

**Dental esthetic proportions – A review**

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**Abstract**

Selection of teeth is a crucial step in fabricating a denture. Denture teeth with proper size, form, color, position is essential for maintaining facial and functional harmony, facial expressions and facial esthetics. Many pre-extraction records such as extracted teeth, diagnostic casts, photographs, roentgenograms etc will guide selection of tooth mold. When pre-extraction records are not available, facial measurements and various facial proportions aid in selection of artificial tooth dimensions. This article reviews some of the commonly used dental esthetic proportions from articles of various databases such as Pubmed, Research gate from 1993 till 2020 and a short study conducted among 100 subjects in Tamilnadu Government Dental College to compare various dental esthetic proportions. Results of the conducted study showed values closer to the Golden Percentage whereas

the data analysed from various articles showed that no one method solely should be embraced to measure Dentofacial esthetics, yet RED proportion existed more than golden proportion. Anthropometric measurements differ for each population. They should be only used as general guidelines along with other determinants of Dentofacial attractiveness.

**Keywords:** Golden proportion, RED Proportion, Preston proportion

**Introduction**

Harmony between facial proportions determines the beauty of a face. There should a balance between teeth, skeletal structures and soft tissues. Facial profile is an important factor in determining facial attractiveness. Ethnicity has a strong influence over it. The selection of correct tooth size is necessary, when designing a natural

smile to enhance facial and dental esthetics as well as the treatment outcome.

### Tooth Proportions

Two proportional relationships important for appearance include:

- The height/width proportion of teeth (should be approximately about 80% of its height)
- The width of tooth in relation to each other.

Teeth proportion was a major concern for dentists for a long time. Various tooth proportions include:

Golden Proportion (62%), Golden Mean, Preston Proportion, RED, Esthetic norm Proportion (71%), Plato Beauty Proportion (57%), Quarter 3:4 Proportion (75%), Human norm 5:6 Proportion (80%)<sup>[1]</sup>. Methods Proportion<sup>[2]</sup>. This article compares the most commonly used proportions.

**Golden Proportion:** In 1509, Luca Pacioli published the first canon of facial proportion, golden section in his “De Divina Proportionale”, illustrated by Leonardo da Vinci.<sup>[3]</sup>

The golden ratio arises from dividing a line segment asymmetrically so that ratio of the whole segment to large piece is equal to the ratio of larger piece to smaller piece. So if the bigger segment is X then  $X = 0.618033\dots$  And  $1/X = 1.618033$ . The letter  $\Phi$  is used for representation of the golden ratio 1.61803.<sup>[4]</sup>

The golden proportion proposed by Lombardi states an existence of relationship between beauty and mathematics. As seen in figure 1, when progressing from anterior teeth to the posterior teeth, the proportion between the width of central incisor and lateral incisor should be constant. As seen in figure 2, from frontal view, the maxillary lateral incisor should be 62% of the width of maxillary central incisor, and the width of maxillary canine should be 62% of the width of lateral incisor<sup>1</sup>. Kepler called the proportion as “Divine Proportion”.<sup>[5]</sup>

Central Incisor width=Intercanine width x 0.25

Lateral Incisor width= Central Incisor width x 0.62

Canine width= Lateral Incisor width x 0.62

**Golden Mean or Golden Percentage:** It states that the width of the permanent maxillary central incisor tooth should be 25% of the intercanine distance i.e. the distance of distal of maxillary canine on one side to the distal of the canine on the other side. As seen in figure 3, from the frontal view, maxillary lateral incisor should be 15% and maxillary canine should be 10% of the intercanine distance.<sup>[4], [6]</sup>

Central Incisor width= Intercanine width x 0.25

Lateral Incisor width= Intercanine width x 0.15

Canine width= Intercanine width x 0.10

**Methods Proportion (“M”):** It is a modified Golden proportion. For a pleasing smile, determination of the width of the central incisors is necessary for the correct balance of teeth display in arch. The inter-molar distance of each individual represents the width of the arch. The modified ratio is 1.367, in contrast to the Golden Proportion of 1.618.<sup>[2], [7]</sup>

**Red(Recurring Esthetic Dental):** It was proposed for designing smiles. As it is a two-dimensional evaluation of a three-dimensional smile, buccopalatal placement of the teeth affects their apparent tooth width<sup>17</sup>. It is based on a principle that linear coefficient progression in which the width of each successive tooth diminishes by the same proportion as viewed from the front.<sup>[1]</sup>

For normal length teeth with a 78% width/height ratio of maxillary central incisors, 70% RED proportion has been recommended, as seen in figure 4.<sup>[1]</sup> Taller individuals have taller teeth, smaller the RED proportion. Extra tall individuals have a smile with 62% RED proportion, and a very short person have a smile with 80% RED proportion.<sup>[8]</sup>

Central Incisor width=Total Intercanine frontal view width

$$\frac{\text{Central Incisor width}}{2(1+\text{RED}+\text{RED}^2)}$$

Lateral Incisor width= Central Incisor width x 0.70

Canine width = Lateral Incisor width x 0.70

### Preston (Natural) Proportion

Preston states that the width of average maxillary lateral incisor was approximately 66% of the width of the maxillary central incisor and width of maxillary canine was approximately 84% of width of maxillary lateral incisor.<sup>[1],[9]</sup>

Central Incisor width= Total Intercanine frontal view width

$$\frac{\text{Central Incisor width}}{2(1+0.66 + (0.66 \times 0.84))}$$

Lateral Incisor width= Central Incisor width x 0.66

Canine width= Lateral Incisor width x 0.84

Foster and colleagues reported that average tooth to tooth width proportion was 62% for lateral incisor to central incisor and 85% for canine to lateral incisor.<sup>[8]</sup>

Asians reported smaller lateral incisors than North American and Europeans. Ethnicity and region is important to determine their applicability for smile designing.<sup>[8]</sup>

### Materials And Methods

In this study, electronic search was conducted for scholarly articles from 1993 till 2020 with keywords: facial proportion, golden proportion, RED proportion from various databases such as Pubmed, Research gate etc were reviewed and a short study was conducted among 100 subjects in Tamilnadu Government Dental College to compare various dental esthetic proportions.

### Discussion

Rosseetti A et al in a study found that the ratios between 3D facial distances were not related to facial

attractiveness. Facial ratios were found to be different from the golden ratio.<sup>[3]</sup>

Anand S et al in a study found that the golden proportion should not be embraced as the only method to measure human beauty with the exclusion of other factors.<sup>[10]</sup>

Mahesh P et al in a study found the existence of a constant ratio (2.04) between combined mesiodistal width of 6 maxillary Anteriors and combined mesiodistal width of 4 mandibular incisors. There was a slight difference from (1.618) golden proportion.<sup>[5]</sup>

Dashti et al in a study showed, for smile with normal-length teeth, 70% RED proportion was preferred over both the golden proportion (75%) and the Preston proportion (57%). Dentists preferred 80 percent proportion for shorter teeth and they preferred golden proportion for very longer teeth. Golden proportion was worst both for normal height and shorter teeth.<sup>[1]</sup>

Hasanreisoglu U et al in a study found that neither golden proportion nor recurrent proportion for anterior teeth was determined in Turkish population. Interalar width and Bizygomatic width could be used as a reference guide for establishing width of maxillary anteriors, especially in women.<sup>[12]</sup>

Sunilkumar et al in a study found soft-tissue facial balance in comparison with the golden proportion among North Maharashtra population along with some parameters showing some deviation from it.<sup>[13]</sup>

Sreenivasan Murthy B V et al in a study showed that both RED proportion and golden proportion was not found to exist between widths of maxillary anterior teeth. They are unsuitable to relate width of maxillary anterior teeth. If percentages are adjusted, and ethnicity of population are considered, golden percentage can be applied.<sup>[15]</sup>

Peron et al in a study found that there was no association between perception of facial beauty and golden proportion.<sup>[16]</sup>

Ward et al in a study stated that evaluation of the body, the face, and the existing dentition must be considered for smile design. The RED proportion is a useful tool for smile designing.<sup>[8]</sup>

Preston JD et al in a study found that golden proportion of 1.618:1 was not correlated with the maxillary central incisor and the mandibular lateral incisor. The golden proportion existed between the maxillary central incisor and mandibular central incisor only in 25 % of the material surveyed. The golden proportion existed between the width of the maxillary central and lateral incisors in 10 out of 58 images (17%).The golden proportion was not existed between maxillary lateral incisor and canine widths.<sup>[9]</sup>

Sandeep N et al in a study found that golden proportion was not found to be existed between mesiodistal widths of maxillary anteriors. The width-to-height ratio of maxillary central incisor tooth analysed was found to be within 75-80%. No significant differences were found in teeth proportions between males and females.<sup>[17]</sup>

Rajiv A et al conducted a study in which facial proportions of attractive females were found to be different from those with malocclusion and golden proportion was not found to be correlating with the facial esthetics of attractive females.<sup>[18]</sup>

Khan NA et al in a study found that facial proportions of attractive females in North-Indian population were closer to divine proportion and found as an important factor in the perception of facial attractiveness.<sup>[19]</sup>

George S et al in a study found inner canthal distance and golden proportion as suitable for determination of width of maxillary central incisor tooth among South Indian population, as seen in European population.<sup>[20]</sup>

Alam MK et al in a study found that only 17.1% of analysed Malaysian facial proportion correlated with golden ratio, with majority found to be having short face

(54.5%). Facial index did not depend on races; sexual dimorphism was found among Malaysian Chinese. Significant interracial differences in facial evaluation score were found between Malaysian Chinese and Malaysian Indian, and between Malaysian Chinese with Malaysian Malay; no sexual dimorphism was shown. Golden ratio was not existed among Malaysian population.<sup>[21]</sup>

Meshramkar R et al conducted a study in which smiles were digitally analysed the prevalence of Golden Proportion and RED proportion. RED proportion was seen in 6.6% of population and golden proportion in 0.6% of analysed population. It was found that 70% RED proportion existed more than Golden Proportion in both attractive and unattractive smiles.<sup>[22]</sup>

Swelem AA et al in a study found that width ratios of maxillary anteriors did not follow the Golden Proportion for the examined Saudi population.<sup>[23]</sup>

Nikgoo A et al in a study found that golden ratio between widths of maxillary laterals to canine was not crucial for an attractive smile and other factors should be considered.<sup>[11]</sup>

Yeon et al conducted a study in Korean population and found that width ratio of maxillary anterior teeth did not follow golden ratio.<sup>[24]</sup>

Liao et al in a systematic review found that RED proportion with interalar distance as the accurate method to determine the combined width of permanent central incisors. Neither inner canthal distance nor interalar distance can be used to determine the Inter canine distance.<sup>[25]</sup>

Rabi et al in a literature review stated that the smile line should also be considered as an important factor for an esthetic smile along with the various proportions.<sup>[26]</sup>

A short study was conducted by Meenakshi et al among 100 subjects with nativity of Tamilnadu were selected and

standardized frontal images of 50 males and 50 females subjects (patients, their attendants, interneers, undergraduates, postgraduates, technicians) were captured. Each maxillary anterior tooth was digitally measured. Measurements were recorded, and the data was statistically analysed with statistical package SPSS 16 version. Results showed that the golden proportion existed only in 14-69% of subjects, least being the permanent left lateral incisor and highest being permanent right canine between perceived maxillary anterior teeth in natural dentition. The value of RED proportion was not found to remain constant. Widths of the maxillary anterior teeth were not found in association with Golden Proportion and RED Proportion. The Preston Proportion was in concordance with the population. The analysed values observed found to be closer to the Golden Percentage.

### Conclusion

Results of the conducted short study showed values closer to the Golden Percentage whereas the data analysed from various articles showed that no one method solely should be embraced to measure Dentofacial esthetics, yet RED proportion existed more than golden proportion. Efforts should be made for conducting studies in a larger population to find the exact coexistence of particular esthetic proportion in that population. Role of factors such as age, sex, environment, heredity and race on the facial morphology should be considered to found the correlation of various dental esthetic proportions to that population.

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### Legends Figures

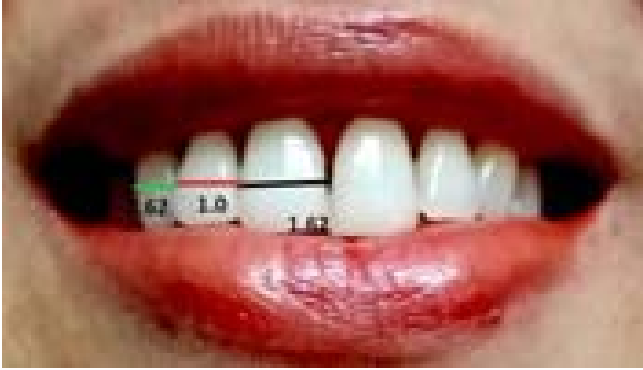


Figure 1:Golden Proportion



Figure 2: Golden Proportion



Figure 3: Golden Mean



Figure 4: Red Proportion