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The selection of maxillary anterior teeth width in relation to facial measurements at different types of face form

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ABSTRACT

It is difficult to determine the dimensions of maxillary anterior teeth for edentulous patient when pre–extraction records are not available. Therefore, the present clinical study was carried out to evaluate the relationships between maxillary anterior teeth measurements [canine arc distance (CARCD), central incisor width] and certain horizontal facial parameters which included: [(interzygomatic, inner and outer canthus and inter-pupillary) distances in addition to that (interalar, mouth and philtrum of upper lip) widths], and also to determine those relations at different types of facial form in both sexes for the best selection of maxillary anterior teeth widths.

The facial and dental measurements were obtained directly from 100 Iraqi undergraduate dental students by using an electronic digital vernier caliper. Depending on facial index for each subject, the larger percentage of students (80%) had a leptoprosopic (long and narrow) face in which their facial indices were 90 or above, whereas 4% of students had a euryprosopic (square) face in which their facial indices 82.1–83.1; while 16% of those students had a mesoprosopic (ovoid) face in which their facial indices 85.3–89.5.

The Pearson Product Moment Correlation Coefficient was used for all relationships and the results revealed that there was a significant correlation between CARCD and mouth width in males with leptoprosopic face while in those with mesoprosopic face the CARCD was significantly correlated with both mouth and interzygomatic widths but with higher correlation coefficient value being with mouth width, the maxillary central incisor width was significantly correlated with both inner canthal distance and philtrum width of upper lip but with higher correlation coefficient value being with first one. In females with leptoprosopic face, the CARCD had a high significant correlation coefficient with inner canthal distance; while in those with mesoprosopic face the maxillary central incisor width was significantly correlated with interzygomatic distance while the other correlations in different types of face form for both sexes were found to be in low magnitude and were not significant.

On the above mentioned results, this study demonstrated that certain horizontal facial parameters could be used as a guide in maxillary anterior denture teeth selection to achieve the best esthetic result in each type of face form in both sexes.

Key Words: Artificial teeth selection, facial measurements, esthetic, face form.

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INTRODUCTION

The selection of appropriate size of maxillary anterior teeth is one of the most confusing and difficult aspect of complete denture construction.[1] Since the prosthesis replacing anterior teeth frequently look artificial because the teeth which have been selected are smaller than the natural teeth which they are replacing,[2] and this is considered a problem in fabricating dentu-res.[1]

Many attempts had been made to the use of facial measurements as a guide for selection of anterior teeth for complete denture.[3] Since the face is the most visible part of human anatomy and it helps to de-termine our social acceptance[4] and one's dental and facial appearance is important not only in the role that attractiveness pl-ays to others but also in one's self–con-cept;[5] therefore, the selection of maxillary anterior teeth must be in proportion with face measurements to achieve a good esth-etic.[6]

The most important tooth in selection of anterior teeth was the maxillary central incisor since it is most visible to the causal observer in unstrained facial activity[7, 8] and it makes the best statement of patient age whereas lateral incisor reflect patient's sex and canine reflect patient vigor.[9]

More than one facial measurement could be used as predictor of maxillary anterior teeth width,[10–12] while Cessario and Latta[13] reported that interpupillary distance could be used as a guide in maxillary anterior teeth selection,[6] whereas Hoffman *et al*.[1] studied the relationship of canine arc distance (CARCD) to interalar width.

Depending on what's previously men-tioned, this clinical study was conducted to evaluate the correlation between maxillary anterior teeth measurements (CARCD, central incisor width) and different horiz-ontal facial parameters for predicting the proper width of maxillary anterior artifi-cial denture teeth at different types of fac-ial form in both sexes.

MATERIALS AND METHODS

The data for this study were collected at the College of Dentistry, Mosul University from 250 undergraduate dental students. Only 100 students were selected for this study, consisting of 50 males and 50 females whom they meet the following criteria:

1) The students should have permanent maxillary anterior teeth with normal canine occlusion.[14]
2) Good alignment of maxillary anterior teeth without spacing, missing, overlapping and with the absence of caries, proximal restorations, abrasion, attrition and crowns that grossly affected their width.
3) They had no history of previous orthodontic and facial surgical treatments.
4) All of dental students were Iraqi and their ages range between 19–24 years so their facial growth was completed.

Direct facial measurements were obtained from each student while he/she was sitting in upright position with his/her teeth in centric occlusion, lips relaxed and with unsupported head, looking straight forward to maintain natural head position[15] and on the bases of Anthropology.[16] The measurements were carried out by using an electronic digital vernier caliper (Lezaco/ Art/ 2771/ China) which measure to the nearest of 0.01 mm by keeping the calipers in contact with soft tissue poi-nts with minimum pressure,[17, 18] the aver-age of 3 readings for every distance was considered as a final reading.

The facial parameters that had been measured were shown in Figure (1). Those are:

1. Interzygomatic distance (IZD).[17, 19, 20, 29]
2. Inner and outer canthal distances (ICD and OCD).[18, 26]
3. Mouth width (MW).[17, 22]
4. Nose width (NW).[17, 29]
5. Interpupillary distance (IPD).[13]
6. Philtrum width (PW).[23]
7. Face length (Nasion–Gnathion) was measured while the subject occludes his teeth.[17, 18, 29]

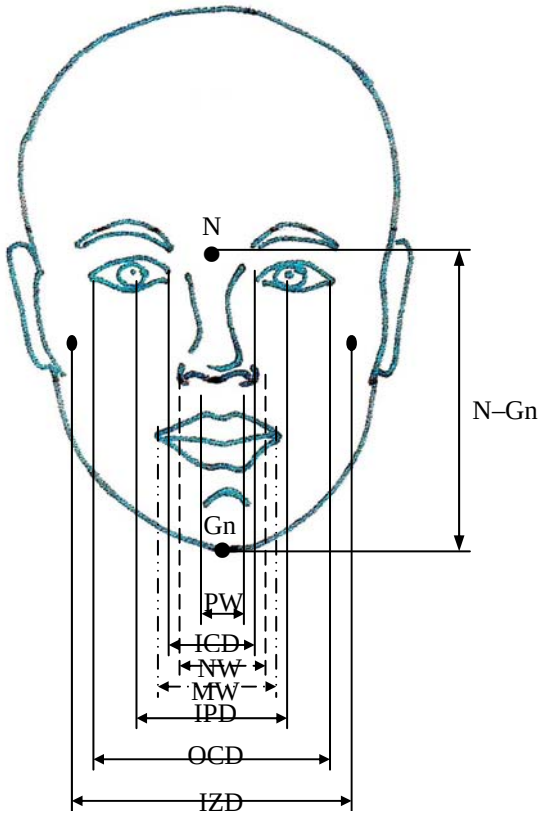

Figure (1): Facial landmarks and dimensions

N–Gn: Anterior facial length; IZD: Interzygomatic distance; OCD: Outer canthal distance; ICD: Inner canthal distance; IPD: Interpupillary distance; PW: Philtrum width; MW: Mouth width; NW: Nose width.

The oral measurements shown in Figure (2) included:

1. Central incisor width (CIW) which was determined at incisal angles.[17, 20] For the sake of consistency, the right maxillary central incisor was taken as a guide for measuring in all students.
2. Circumferential arc distance or CARCD was measured between the distal surfaces of maxillary canines[1, 24] according to Scandrett *et al*. method.[10]

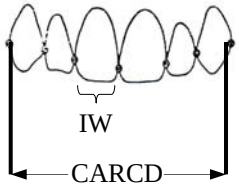

Figure (2): Dental Measurements

IW: Incisal width of central incisor.
CARCD: Canine arc distance.

According to facial index formula,[30] which is based on the ratio of bizygomatic width to anterior face height, the face form was classified into the following types:

1. Leptoprosopic face (long and narrow) which has a facial index of 90 or above.
2. Mesoprosopic face (ovoid) which has a facial index range between 85–89.9.
3. Euryprosopic face (square) which has a facial index range between 80–84.9.

The statistical analyses were performed using SPSS computer program and the Pearson Product Moment Correlation Coefficients were calculated for all the relationships at levels of significance $p \leq 0.05$ and $p \leq 0.01$, which were accepted as being statistically significant and highly significant respectively.

RESULTS

In the present study the facial indices of 100 dental students revealed that 80% had a leptoprosopic face in which their facial indices range between 90.36–112.3 and the percentage of leptoprosopic face in total male group was 82% whereas in total female group was 78%; while the opposite result was obtained with those with mesoprosopic face in which the percentage was 18% in total female group and 14% in total male group in which their facial indices range between 85.3–89.5, and the last type of face form was euryprosopic face which had the smaller percentage (4%) for every sex and in total sample size, in which their facial indices range between 82.1–83.1. The percentage and distribution of dental students according to face form type were shown in Table (1) for total male, female groups while Figure (3) demonstrated the result for total sample size. The range of facial indices in each type of face form for the dental students which were obtained in this study were shown in Table (2). The data that collected for the last type of face was inadequate and can not give an accurate statistical result. Therefore, this type of face form was neglected from this study.

Table (1): The percentage and distribution of dental students according to facial form type and sex

Face Form	Sex	
	Male	**Female**
Leptoprosopic (Long and Narrow)	41 82%	39 78%
Mesoprosopic (Middle or Ovoid)	7 14%	9 18%
Euryprosopic (Square)	2 4%	2 4%
Total	50 100%	50 100%

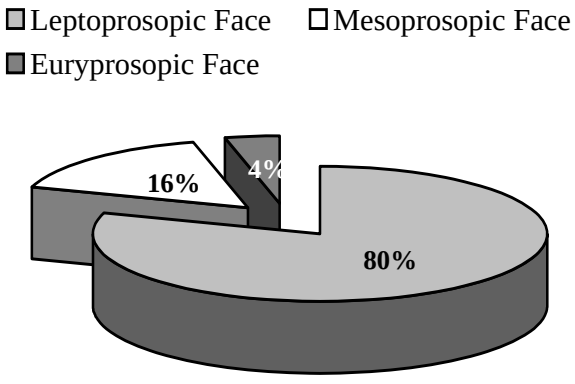

Figure (3): The percentage of dental students according to facial form type

Table (2): The facial indices in each type of face form for dental students

Face Form	Facial Index
Leptoprosopic (Long and Narrow)	90.36–112.3
Mesoprosopic (Middle or Ovoid)	85.3–89.5
Euryprosopic (Square)	82.1–83.1

The means and standard deviations for oral and facial measurements in total males and females and in each type of face forms for both sexes were shown in Tables (3) and (4).

The results of Pearson Product Moment Correlation Coefficient test revealed that males with leptoprosopic face had a significant correlation coefficient between CARCD and MW which was 0.351, whereas the CIW was non significantly correlated with all facial parameters as shown in Table (5). While in those with mesoprosopic face, the CARCD was significantly correlated with IZD and MW but with higher correlation coefficient value (0.794) being with MW, whereas the CIW was significantly correlated with ICD and PW but with higher correlation coefficient value (0.823) being with ICD as shown in Table (5).

The results also demonstrated that females with leptoprosopic face had a high significant correlation coefficient between CARCD and ICD which was 0.712 whereas CIW was non significantly correlated with all facial parameters as shown in Table (5). While in females with mesoprosopic face, the result indicated that there was a non significant correlation between CARCD and all facial parameters, while CIW had a significant correlation with IZD which was 0.742 as shown in Table (5).

Table (3): The means and standard deviation values for facial and dental parameters in total male and female groups

		IZD	OCD	ICD	IPD	NW	MW	PW	IW	CARCD
Total Female	**Mean**	108.92	98.71	26.42	59.42	32.17	44.29	10.92	8.004	48.59
	± SD	7.92	9.7	5.16	7.66	2.58	5.17	1.85	0.85	4.97
	No.	50	50	50	50	50	50	50	50	50
Total Male	**Mean**	118.96	102.38	28.9	64.9	38.2	50.19	14.27	8.23	51.35
	± SD	7.4	7.03	5.03	2.1	2.6	5.3	7.21	0.67	2.6
	No.	50	50	50	50	50	50	50	50	50

IZD: Interzygomatic distance; OCD: Outer canthal distance; ICD: Inner canthal distance; IPD: Interpupillary distance; PW: Philtrum width; MW: Mouth width; NW: Nose width; IW: Incisor width; CARCD: Canine arc distance; SD: Standard deviation.

Table (4): The means and standard deviation values for facial and dental parameters in two types of face form in male and female groups

			IZD	OCD	ICD	IPD	NW	MW	PW	IW	CARCD
Leptoprosopic Face	**Male**	**Mean**	120.55	102.58	28.99	66.26	38.51	50.23	13.98	8.21	51.53
		± SD	7.1	7.61	5.36	23.05	2.39	5.47	6.77	0.55	2.5
		No.	41	41	41	41	41	41	41	41	41
	Female	**Mean**	110.7	99.75	26.88	60.47	34.21	43.86	11.01	7.89	48.37
		± SD	6.59	9.9	5.54	5.7	2.6	4.1	1.93	0.76	5.36
		No.	39	39	39	39	39	39	39	39	39
Mesoprosopic Face	**Male**	**Mean**	111.66	102.6	29.48	58.8	37.01	51.2	16.49	8.15	50.00
		± SD	3.4	2.9	3.1	4.5	3.6	5.1	10.55	1.2	3.5
		No.	7	7	7	7	7	7	7	7	7
	Female	**Mean**	101.1	97.13	25.63	59.24	34.08	46.59	10.44	8.19	49.55
		± SD	6.1	7.1	2.8	5.8	2.5	8.6	1.7	0.65	3.7
		No.	9	9	9	9	9	9	9	9	9

IZD: Interzygomatic distance; OCD: Outer canthal distance; ICD: Inner canthal distance; IPD: Interpupillary distance; PW: Philtrum width; MW: Mouth width; NW: Nose width; IW: Incisor width; CARCD: Canine arc distance; SD: Standard deviation.

Table (5): The significant correlation coefficient in male and female groups at different face forms

Sex	**Face Form**	**Facial Parameters**	**IZD**	**OCD**	**ICD**	**IPD**	**NW**	**MW**	**PW**
Female	**Leptopro-sopic**	**CIW**	0.62	–0.010	0.006	0.177	0.036	0.202	0.307
		CARCD	0.097	–0.024	0.712**	–0.113	0.008	0.173	0.225
	Mesopro-sopic	**CIW**	0.742*	0.581	0.328	0.092	0.399	0.417	0.295
		CARCD	–0.047	0.383	0.158	0.198	0.361	0.224	0.190
Male	**Leptopro-sopic**	**CIW**	0.118	0.110	–0.275	–0.024	–0.236	0.224	–0.129
		CARCD	0.291	0.098	–0.266	–0.153	–0.064	0.351*	0.178
	Mesopro-sopic	**CIW**	–0.055	0.036	0.823*	–0.214	0.152	0.464	0.791*
		CARCD	0.763*	0.159	0.219	0.150	0.700	0.794*	0.326

* Correlation is significant at 0.05 level.

** Correlation is significant at 0.01 level.

IZD: Interzygomatic distance; OCD: Outer canthal distance; ICD: Inner canthal distance; IPD: Interpupillary distance; PW: Philtrum width; MW: Mouth width; NW: Nose width.

DISCUSSION

In the present study, the direct method was used for measuring facial and oral parameters since neither facial nor anatomical measurements changed significantly with age,[23] and it is more accurate than indirect method, which lack of definition of interdental contact points because of limited flow or fracture of impression material and also difficulty of inserting calipers to the facial points of teeth on stone cast and the wear of casts by repeated measurements.[2, 25]

On the bases of the facial index,[30] the dental students were classified into three facial forms (leptoprosopic, mesoprosopic and euryprosopic) since this ratio is differentiated between facial types[27] and also the most successful classification of human face form is based on this proportionality.[30]

The true square face form was not found in this study. This result was agreed with Hatim,[20] and the facial and oral measurements in general were higher in males than females. This agreed with several studies[17, 18, 28] due to sexual variations.

Since the maxillary central incisor represents a major part of esthetic impact in person's appearance,[26] therefore it was selected to be measured than others in this study and measuring its width at incisal angles not at contact points due to their locations at different levels.[26]

The mean widths of nose, mouth, and philtrum were 35.1 mm, 47.1 mm and 12.7 mm, respectively. These results were nearly as the same as those obtained by Hoffman *et al*.[1] and Latta,[23] while the average of IZD distance was 113 mm which was nearly as the same as that obtained by Rauf,[18] because the larger percentage of students in this study had a leptoprosopic face.

The OCD had an average of 100 mm. This coincides with Mohammed's result[29] and both of ICD and OCD were larger in males than females. This agreed with Rauf[18] and Rejab.[28] Also, the average of IPD was 62.1 mm which was nearly as the same as that obtained by Cessario and Latta.[13]

For IW, the mean was 8.1 mm which was the same as the results of other studies.[13, 17] The average of CARCD was 49.9 mm; this coincide with other researchers[1, 29] and larger in males than females[17,24,29] which indicated sexual variations.

Different studies were done and determined the correlations between (CARCD, CIW) and certain facial parameters, like Scandrett *et al*. Study,[10] but they did not separate between the types of facial forms in every sex. Also, a study by Abdul–Hadi,[17] which correlate tooth form to face form but also he did not evaluate different types of face form in each sex. So that the organization of the sample in the present study according to the types of face form into 3 types for each sex was the main reason for the differences seen between the result of this study and other studies.

CONCLUSIONS

The correlation between maxillary an-terior teeth measurements (CARCD and CIW) and horizontal facial parameters at different types of facial form in both sexes were represented for the first time in this study.

The higher percentage of leptoprosopic (long and narrow face) was found to be higher in males than females, while the opposite result was obtained with mesoprosopic (ovoid) face.

The truly square form (euryprosopic) for both sexes was not found.

Depending on the types of face form in both sexes, there were certain horizontal facial parameters could be used as a guide in maxillary anterior teeth selection. These are:

1. CARCD in males with leptoprosopic face was equal to MW / 0.97 or MW×1.02 while non of facial parameters could be used to determine the CIW.
2. Both of MW and IZD could be used to determine CARCD in males with mesoprosopic face by dividing MW / 1.02 and IZD / 2.23 or MW×0.97 and IZD×0.46 but MW was more preferable to be used because it had a higher value of correlation coefficient, while CIW could be determined by dividing ICD / 3.6 and PW / 2.02 or ICD×0.27 and PW×0.49, but ICD had a higher value of correlation coeffic-

ient so it is more preferable and give better results.

3. The ICD divided by a factor 0.55 or ICD×1.8 could be used to determine the CARCD in females with leptoprosopic face, while in those with mesoprosopic face the CIW is determined by dividing IZD / 12.34 or IZD×0.08; whereas non of facial parameters could be used in females to determine the CARCD in mesoprosopic face and CIW in leptoprosopic face.

REFERENCES

1. Hoffman W, Bomberg TJ, Hatch RA. Interalar width as a guide in denture tooth selection. *J Prosthet Dent*. 1986; 55: 219-221.
2. Woodhead CM. The mesiodistal diameter of permanent maxillary central incisor teeth and their prosthetic replacement. *J Dent*. 1977; 5: 93-98.
3. Kern BE. Anthropometric parameters of tooth selection. *J Prosthet Dent*. 1967; 17: 431.
4. Watt DM, David A, Roy MA. Designing Partial Denture. John Wright and Sons, Ltd, Bristol, UK. 1984; p: 184.
5. Stenvik A, Espeland L, Linge B, Linge L. Lay attitudes to dental appe-arance and need for orthodontic treat-ment. *Eur J Orthod*. 1997; 19: 271-277.
6. Hickey JC, Zarb GA, Bolender CL. Boucher's Prosthodontic Treatment for Edentulous Patients. 11th ed. CV Mosby Co, Philadelphia. 1997; p: 231.
7. Robert HW, Brodbelt PHR. Comparison of face shape with tooth form. *J Prosthet Dent*. 1984; 52: 588-596.
8. Ash MM. Wheeler's Dental Anatomy, Physiology and Occlusion. 7th ed. WB Saunders Co, Philadelphia. 1993; p: 128.
9. Robert LE. Complete denture esthetics. *Dent Clin North Am*. 1996; 40: 1-71.
10. Scandrett FR, Kerber PE, Umrigar ZR. A clinical evaluation of techniques to determine the combined width of maxillary anterior teeth and the maxillary central incisor. *J Prosthet Dent*. 1982; 48: 15-22.
11. Al–Kanani KM. Face form and measurements as a guide for the selection of maxillary central incisors by using computerized photogrammetry. MSc thesis. College of Dentistry. Universi-ty of Baghdad. 2002.
12. Ali MM. The use of facial measurements in the selection of anterior teeth. *Iraqi Dent J*. 1998; 22: 91-115.
13. Cessario J, Latta J. The relationship between the mesio–distal width of the maxillary central incisor and the interpupillary distance. *J Prosthet Dent*. 1984; 52: 641-643.
14. Proffit W. Contemporary Orthodontics. 3rd ed. CV Mosby Co, Philadelphia. 2000; p: 135.
15. Galsson GE, Ingerral B, Kocak G. The effect of increasing vertical dimension on the masticatory system in subjects with natural tooth. *J Prosthet Dent*. 1979; 41: 284-289.
16. Arnett HGW, Bergman RJ. Facial keys to orthodontic diagnosis and trea-tment planning. Part 1. *Am J Orthod Dentofac Orthop*. 1993; Apr: 299-312.
17. Abdul–Hadi L. Relation of facial and tooth measurements. *Iraqi Dent J*. 1989; 14: 144-155.
18. Rauf FMS. Facial analysis and facial types of the students in Mosul University aged 20–25 years with Class I normal occlusion. Direct method. MSc thesis. College of Dentistry. Univers-ity of Mosul. 1997.
19. Farkas LG, Bryson W, Klotz J. Anthropometry of the face in lateral facial dysplasia. *J Cleft Palate*. 1977; Jan: 41-51.
20. Hatim NA. Relationship between different face forms to tooth form. *Iraqi Dent J*. 1996; 8: 187-194.
21. Henderson D, Poswillo DE. Assessment and treatment planning of facial disproportion. *Atlas Orthognath Surg*. 1985: 68-75.
22. Ricketts RMC. The biologic significance of the divine proportion and Fibonacci series. *Am J Orthod*. 1982; 81: 351-370.
23. Latta GH. The midline and its relation to anatomic landmarks in the edentulous patient. *J Prosthet Dent*. 1988; 59: 681-683.

24. Hatim NA. Selection of maxillary anterior teeth in relation to mandibular natural anterior teeth. *Iraqi Dent J*. 2000; 26: 241-245.
25. Lavelle CL. A metrical study of dental arch form. *J Dent*. 1978; 6: 120-124.
26. Brodbelt RHW, Walker GF, Nelson N, Seluk LW. Comparison of face shape with tooth form. *J Prosthet Dent*. 1984; 52(4): 588-592.
27. Farkas LG, Munro IR. Anthropometric Facial Proportions in Medicine. Charles C Thomas. 1987; Pp: 3, 4.
28. Agha NF. Facial profile soft tissue analysis for Mosul adults, Class I normal occlusion (A cephalometric study). MSc thesis. College of Dentistry. University of Mosul. 1998.
29. Mohammed MM. The use of facial measurements in selection of anterior teeth. MSc thesis. College of Dentistry. University of Baghdad. 1990.
30. Zwemer JT, Lorber RM. An annotated atlas of facial analysis. *Dent Clin North Am*. 1976; 20: 641.