the pachymeter in the evaluation of orofacial morphology. Rev Soc Bras Fonoaudiol. 2006; 11 (1): 52-8.
[4] Weinberg SM, Naidoo S, Govier DP, Martin RA, Kane AA, Marazita ML Anthropometric accuracy and accuracy of digital three- dimensional .photogrammetry: comparing the genex and 3dMD imaging systems with one another and with direct anthropometry. J Craniofac Surg. 2006; 17 (3): 477-83.
[5] Bianchini EMG. Cephalometry in oral myofunctional changes: diagnosis and speech therapy. 5th ed. E ampl. Carapicuíba: Pro-phone,2002.
[6] KumarM.,ShanavasM., Sidappa A., Kiran M. Cone Beam Computed Tomography - Know its Secrets . Journal of International Oral Health.2015; 7(3):1-5.
[7] Daruge E, Zallaf CF.A biometriaaplicadanaidentificação. RGO. 1985; 33(2):153-55.
[8] Farkas LG. Anthropometry of the head and face. 2a ed. New York: Raven Press; 1994.
[9] Arslan SG, Genç C, Odabaş B, Kama JD. Comparison of facial proportions and anthropometric norms among Turkish young adults with different face types. Aesthetic Plast Surg. 2008;32(2):234-42.
[10] Bianchini AP, Guedes ZC, Vieira MM. Estudo da relação entre a respiração oral e o tipo facial. Rev Bras Otorrinolaringol. 2007;73(4):500-5.
[11] Sies ML, Farias SR, Vieira MM. Respiração oral: relação entre o tipo facial e a oclusãodentáriaemadolescentes. Rev Soc Bras Fonoaudiol. 2007;12(3):191-8.
[12] Hajniš K, Farkas LG, Ngim RC, Lee ST, Venkatadri G. Racial and ethnic morphometric differences in the craniofacial complex. In: Farkas LG. Anthropometry of the head and face. 2a ed. New York: Raven Press; 1994. p.201-18.
[13] Enlow DH, Poston WR, Bakor SF. Crescimento facial. 3a ed. São Paulo: Artes Médicas; 1993.
[14] Kim, D.I., Kim, H.S. and Chung, I.H . High-resolution CT of the pterygopalatine fossa and its communications. Neuroradiology1996; 38, pp.S120-S126.
[15] Pauwels, R, Beinsberger, J, Collaert, B, Theodorakou, C, Rogers, J.A., Walker, Cockmartin, L, Bosmans, H, Jacobs, R, Bogaerts, R, and Horner, K. Effective dose range for dental cone beam computed tomography scanners. European Journal of Radiology.2010; 81, 267–271.
[16] Horner, K., Jacobs, R. and Schulze, R. Dental CBCT equipment and performance issues.Radiation protection dosimetry. 2013;153(2), pp.212-218.
[17] Ramires, R.R., Ferreira, L.P., Marchesan, I.Q. and Cattoni, D.M. Proposal for facial type determination based on anthropometry. Jornal da SociedadeBrasileira de Fonoaudiologia.2011; 23(3), pp.195-200.
[18] Guedes SP, Teixeira BV, Cattoni DM .Orofacial measures in adolescents of the state of Rio de Janeiro according to the facial typology. Rev CEFAC 2010 ; 12 (1): 68-74.