

Evaluation of Golden Proportion of Maxillary Anterior Teeth in Different Morphological Facial Types in A Sample of Class I Normal Occlusion (Photographic, Cross Sectional Study)

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Abstract: Since the face is the most visible part of human anatomy and the maxillary anterior teeth hold a significant effect during smiling, this study aims to evaluate the golden proportion of the maxillary anterior teeth in different morphological facial types and detect possible gender differences in a sample of class I normal occlusion. The sample consisted of 82 Iraqi adults (40 males and 42 females) aged (18-25) years. Each individual was clinically examined, frontal facial and intraoral photographic records were performed for each individual; the facial index from facial measurements and golden proportion from dental measurements were calculated. Descriptive statistics were obtained for the measured variables for both genders and independent-samples t-test was performed to evaluate the genders difference and pearson coefficient used to correlate the facial index and golden proportion of maxillary anterior teeth. The results revealed that the leptoprosopic type comprised 78% of the sample and 20% of the sample was of mesoprosopic type, whereas the remaining 2% of euryprosopic type was excluded from the study. The results showed a high significant gender difference in facial measurements and non-significant gender difference in dental measurements, the golden proportion of maxillary anterior teeth did not present in the different facial types, and there was a non-significant facial type difference in golden proportion; therefore the golden proportion did not depend on gender and facial form.

Keywords: Golden proportion, facial types, photographic record

I. Introduction

The maxillary anterior teeth represent the most visible teeth and carry the most significant effect during smiling, therefore; one of the most critical aspects of esthetic dentistry is creating a mathematical proportion relative to the width of maxillary anterior teeth [1]. The golden proportion is one of the geometric proportions that have been suggested as a cornerstone in creation of pleasing smile [2]. Lombardi was the first who suggested the application of the golden proportion in dentistry in which the mesiodistal widths of maxillary lateral incisors to central incisors and the mesiodistal width of the maxillary canines to lateral incisors following a repeated ratio [3], Whereas Levin suggested the use of Golden proportion to relate the successive width of the maxillary anterior teeth in which the mesiodistal width of the maxillary central incisor should be in golden proportion to that of the lateral incisor and the mesiodistal width of maxillary lateral incisor should be in golden proportion to that of the canine, when viewed from the labial aspect [1]. In addition to the dental assessment, facial type assessment is important for diagnosis and treatment planning in orthodontics, since the muscular and the skeletal configuration of each facial type responds differently to the orthodontic treatment, affecting either positively or negatively the final orthodontic treatment results [4]. Facial morphology depends on many factors, such as gender, race and ethnicity, occlusion type, socio-economic status, nutritional, and genetic factors [5,6]. One of the most common indices that represent the facial proportion is the facial index in which the facial height and facial width correlated, and classifies the face into euryprosopic, mesoprosopic and leptoprosopic [7].

Since the face is the most visible part of human anatomy and it mainly determine the social acceptance [8]; additionally, the dental and facial appearance is important not only in the role that the attractiveness plays to others but also in the one's self-concept [9]. This study aims to evaluate the golden proportion that present in different facial type and to verify the presence of gender differences.

II. Materials And Methods

2.1 The sample: The sample of this study consists of 82 Iraqi dental students (40 males and 42 females), they were selected according to the specific criteria in which they are of age ranged 18-25 years, all have full permanent dentition regardless of third molar, have normal skeletal relationships (10) and class I relationship with normal overjet and overbite according to Angle (11). Those with history of facial trauma, orthodontic, orthognathic, dentofacial deformities, surgeries, asymmetry or proximal caries or restoration in maxillary anterior teeth were excluded from the study.

Methods

2.2.1 History: Each individual was seated on the dental chair and informations regarding name, age, history were obtained, then each one was subjected to clinical examination to assess the anteroposterior relation and molar, canine and incisor relation. Then a witten consent form obtained from each subject before enrolling in the study.

2.2.2 Standardization of the Photographs: The digital camera (Canon D70, Japan) was fixed in position with a height adjustable tripod, each participant was positioned in the cephalostat with the frankfort plane parallel to the floor and instructed to be relaxed and gently closed lips, a distance of 1.01m from the camera lens to the ear rods of the cephalostat was used [12], then each participant subjected to frontal facial photograph and frontal intraoral photograph with the use of cheek retractor to clearly display the maxillary anterior teeth. Additionally A ruler divided into millimeters that allowed measurements at life size was placed beside the subject.

2.2.3 Photographic analysis: Each frontal facial and intra-oral photograph was analyzed by AutoCAD 2014 program.

a) Facial Landmarks:

- Nasion (n): the midpoint of the nasofrontal suture.
- Zygojn (zy): the most lateral point on the zygomatic arch under the eye on both sides of the face.
- Gnathion (gn): the lowest midline point at the lower border of the chin. The location of each facial landmark is represented in fig.1.

b) The Facial Measurements:

- The facial height (n-gn): is the distance between the nasion and the gnathion.
 - The facial width (zy-zy): is the distance between the two zygojn points.
- The facial index = {The facial height (n-gn) / The facial width (zy-zy)} X 100
According to this formula the faces can be classified into: [13]
- Leptoprosopic face which has a facial index of 90% or above.
 - Mesoprosopic face which has a facial index range between 85–89.9%.
 - Euryprosopic face which has a facial index range between 80–84.9%.

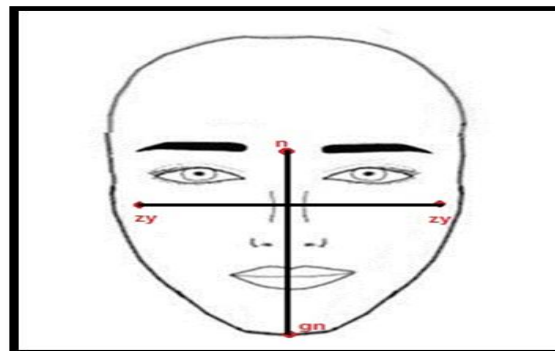


Figure 1. Facial height (n-gn), Facial width (zy-zy)

c) The Golden Proportion: The mesiodistal dimension measured at the widest mesiodistal portion and parallel to the incisal edge of each tooth, as explained in fig. 2, the golden proportion could be defined as the ratio of the recurring 62% proportions [14], it was calculated as follow according “to the anterior teeth size as viewed from the front” :

Golden Proportion = {(MDW of smaller tooth / MDW of larger tooth)} X100

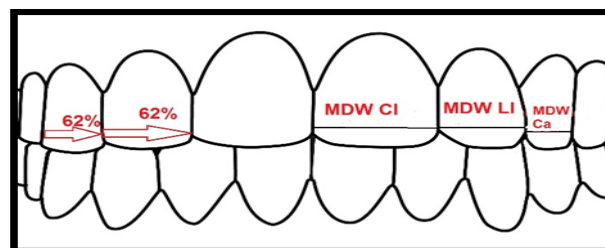


Figure 2. MDW CI: Mesiodistal Width Of Central Incisor, MDW LI: Mesiodistal Width Of Lateral Incisor, MDW Ca: Mesiodistal Width Of Canine.

III. Statistical Analysis

All the data of the sample were subjected to computerized statistical analysis using SPSS version 15 (2006) computer program. The statistical analysis included:

1. Descriptive Statistics; mean, standard deviation (SD), percentage, and statistical tables.
2. Inferential Statistics; independent- samples t-test for the comparison between both genders, and Pearson's correlation coefficient (r) to determine the relation between facial index and golden proportion of maxillary anterior teeth in both genders. In the statistical evaluation, the following levels of significance are used:
 $P > 0.05$ Non-significant
 $0.05 \geq P > 0.01$ Significant
 $0.01 \geq P > 0.001$ Highly significant
 $P \leq 0.001$ Very highly significant

IV. Results And Discussion

As shown in fig. 3, after obtaining the facial index of each subject, the leptoprosopic facial type (36 males, 28 females) was the predominant facial type followed by the mesoprosopic type (4 males, 12 females) and the least one was the euryprosopic facial type (2 females); therefore the euryprosopic facial type was excluded from the sample, this is comes in line with Jeremić and Kassab.[6, 13]



Figure 3. The percentage of each facial type in both genders

Table 1 showed that the mean values were generally higher in males than females except in zygomatic width which may explained the presence of mesoprosopic type among females than males, and measurements related to maxillary lateral incisor which may be attributed to the fact that the maxillary lateral incisors shows the greatest degree of variability than other teeth [15], on the other hand there is a high significant gender difference regarding facial height and index and this was explained by presence of different percentages of the facial types between males and females[16].

Table 2, 3 showed a high significant facial type difference regarding the facial index, since the mean values of leptoprosopic type were higher than that of mesoprosopic type, additionally the leptoprosopic faces were longer and narrower than mesoprosopic faces. Regarding the golden proportion of maxillary anterior teeth, in addition to the non-significant facial type difference in both genders; no existence of golden proportion in leptoprosopic and mesoprosopic types which is in accordance with Fayyad et al [17], the maxillary canines in both genders and facial types were larger than that suggested by Lombardi and Levin [1, 3], therefore the golden proportion regarding the maxillary canines were far from that of 62%, whereas those regarding the maxillary lateral incisors were near to 62% that suggested by Lombardi and Levin [1, 3].

Various studies were conducted to determine the relation between facial and dental measurements like Gomes et al study [18], but the present study differs from other studies in that the pearson correlation coefficient in table 4 used to determine the relation between the facial index and the golden proportion of maxillary anterior teeth which was non-significantly weak correlation, which means that the golden proportion doesn't affected by facial form.

Table 1. Descriptive statistics and gender difference of the facial and dental variables

Variables	Descriptive statistics				Gender difference (d.f.=78)	
	Males (N=40)		Females (N=40)		t-test	p-value
	Mean	S.D.	Mean	S.D.		
ZW	126.80	8.74	128.02	5.87	-0.732	0.467 (NS)
FH	123.05	9.30	118.22	5.17	2.876	0.005 (HS)
Facial index	97.13	4.98	92.46	4.51	4.398	0.000 (HS)

MDW 1L	8.89	0.50	8.71	0.52	1.512	0.135 (NS)
MDW 1R	8.82	0.48	8.67	0.54	1.255	0.213 (NS)
MDW 2L	5.88	0.47	5.90	0.59	-0.220	0.827 (NS)
MDW 2R	5.83	0.46	5.90	0.46	-0.651	0.517 (NS)
MDW 3L	4.90	0.60	4.79	0.63	0.793	0.430 (NS)
MDW 3R	4.71	0.68	4.59	0.57	0.896	0.373 (NS)
Golden Proportion. Lateral-central (left)	66.38	6.83	67.87	6.99	-0.969	0.336 (NS)
Golden Proportion. Lateral-central (right)	66.22	4.84	68.18	5.73	-1.657	0.101 (NS)
Golden Proportion. canine-lateral (left)	83.92	12.34	81.68	11.23	0.852	0.397 (NS)
Golden Proportion. canine-lateral (right)	81.09	12.29	78.18	11.22	1.104	0.273 (NS)

ZW: zygomatic width, **FH:** facial height, **MDW 1L:** mesiodistal width of left central incisor, **MDW 1R:** mesiodistal width of right central incisor, **MDW 2L:** mesiodistal width of left lateral incisor, **MDW 2R:** mesiodistal width of right lateral incisor, **MDW 3L:** mesiodistal width of left canine, **MDW 3R:** mesiodistal width of right canine.

Table 2. Golden proportion and Facial types' difference in male group

Variables	Descriptive statistics				Facial type difference (d.f.=38)	
	Meso (N=4)		Lepto (N=36)		t-test	p-value
	Mean	S.D.	Mean	S.D.		
Facial index	88.59	0.62	98.08	4.28	-4.378	0.000 (HS)
Lat. GProL	67.64	3.70	66.23	7.11	0.385	0.702 (NS)
Lat. GProR	66.92	2.57	66.14	5.05	0.301	0.765 (NS)
Can. GProL	81.81	11.40	84.16	12.56	-0.357	0.723 (NS)
Can. GProR	86.36	12.50	80.50	12.31	0.901	0.373 (NS)

Table 3. Golden proportion and Facial types' difference in female group

Variables	Descriptive statistics				Facial type difference (d.f.=38)	
	Meso (N=12)		Lepto (N=28)		t-test	p-value
	Mean	S.D.	Mean	S.D.		
Facial index	86.93	1.80	94.83	2.93	-8.634	0.000 (HS)
Lat. GProL	66.55	6.32	68.44	7.30	-0.777	0.442 (NS)
Lat. GProR	67.60	6.11	68.43	5.65	-0.418	0.678 (NS)
Can. GProL	83.80	10.43	80.77	11.62	0.779	0.441 (NS)
Can. GProR	79.84	9.14	77.47	12.08	0.608	0.547 (NS)

Table 4. Pearson correlation coefficient between facial index and golden proportion in different facial types

Correlations		Lat. GProL	Lat. GProR	Can. GProL	Can. GProR
Facial index	r	-0.088	-0.130	0.003	-0.135
	p	0.436	0.250	0.976	0.234

V. Conclusion

The leptoprosopic type is the predominant facial type, and it is significantly affected by gender. Additionally, the golden proportion of maxillary anterior teeth did not exist in the different morphological facial types and did not affected by gender and morphological facial form.

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