SUJMS
Sana'a University Journal of Medical Sciences

Original Article

The Esthetic Proportions of the Maxillary Anterior Teeth Among Yemeni Sample

R.A. Al-Aslami[1], Bandar M.A. AL-Makramani[1], Ibrahim Z. AL-Shami[1], Fuad A.A. AL-Sanabani,[2]

1 Assistant Professor, Department of Conservative Dentistry, Faculty of Dentistry, Sana'a University, Sana'a, Yemen.

2 Assistant Professor, Department of Prosthodontics, Faculty of Dentistry, Sana'a University, Sana'a, Yemen.

Abstract

Aim: The objective of this study was to investigate the existence of the golden proportion, RED proportion, and the golden percentage between the widths of maxillary anterior natural teeth in dental students in University of Sana'a, Yemen.

Materials and method: An alginate impression was taken for 99 dental students and poured with dental stone. Standardized frontal image was taken for each cast using a digital camera. The images were transferred to a desktop computer, and the widths of the maxillary anterior teeth were measured using computer software (Leica QWin). Once the measurements were recorded, the three theories were applied and the data were statistically analyzed.

Results: The results of the study indicated that golden proportion did not exist in the majority of the Yemeni population. The golden proportion was found to exist only in 14 (14.1%) of the subjects, in relation to perceived right lateral incisor and canine widths as seen from front. Regarding the RED proportion, the result was not constant, since the proportion was gradually increased as we move distally.

In addition, the results revealed that golden percentage was rather constant in terms of relative tooth width. Central incisor represented 23.3-24.0%, lateral incisor 14.4-15.5% and canine 10.8-12.2% of the width of six maxillary anterior teeth, as viewed from the front.

Conclusion:Both golden proportion and RED proportion were unsuitable methods to relate the successive width of the maxillary anterior teeth in Yemeni subjects. However, the golden percentage theory can be applied if percentages are adjusted, taking into consideration the ethnic differences of the population.

Key words: Golden proportion, maxillary anterior teeth, Yemeni subjects

Introduction:

The pleasant appearance of any restorative treatment of upper anterior teeth is an important objective which must be ensured by the dentist to satisfy the patient. The harmony between the width of central incisor, lateral incisor and canine will result in esthetic smile.

Many studies have published different postulated geometrical and mathematical ratios of upper anterior teeth to achieve the esthetic appearance. The golden proportion between two parts is 1.62:1 which means that the smaller part is 62% of the larger part. The uniqueness of this ratio is that the ratio of the smaller part to the larger part is the same as the ratio of the larger part to the whole [1]. This proportion was introduced in dentistry by Lombardi in 1973 as a guideline to achieve the esthetic appearance of maxillary anterior teeth when they viewed from the anterior [2].

Based on that, the width of lateral incisor is 62% of the width of the central incisor and the width of the canine is 62% of the width of lateral incisor. The golden proportion of anterior teeth is used in dentistry as an esthetic guideline. However, many investigators found that the golden proportion is not common in natural teeth in samples of esthetic smile [3,4].

In 1999 the golden percentage was proposed by Snow as an alternative guideline that could be used to distribute the width of maxillary anterior teeth [5]. The author stated that, the percentage of the width of each upper anterior tooth on each side should be as follows: central 25%,

lateral 15% and canine 10% of the total width of upper anterior teeth.

The recurring esthetic dental (RED) proportion is suggested by Ward in 2001, the proportion of the width of a central to a lateral is equal to the proportion of the width of a lateral to canine [6].

It seems that the existence of the golden proportion between the widths of maxillary anterior teeth varies among different populations and ethnic groups. To date, no study has evaluated this relationship in Yemeni subjects. Therefore, this study was conducted to determine the presence of the golden proportion, golden percentage and RED proportion between the widths of maxillary anterior teeth in a Yemeni sample.

Materials and methods:

The sample of this study comprised 99 undergraduate dental students (31 men and 68 women) from Faculty of Dentistry, Sana'a University, Sana'a, Yemen. The purpose of this study was explained to the students. Only those who agreed to participate in the study and those who were satisfied with the selection criteria were included in this study. The selection criteria included the absence of malformed anterior teeth, absence of restorative alteration of anterior teeth, crowding, and rotation or spacing of anterior teeth. An alginate impression was taken for each participant and the impression was poured with dental stone.

Standardized frontal image was taken for each cast using a digital camera (Nikon D300 Digital SLR, Nikon Inc., USA). All images were transferred to a desktop computer and all measurements of width of anterior teeth were performed by one investigator using computer software (Leica QWin, Leica Microsystems GmbH, Wetzlar, Germany). Three measurements for each anterior tooth were performed and the mean of those measurements was considered as the mesiodistal width of the tooth.

The golden proportion was calculated at 0.62 and investigated within the range of 1.59 - 1.65 as suggested by Preston in 1993.

The golden proportion for each subject was measured as follows: the width of the central incisor was multiplied by 62% and compared with the width of the adjacent lateral incisor. Similar values mean that the width of the central incisor is in golden proportion to the width of the lateral incisor. In comparing the width of the lateral incisor multiplied by 62% with the width of the adjacent canine, it can be determined if the width of the lateral incisor is in golden proportion to the width of canine.

The golden percentage was calculated by dividing the width of each central incisor, lateral incisor and canine by the total width of all six maxillary anterior teeth multiplied by 100 in order to obtain the golden percentage for each tooth. If the values from canine to canine were 10%, 15%, 25%, 25%, 15%, and 10%, it means that the six maxillary anterior teeth are in golden percentage.

The RED proportion was calculated by dividing the width of each lateral incisor by the width of the adjacent central incisor multiplied by 100. Similarly, the width of each canine was divided by the width of the adjacent lateral incisor and multiplied by 100. If the resultant values are constant, it means that the central incisor, lateral incisor, and canine are in RED proportion.

Data were processed using a statistical software package SPSS for Windows version 17.0 (SPSS Inc Chicago Illinois, USA). The level of significance was set at $p< 0.05$. The statistical difference was analyzed using Student's paired t-test.

Results

The descriptive statistics of width of maxillary anterior teeth among males and females cases is shown in table 1.

Table 2 shows the golden proportion relation between central incisor, lateral incisor and canine for the total subject in both left and right sides. According to Preston (1993), values lying within the range of 1.59 - 1.65 was considered to be in golden proportion [3]. Therefore, within this range and out of the total subject, the golden proportion between central incisor and lateral incisor was found in 5.1% in left side and 14.1% in right side.

Similarly, the golden proportion of lateral incisor to canine was found in 1.0% in the left side and 3.0% in the right side.

In female subjects, the golden proportion between central incisor and lateral incisor was present in 7.4% in left side and 13.2% in right side. However, the lateral incisor was in golden proportion to canine only in 1.5% in the left side and 4.4% in the right side.

The golden proportion in male subjects was found only in the right side between central incisor and lateral incisor with a percentage of 16.1%.

The mean values and standard deviation for RED proportions among males and females in the present study are listed in table 3. It can be seen that, in female subjects on the right side, the mean proportion of the lateral incisor to central incisor and canine to lateral incisor were: 62.28 and 78.46, respectively. However, the mean proportion of the lateral incisor to central incisor and canine to lateral were: 66.25 and 79.36 on the left side respectively.

In male subjects, on the right side, the mean proportion of the lateral incisor to central incisor and canine to lateral incisor were: 62.89 and 83.61 respectively. The mean proportion of the lateral incisor to central incisor and canine to lateral incisor were 62.38 and 73.48 on the left side respectively.

The values obtained for golden percentage in female subjects, beginning with the right side canine and moving to the left canine, were 11.2, 14.4, 23.3, 23.5, 15.5 and 12.2%. However, in male subjects, the values were 12.0, 14.5, 23.6, 24.0, 14.9 and 10.8%, beginning with the right side canine and moving to the left canine.

Discussion:

An important aspect of aesthetic dentistry is creating geometric or mathematical proportions to relate the successive widths of the anterior teeth. The golden proportion, the recurring aesthetic dental (RED) proportion, and the golden percentage are theories introduced in this field. This study was conducted on 99 dental students, 31 being male subjects and 68 female subjects, to investigate the existence of the golden proportion, RED proportion, and the golden percentage between the widths of maxillary anterior natural teeth in undergraduate dental students at University of Sana'a, Yemen.

Regarding the golden proportion, the best results in this study were seen in relation to perceived right central incisor and lateral incisor widths as seen from front. This was observed in a total of 14 (14.1%) out of 99 subjects, of which 5 (16.1%) were male subjects and 9 (13.2) were female subjects. The results of this study showed that the golden proportion did not seem to exist. This was in agreement with the result of different researchers who have reported that the golden proportion did not exist between the widths of the maxillary anterior teeth [4, 6-10].

Fayyad et al. (2006) found 31.3% of males and 27.1% of females had golden proportion between the width of the maxillary right central and lateral incisors [8]. Another study found 15% of males and 30.6% of females had golden proportion in relation to perceived left lateral incisor and canine widths as seen from front [9]. George and Bhat (2010) found that the golden proportion is a reliable predictor for determining the width of the maxillary central incisors in the south Indian population [10]. However, this result was greater than the percentage of golden proportion (17%) that was found by Preston (1993) [3].

With respect to RED proportion, the results of this study showed that the RED proportion between lateral incisor and central incisor lie in the 62.28-66.25% range. However, the RED proportion between canine and lateral incisor lie in the 73.48-83.61% range. In the current study, the ratio between lateral and central incisors and between canine and lateral incisor was not constant. The ratio increases as we move distally. The range of RED proportion of this study is not far from that reported by other investigators [7,8].

Regarding the use of Golden percentage theory to correlate the maxillary anterior teeth, the result of the present investigation suggests that the mean values for golden percentage for central incisor is 23.3-24%. The mean value for lateral incisors is 14.4-15.5% and the mean value for canines is 10.8-12.2. The values of golden percentage of maxillary anterior teeth reported in the present study were similar to the findings of Fayyad et al, (2006). [8]

The values for lateral incisor was in agreement with those suggested by Snow,[5] who recommended a value of 15 as the golden percentage for lateral incisor. The values obtained for central incisor were slightly lower than those suggested by Snow,[5] who estimated 25% for central incisors. The values for canines were also slightly higher than those suggested by Snow,[5] who recommended a value of 10% for canines.

Generally, it appears that the width of central incisors is slightly smaller and the width of canines is slightly larger than those suggested by the golden percentage theory. However, a value of 23.3% for centrals, 15.5% for laterals, and 12.2% for canines can be adopted, as these percentages are more applicable to the natural dentition.

The minor variations in the values obtained in this study in comparing to previous studies, may be attributed to the differences in ethnicity and methods used to evaluate the three theories.

Conclusion:

1- The golden proportion and RED proportion between maxillary anterior teeth were not found in this study

2- The golden percentage of maxillary anterior teeth was found more applicable esthetic guideline

3. In order to establish applicable esthetic proportions of maxillary anterior teeth, a range of those ratios should be considered accommodating ethnic, gender and individual variability.

References:

1.Levin EI. Dental esthetics and the golden proportion. J Prosthet Dent1978; 40:244–252.

2.Lombardi RE. The principles of visual perception and their clinical application to denture esthetics. J Prosthet Dent 1973; 29: 358-382.

3.Preston JD. The golden proportion Revisited. J Esthet Dent1993; 5: 247–251.

4.Gillen RJ, Schwartz RS, Hilton TJ, Evans DB. An analysis of selected normative tooth proportions. Int J Prosthodont 1994; 7:410–417

5.Snow SR. Esthetic smile analysis of anterior tooth width: The golden percentage. J Esthet Dent 1999; 11: 177–184.

6.Ward DH. Proportional smile design using the recurring esthetic dental (RED) proportion. Dent Clin North Am 2001; 45:143–154.

7.Mahshid M, Khoshvaghti A, Varshosaz M, Vallaei N. Evaluation of “golden proportion” in individuals with esthetic smile. J Esthet Restor Dent 2004; 16:185-192.

8.Fayyad M, Jamani K. & Agrabawi J. Geometric and Mathematical Proportions and their Relations to Maxillary Anterior Teeth. J Contemp Dent Pract 2006 November; (7)5:062-070.

9.Sreenivasan Murthy BV, Ramani N. Evaluation of natural smile: Golden proportion, RED or Golden percentage. J Conserv Dent 2008;11:16-21.

10.George S, Bhat V. Inner canthal distance and golden proportion as predictors of maxillary central incisor width in south Indian population. Indian J Dent Res 2010;21:491-5.

Table 1: The mean width of maxillary anterior teeth

Females	N	Minimum	Maximum	Mean	SD
Right central	68	5.65	13.43	8.06	1.54322
Right lateral	68	2.86	7.65	4.99	1.05600
Right canine	68	2.33	6.28	3.88	.91835
Left central	68	5.52	13.07	8.13	1.63926
Left lateral	68	3.39	8.20	5.35	1.03414
Left canine	68	2.04	7.37	4.20	.95359
Males					
Right central	31	4.17	11.80	8.58	1.54450
Right lateral	31	3.64	7.75	5.31	1.01106
Right canine	31	2.86	8.96	4.37	1.14772
Left central	31	6.43	11.73	8.72	1.31272
Left lateral	31	3.22	7.46	5.44	1.01395
Left canine	31	2.31	5.79	3.93	.81070

Table 2: The golden proportion for maxillary anterior teeth

N=99	Gender	No	Left Central /Lateral	Left lateral /Canine	Right Central /Lateral	Right lateral /Canine
>1.65	Female	68	25.0%	8.8%	33.8%	8.8%
	Male	31	51.6%	6.5%	35.5%	16.1%
	Total	99	33.3%	8.1%	34.3%	11.1%
<1.59	Female	68	67.6%	89.7%	52.9%	86.8%
	Male	31	48.4%	93.5%	48.4%	83.9%
	Total	99	61.6%	90.9%	51.5%	85.9%
GP % (1.59-1.65)	Female	68	7.4%	1.5%	13.2% (9)	4.4%
	Male	31	0.0%	0.0%	16.1% (5)	0.0%
	Total	99	5.1%	1.0%	14.1% (14)	3.0%

Table 3: The RED proportion relation between maxillary anterior teeth

	Gender	N	Mean	SD	Minimum	Maximum
Right lateral / central	Female	68	62.28	8.35	39.29	81.11
	Male	31	62.89	13.87	49.32	125.42
	Total	99	62.48	10.32	39.29	125.42
Right canine / lateral	Female	68	78.46	14.35	50.27	126.92
	Male	31	83.61	21.16	56.45	171.32
	Total	99	76.9	14.83	34.7	126.92
Left lateral / central	Female	68	66.25	7.87	48.60	86.51
	Male	31	62.38	7.43	47.08	78.91
	Total	99	65.04	7.91	47.08	86.51
Left canine / lateral	Female	68	79.36	14.77	48.37	131.86
	Male	31	73.48	15.52	43.70	117.95
	Total	99	77.52	15.18	43.7	131.86