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The correlation between certain facial and dental measurements that influence dental aesthetics "Cephalometric study"

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ABSTRACT

The purpose of the present study was to assess and determine if the correlation between certain facial measurements was significant to recommend their use as reliable aesthetic factors for selection of suitable tooth moulds for anterior teeth restoration.

The materials for this study included 50 cephalometric radiographs for selected undergraduate students of Dentistry Collage, Mosul University; 25 males and 25 females. The age ranged from 18–25 years old with normal occlusion.

The data were analyzed by using Minitab system and the result confirmed that certain facial measurements considered directly to determine the outline form to restore anterior teeth such as tooth width at the incisor edge, incisor tooth length, intercanine distance, the ratio of incisor tooth length and tooth width at the incisor edge, bi–incisors width, and bi–orbital width, while the others, bi–zygomatic width, intermolar distance, anterior facial height, and the ratio of anterior facial height and bi–zygomatic width, were indirectly indicated. Also there was a significant difference between male and female groups with different facial measurements. The ratio of the anterior facial height to bi–zygomatic width for the total sample was 0.93 mm, while that for the tooth length to tooth width was 0.81 mm. It could be concluded that certain facial measurements recommended as reliable aesthetic factors for selection of suitable tooth moulds for anterior teeth restoration.

Key Words: Facial aesthetics, dentofacial appearance, facial features.

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INTRODUCTION

Social behavior is markedly determined by the perception of facial aesthetics.[1–3] Facial appearance not only appears to be an influential quality in being asked as a dating partner, but handsome people are also thought to have a nicer personality.[4–8] Furthermore, they are expected to be more intelligent, which implies a higher educational potential and to have more socially desirable characteristics.[5, 9, 10]

Studies concentrating more specifically on presumed personality characteristics related to dentofacial appearance have shown that attractive persons are judged as more extrovert, more interesting, and of a higher social class[10–13] (Figure 1). These findings clearly show that facial attractiveness is an important factor in our daily social interactions.[5, 6]

Figure (1): Attractiveness appearance for anterior teeth setting

An interesting question with the field of restorative dentistry is which facial features are determinants for anterior teeth restoration (anterior tooth reshaping, crowning, and bridge for anterior regain).[4, 14, 15]

In order to answer this question, several researchers have focused on the importance of various facial features in the assessment of anterior teeth restoration to maintain a good facial appearance.[15, 16] Male and female judges agree on the importance of features such as intereye distance, tooth width at the incisor edge, incisor tooth length, face form and width arch form and width and so on for anterior teeth restoration.[5, 6, 17–19]

The aim of this study was to assess and determine if the correlation between certain facial measurements (tooth width at the incisor edge, incisor tooth length, bi–zygomatic width, intermolar distance, intercanine distance, anterior facial height, the ratio of anterior facial height and bi–zygomatic width, the ratio of incisor tooth length and tooth width at the incisor edge, bi–incisors width, and bi–orbital width) were significant to recommend their use as reliable aesthetic factors for selection of suitable tooth moulds for anterior teeth restoration.

MATERIALS AND METHODS

The materials for this study were consisted of 50 cephalometric radiographs for selected undergraduate students of Dentistry College, Mosul University; 25 males and 25 females of age ranging from 18–25 years. The criteria for selection were as follows: They should possess full sets of sound permanent teeth excluding third molars, acceptance occlusion and harmonious facial profile.

The following cephalometric landmarks were used in this study (Figure 2) as described by several researchers:[20–24]

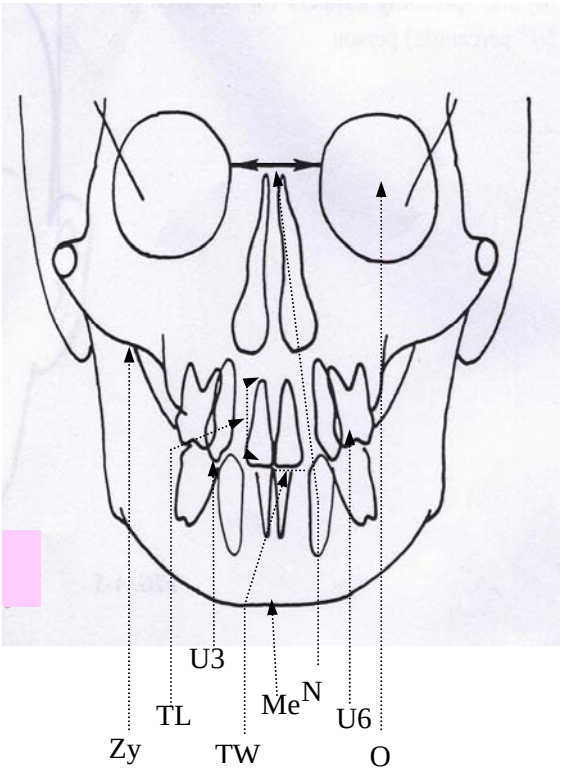

Figure (1): Cephalometric points (postero–anterior view)

Zy: A prominent point of zygoma, TL: Tooth length, U3: Tip of crown of upper canine, TW: Tooth width, Me: Menton, N: Nasion, U6: A prominent point of the buccal surface of upper first molar, O: The center of the orbit.

- Point N (nasion): The most anterior point of the nasofrontal suture in the median plane.
- Point Me (menton): The lowest point in the symphyseal shadow of the mandible.
- N–Me (anterior facial height): A vertical distance between point N and point Me.
- O–O (bi–orbital width): A transverse linear measurement between the center of orbit (a transverse line between the right and left pupils of the eye).
- Zy–Zy (a prominent point of the zygoma): A transverse linear measurement between the right and left prominent point of the zygomatic bone.
- U3–U3 (maxillary intercanine width): A transverse linear measurement between the tip of the crown of the right and left maxillary prominent canines.
- U6–U6 (maxillary intermolar width): A transverse linear measurement between the right and left maxillary molars at the most prominent point at the buccal surface of maxillary first molar.
- Tooth width at the incisor edge: A transverse linear measurement between the mesial and distal incisor edges of the upper central incisor.
- Tooth width×2: A transverse linear measurement between the mesio and disto incisor edge of the upper central incisor× 2 (represent the width of the two upper central incisors at the incisor edge).
- Tooth length: A vertical distance between incisor edge and cervical end in mid of the middle third of the upper central incisor.

All radiographs were traced and measured by intra– and inter– investigator to reduce the incidence of error in tracing procedures and reading the measurements.

The data were analyzed by using Minitab system and the statistical analyses included: Descriptive statistics (means, standard deviations of all variables measured for the total sample, male and female groups), significant differences between male and female groups using t–test at 1% and 5% levels of significance, and Pearson Correlation Coefficient "r value" were done for all variables; males, females and total samples (the value of probability for "r" value was at 1%, and 5% levels of significance).

RESULTS AND DISCUSSION

The analysis of data for 25 males undergraduate students showed that the mean of tooth width at incisor edge was 8.964 mm, while for female group the mean was 8.393 mm (Table 1). At the same time all other measurements that done for both groups showed that the measurements in male group was larger than that for female group and this may be due to the differences in size of the jaws and teeth for both sexes, and this difference was in conformity with other studies.[25–28]

The differences of the means of the measurements for the total variables were subjected to statistical t–test at 1%, and 5% levels of significance and revealed that in female group, the tooth width at incisor edge was significant at 1%, the ratio of the tooth length/tooth width was significant at 5%, and the ratio of the anterior facial height/bi–zygomatic width was significant at 5%andthis was in conformity with other studies.[25–28]While in male group the anterior facial height measurement only was significant at 5% which confirmed with Wei,[28] and these were shown in Table (1).

The Pearson Correlation Coefficient of linear measurements was done to correl-ate between the anterior teeth and facial measurements, and some of these variables revealed a direct, while others were indire-ctly considered as an indicator for deter-mination of tooth outline during anterior teeth restoration as shown in Table (2 a and b).

Firstly, the facial measurements that revealed a direct relation for determination the outline form of tooth during anterior teeth restoration, as shown in Table (2 a), included tooth width at the incisor edge, tooth length, maxillary intercanine width, the ratio of the tooth length/tooth width, tooth width at the incisor edge×2 and the bi–orbital width for both male, female, and total groups.

Table (1): Mean and standard deviations for linear measurement of the total sample with comparison between males and females and t–test with level of significant for the variable

Variable	Mean ± SD	Sex	Mean ± SD	T–value	Significance	
					Male	Female
TW	8.679 ± 0.819	M F	8.964 ± 0.886 8.393 ± 0.656	–1.94	NS	S**
TL	10.786 ± 1.013	M F	11.000 ± 1.060 10.571 ± 0.958	–1.12	NS	NS
Zy–Zy	137.660 ± 5.610	M F	141.110 ± 5.390 134.210 ± 3.290	–4.09	NS	NS
U6–U6	62.286 ± 2.780	M F	63.210 ± 2.760 61.360 ± 2.570	–1.84	NS	NS
U3–U3	35.036 ± 2.476	M F	35.960 ± 2.070 34.110 ± 2.570	–2.11	NS	NS
N–Me	128.590 ± 7.300	M F	133.290 ± 7.060 123.890 ± 3.640	–4.42	S*	NS
N–Me / Zy–Zy	0.93214 ± 0.04756	M F	0.9429 ± 0.0514 0.9214 ± 0.0426	–1.2	NS	S*
TL / TW	0.8143 ± 0.0651	M F	0.8214 ± 0.0699 0.8071 ± 0.0616	–0.57	NS	S**
TW*2	17.357 ± 1.638	M F	17.930 ± 1.770 16.790 ± 1.310	–1.094	NS	NS
O–O	65.929 ± 2.304	M F	65.860 ± 2.820 66.000 ± 1.740	0.16	NS	NS

NS: Non significant, S*: Significant at 5%, S**: Significant at 1%, SD: Standard deviation, Zy: A prominent point of zygoma, TL: Tooth length, U3: Tip of crown of upper canine, TW: Tooth width at the incisor edge, TW×2: Bi–incisors width, Me: Menton, N: Nasion, U6: A prominent point of the buccal surface of upper first molar, O: The center of the orbit.

From above, the tooth width at the incisor edge was highly correlated with the tooth length, the ratio of the tooth length/ tooth width, tooth width×2 and maxillary intercanine width especially for female rather than male group (Figure 3) and this may be related to sex differences and such result was confirmed with other researchers. [4, 27, 28] While the tooth length was correlated with tooth width, tooth width×2, and bi–orbital width especially for female rather than male group (Figure 4) and this may be related also to sex differences and this result was confirmed with Scanderrt *et al*.,[29] but disagreed with Cunningham[5] who showed no significant correlation between these variables in different sexes. Furthermore the maxillary intercanine width was correlated with the tooth width, maxillary intermolar width, the ratio of the tooth length/tooth width, and the tooth width×2 especially for female rather than male group (Figure 5) and this may be due to the fact that the facial and dental anatomy are more prominent and precise in females rather than in males and this confirmed with other researchers.[5, 28–32] While the ratio of the tooth length/tooth width was correlated with the tooth width, maxillary intercanine width and tooth width×2 for total group and this result confirmed with other researchers.[4, 27–29, 32] Furthermore the tooth width×2 was correlated with the tooth width, tooth length, maxi-llary inter canine width and the ratio of the tooth length/tooth width especially for female rather than male group due to the differences in dimensions of anterior teeth with different sexes and these agreed with other researchers.[4, 15, 27–29, 32] Finally, the

bi–orbital width was correlated with the tooth width, and tooth length specially for male rather than female groups (Figure 6) due to the differences in facial dimensions between different sexes and these agreed with other researchers,[6, 17, 28] but disagreed with Cunningham,[5] who found that the large and wide eyes, greater intereye distance, a small chin and a wide smile were positively linked with attractive female.

Table (2a): Pearson Correlation Coefficient of linear measurements of males, females and total groups (direct relation)

Pearson Correlation between Variables Significance (1 Tailed)	Groups	T W	T L	U3–U3	$\frac{TL}{TW}$	T W×2	O–O
T W	**Total**		0.628**	0.627**	0.472**	1.000**	–0.336*
	Female		0.687**	0.705**	0.497*	1.000**	
	Male		0.554*	0.481*		1.000**	
T L	**Total**	0.628**		0.324*		0.628**	–0.447**
	Female	0.687**				0.687**	–0.542*
	Male	0.554*			–0.469*	0.554*	
Zy–Zy	**Total**						
	Female						
	Male		–0.576*				
U6–U6	**Total**			0.545**	0.366*		
	Female						
	Male			0.520*			
U3–U3	**Total**	0.627**	0.324*		0.466**	0.627**	
	Female	0.705**			0.628**	0.705**	
	Male	0.481*				0.481*	
N–Me	**Total**						
	Female						
	Male						0.546*
$\frac{N-Me}{Zy-Zy}$	**Total**						
	Female						
	Male						0.470*
$\frac{TL}{TW}$	**Total**	0.472**		0.468**		0.472**	
	Female	0.497*		0.628**		0.497*	
	Male		–0.469*				
T W×2	**Total**	1.000**	0.628**	0.627**	0.472**		–0.336*
	Female	1.000**	0.687**	0.705**	0.497*		
	Male	1.000**	0.554*	–0.481*			
O–O	**Total**	–0.336**	–0.447**			–0.336*	
	Female						
	Male		–0.542*				

*Significant at 5%, **Significant at 1%, Zy: A prominent point of zygoma, TL: Tooth length, U3: Tip of crown of upper canine, TW: Tooth width at the incisor edge, T W×2: Bi–incisors width, Me: Menton, N: Nasion, U6: A prominent point of the buccal surface of upper first molar, O: The center of the orbit.

Table (2b): Pearson Correlation Coefficient of linear measurements of males, females and total groups (indirect relation)

Pearson Correlation between Variables Significance (1 Tailed)	Groups	Zy–Zy	U6–U6	N–Me	$\frac{N-Me}{Zy-Zy}$
T L	**Total**				
	Female				
	Male	–0.576*			
Zy–Zy	**Total**		0.327*	0.574**	
	Female				
	Male				
U6–U6	**Total**	0.327*		0.516**	0.530**
	Female				
	Male			0.563*	0.609*
U3–U3	**Total**		0.545**		
	Female				
	Male		0.520*		
N–Me	**Total**	0.574**	0.516*		
	Female				
	Male		0.563*		0.833**
$\frac{N-Me}{Zy-Zy}$	**Total**		0.530**	0.701**	
	Female			0.612*	
	Male		0.609*	0.833**	
$\frac{TL}{TW}$	**Total**		0.366*		
	Female				
	Male				
O–O	**Total**				
	Female				
	Male			0.546*	0.470*

*Significant at 5%, **Significant at 1%, Zy: A prominent point of zygoma, TL: Tooth length, U3: Tip of crown of upper canine, TW: Tooth width at the incisor edge, Me: Menton, N: Nasion, U6: prominent point of the buccal surface of upper first molar, O: The center of the orbit.

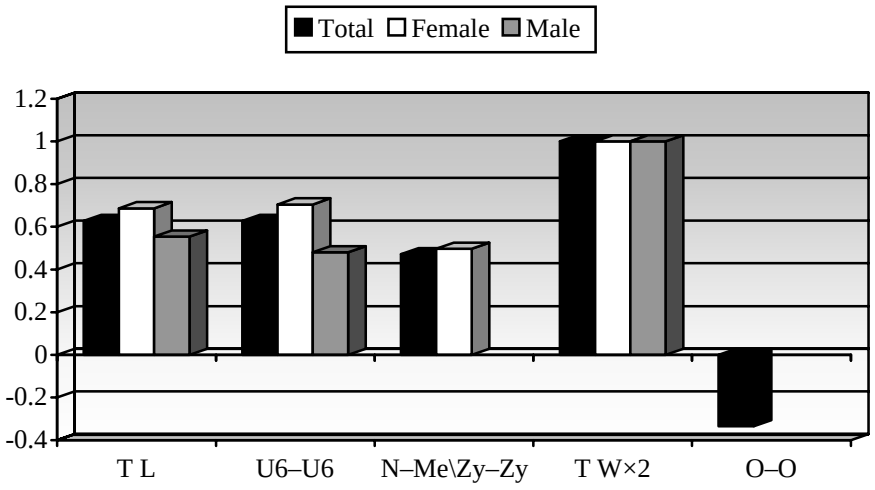

Figure (3): The correlation between the tooth width at the incisor edge (TW) and other linear measurements for total, males and females groups

TL: Tooth length, U6–U6: Inter–molar distance, N–Me/Zy–Zy: Ratio of anterior facial height/bi–zygomatic width, TW×2: Bi–incisors width, O–O: bi–orbital width

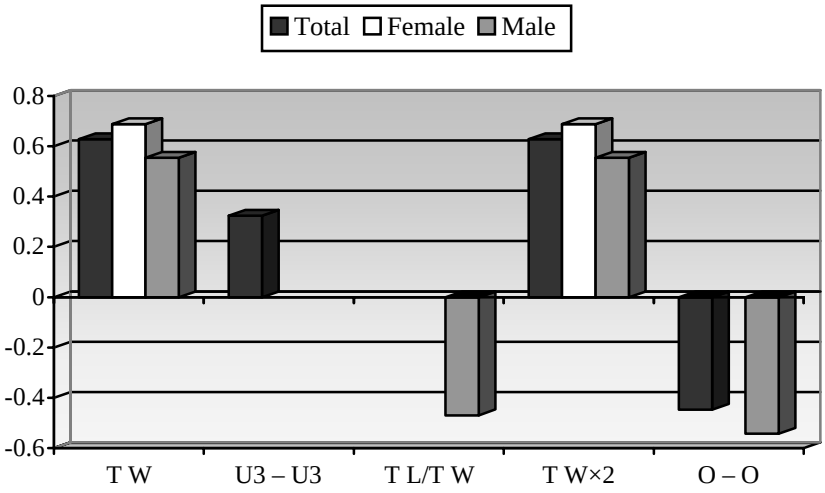

Figure (4): The correlation between the tooth length (TL) and other linear measurements for total, males and females groups

TW: Tooth width at the incisor edge, U3–U3: Inter–canine distance, TL/TW: Ratio of tooth length/tooth width at the incisor edge, TW×2: Bi–incisors width, O–O: Bi–orbital width.

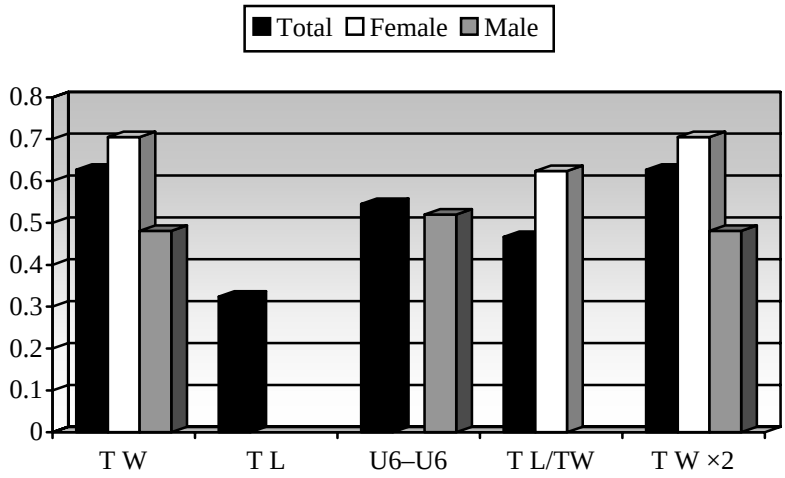

Figure (5): The correlation between the inter–canine distance U3–U3 and other linear measurements for total, males and females groups

TW: Tooth width at the incisor edge, TL: Tooth length, U6–U6: inter–molar distance, TL/TW: Ratio of tooth length/tooth width at the incisor edge, TW×2: Bi–incisors width.

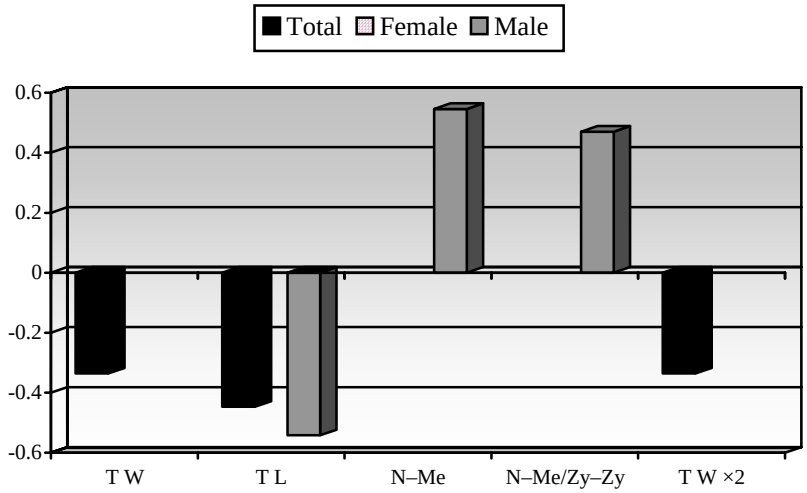

Figure (6): The correlation between the bi–orbital width (O–O) and other linear measurements for total, males and females groups

TW: Tooth width at the incisor edge, TL: Tooth length, N–Me: Anterior facial height, N–Me/ Zy–Zy: Ratio of anterior facial height/bi–zygomatic width, TW×2: Bi–incisors width.

While the facial measurements that revealed an indirect relation for determination the outline form of tooth during anterior teeth restoration, as shown in Table (2 b), included the bi–zygomatic width, maxillary intermolar width, anterior facial height, and the ratio of the anterior facial height/bi–zygomatic width for both male, female, and total groups. Such measurements could be indicated for determination the form of a restored anterior tooth because they had a correlation with the facial and dental measurements mentioned above which interim indicated for determination of the outline form of a restored anterior tooth such as the maxillary bi–molar and bi–canine widths and these agreed with other researchers.[4, 17, 18, 28, 30, 31]

Finally, comparison of the measurements of the anterior facial height to bi–zygomatic width for the total sample showed a ratio of 0.93214, while that for the tooth length to tooth width was 0.8143 (Table 1). Such ratios could be indicated for restoring the decayed anterior teeth.[3,14,16,32,33]

CONCLUSION

A significant difference between male and female groups with different facial measurements was noticed.

Certain facial measurements considered directly to determine the outline form of restored anterior teeth such as tooth width at the incisor edge, incisor tooth length, intercanine distance, the ratio of incisor tooth length/tooth width at the incisor edge, bi–incisor width, and bi–orbital width. Other facial measurements considered indirectly to determine the outline form of restored anterior teeth such as bi–zygomatic width, intermolar distance, anterior facial height, and the ratio of anterior facial height/bi–zygomatic width.

The ratio of the anterior facial height/bi–zygomatic width for the total sample, was 0.93214, while that for the tooth length/tooth width was 0.8143.

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