

Original Article

Evaluating the validity of Golden Proportion, RED (Recurring Aesthetic Dental) Proportion and Golden Percentage in Maharashtrian Population

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Abstract

Context: A pleasing dental aesthetics is achieved by the maxillary anterior teeth. Restoring harmonious proportion between widths of maxillary anterior teeth is an important part of aesthetic dentistry. RED proportion and Golden Percentage are new guidelines introduced in this regards.

Aims: The purpose of this study was to evaluate the validity of Golden Proportion, RED proportion and Golden Percentage in maxillary anterior teeth in Maharashtrian population.

Methods and Material: Dentulous stone casts of maxillary arch were made of college students who met the inclusion criteria. Total of 100 students representing Maharashtrian population were included. The width of the anterior teeth was measured using digital calliper.

Statistical analysis used: The data obtained from all the above methods was entered into Microsoft Excel sheet and statistically analyzed using SPSS statistical package (SPSS 18; IBM Corp, Armonk, NY).

Results: Golden Proportion and RED proportion failed to validate in Maharashtrian population and so were considered unfavourable methods to determine the width of upper anterior teeth.

Conclusions: By adjusting the percentage Golden proportion theory could be applied to the Maharashtrian population for better aesthetics taking into consideration the ethnicity of the population.

1. Introduction

Numerous studies have pointed out to the fact that people are more concerned about missing or unaesthetic anterior teeth than posterior teeth as aesthetics seems to be more important than mastication.[1] During smiling the facial aspects of maxillary anterior teeth are widely visible, hence they bear a significant effect in cosmetic dentistry. One of the important and critical tasks in aesthetic dentistry is creating a harmonious proportion in these anterior teeth. Various theories have been proposed to create this harmony. Lombardi was the first to suggest the application of Golden Proportion in dentistry.[2] Levin suggested the use of the theory of Golden Proportion to relate the successive width of the anterior teeth as viewed from the front. In this manner, the visible width of lateral incisor is 62% (0.618) of Central incisor and the visible width of canine is 62% (0.618) of lateral incisor.[3,4] Ward suggested Recurring Aesthetic Dental (RED) proportion as the proportion of the successive width of the teeth remaining constant as progressing distally from the midline.[5] The Golden Percentage Theory was given by Snow which stated that the width of the central and lateral incisors and canine to be 25%, 15% and 10% respectively.[6]

2. Materials and Methods

Parameters to be evaluated:

1. Golden Proportion
2. RED Proportion
3. Golden Percentage

2.1 Subject Selection

Hundred dental students, 50 males and 50 females in the age group of 20-25 years were selected for study.

2.2 Inclusion Criteria:

Origin of Maharashtra state, all natural teeth except for possibility of third molar.

2.3 Exclusion Criteria:

History of orthodontic treatment, exodontia, tooth size alteration, rotation, spacing and crowding.

2.4 Methodology

Irreversible hydrocolloid impression of the maxillary arches were made in stock trays and poured with Type III dental stone. The dimensions of the anterior teeth and the perceived width of the anterior teeth viewed from front were measured using digital calliper read to the nearest 0.01mm. The measurement of the width of the anterior teeth was done by drawing grids that were obtained by placing the cast on flat surface and drawing vertical lines representing the perceived mesio-distal widths of the teeth. (Fig 1) Readings were taken by measuring the spaces between grids using the digital calliper. (Fig 2) Readings were taken by three researchers who were blinded for the procedure and the averages of those reading were taken as the final readings to avoid bias. If the readings differed for more than 0.2mm, the readings were repeated.

2.5 Measurements

The Golden Proportion for each subject was measured by the following method. The width of central incisors was taken as 62% of the value obtained and compared with the width of the adjacent lateral incisors. Similarly, the width of the lateral incisors was taken as 62% of the value obtained and compared with that of the canine. By the obtained values, it could be determined whether the width of the central incisors was in Golden Proportion with the width of the lateral incisors and the width of the lateral incisors with the canine. To calculate RED proportion, the width of each lateral incisor was divided by the width of the adjacent central incisor and the value obtained was multiplied by 100. Similarly, the width of canine was divided by the width of the adjacent lateral incisor and multiplied by 100. If the values obtained were constant, it showed that the central and lateral incisors and the canine were in RED proportion. The Golden Percentage was calculated by dividing the width of each central and lateral incisor and canine by the total width of all maxillary six anterior teeth and multiplying the value obtained by 100. If the value obtained was 10%, 15%, 25% on each side of arch for canine, lateral and central incisors respectively, it showed that the maxillary teeth were in Golden Percentage. The data obtained from all the above methods was entered into Microsoft Excel sheet and statistically analyzed using SPSS statistical package (SPSS 18; IBM Corp, Armonk, NY).

Descriptive statistics were calculated for the frequency of participants having various ratio of Golden Proportion based on sex. Chi square analysis was used to find if there existed any association between different gender and various ratios of proportion. Rest of the data was analyzed using the paired t-test with value of significance set at $p < 0.05\%$.

3. Results

The values obtained from the data revealed that there was no statistical difference based on the gender. The ratio of 1:2 (35%) and 1:2 (33%) was more common in Maharashtrian population as against the Golden proportion of 1:618 which was seen only in 7% of the population under study. The RED proportion was found to be in the

range of 69.45 – 70.22 % for central and lateral incisors and 80.25 – 83 % for canine and lateral incisor. The average value for Golden Percentage between central and lateral incisor and canine was found to be 22.5%, 15.5% and 12.2% respectively.

Table 1: Ratios obtained in study samples

Ratio	Males	Females	Total
1:1	00(00%)	01(2%)	01 (01%)
1:2	18 (36%)	17(34%)	35(35%)
1:3	17 (34%)	16(32%)	33(33%)
1:4	06(12%)	07(14%)	13 (13%)
1:5	05(10%)	06(12%)	11 (11%)
1:6	04(8%)	03(06%)	07 (07%)

Chi Square value = 2.88, $p=0.7$ (Not Significant)

Table 2: Red proportion Values as obtained for the study samples

		N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Red Proportion Lateral Incisor/ Central Incisor Right Side	Male	50	70.44	6.45	1.13	55.76	81.35
	Female	50	70.33	6.04	1.35	60.16	80.65
	Total	100	70.40	6.75	0.86	55.76	81.35
Red Proportion Canine / lateral Incisor Right Side	Male	50	82.48	11.20	1.87	67.84	113.40
	Female	50	83.25	10.61	2.39	64.18	102.51
	Total	100	82.76	10.92	1.46	64.18	113.40
Red Proportion Lateral Incisor/ Central Incisor Left Side	Male	50	69.50	6.94	1.16	45.71	80.81
	Female	50	69.91	8.28	1.85	55.90	84.08
	Total	100	69.65	7.38	0.99	45.71	84.08
Red Proportion Canine / lateral Incisor Left Side	Male	50	79.98	9.59	1.60	58.10	103.83
	Female	50	82.21	9.08	2.03	68.18	98.45
	Total	100	80.77	9.39	1.25	58.10	103.83

Table 3: Golden Percentage values as obtained for the study samples

S. No.	Teeth	Mean Golden Percentage
1	Central Incisor	
	Male	22.1 - 22.5 %
	Female	22.5 - 22.9 %
	Average	22.5 %
2	Lateral Incisor	
	Male	14.6- 15.0 %
	Female	15.0 - 15.4 %
	Average	15 %
3	Canine	
	Male	11.7 - 12.1 %
	Female	12.3 - 12.7 %
	Average	12.2 %

Figure 1: Use of grid for measuring the width of the teeth



Figure 2: Measuring the width using Digital Calliper



4. Discussion

It is important to determine a mathematical or geometrical relationship between teeth in order to achieve an aesthetic result. The Golden Proportion (1.618:1) describes the ratio between the dimension of larger and smaller objects. Various studies conducted in the past have shown varied opinion regarding the validity of this ratio for use in dentistry.

The study was conducted on 100 dental students from Maharashtra including 50 males and females each. The result of the study indicated that Golden Proportion does not validate in Maharashtrian population. The ratio of 1:2 and 1:3 were more commonly observed. No statistical difference based on the gender was found. The presence of ratio of 1.2 has been substantiated by Rosensteal *et al* [7], Javaheri and Shahnavaaz[8], Jahanbin *et al*[9], Decker[10], Howells and Shaw[11], Wolfart *et al*[12]. Thus, the golden proportion is more of an artistic and theoretical concept and it is inappropriate to anticipate that all human being possess this proportion. In relation to the RED proportion, the results of the study concluded that the width of the maxillary lateral to central incisor was between 69.45 – 70.22% and canine to lateral incisor was 80.25-82.65%.

Ward [5] suggested that the ratio of lateral to central incisor to be 70% Red Proportion. The ratio between central and lateral incisor and between lateral incisor and canine is not constant, so there was no evidence to support Red Proportion theory as applicable to Maharashtrian population. The golden percentage theory states that the width of the central and lateral incisor and canine to be 25%, 15% and 10% respectively. The results of the present study showed that the mean value of Golden Percentage for central and lateral incisors and canine were 22.5%, 15% and 12.2% respectively. The value obtained in Golden Percentage were slightly lower for central incisor and slightly higher for canine as suggested by Snow⁶ to be 25% for central incisors and 10% for canine. The value for lateral incisor was in accordance with the one given by Snow [6]. Thus, the values obtained in the Golden Percentage could be used for aesthetic correction in the Maharashtrian population as attributed to the regional difference of the subjects that were taken into consideration in the present study.

5. Limitations of the Study

Within the limitations of the study, following conclusion could be drawn.

The Golden Proportion is an inappropriate method to relate the successive width of the maxillary anterior teeth in the Maharashtrian population as it was not found to validate.

Red Proportion was also not found to be applicable for the subjects under study.

After taking ethnicity into consideration, we could easily determine the true Golden percentage for the population and use it to establish objectively quantifiable width ratio between maxillary anterior teeth.

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