



A Study to Evaluate the Prevalence of Golden Percentage and Recurring Esthetic Dental Proportion among Young Individuals in Dakshina Kannada

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Abstract

This study was conducted with the aim of identifying the prevalence of recurring esthetic dental (RED) proportion and golden percentage among young individuals in Dakshina Kannada district. The study was conducted by analyzing digital photographs of 100 subjects on Adobe. The measurements were made using a digital ruler. After the measurements were completed, the data collected were statistically analyzed to determine the prevalence of either of the proportions. The result suggested the prevalence of RED proportion being significantly more (72.2%) than golden percentage (27.8%) among the young individuals of Dakshina Kannada population. Based on gender-wise distribution, golden percentage was more prevalent among females, whereas RED proportion was more prevalent among males. Within the scope and limitations of this study, it is suggested to use of RED proportion to design a harmonious smile.

Keywords

- ▶ golden percentage
- ▶ prevalence
- ▶ RED proportion
- ▶ smile design

Introduction

A pleasing smile is one of the major contributing factors in overall wellbeing of a human being. In recent years with advent of social media, people have become more aware of their appearance and expect superior esthetics. Smile design has thus become a discipline of dentistry that involves intensive evaluation followed by complex treatment planning. This demand for esthetics enforces dental clinicians to be adequately knowledgeable and skillful enough to deliver the expected results. Therefore, it is an amalgamation of science and art in its truest sense.

An esthetic smiles is the one comprising of maxillary anterior teeth that are in a harmonious proportion with each other as well as face of the person.

Replacing or restoring these maxillary teeth while maintaining a tuneful relationship is one of the most daunting tasks for clinicians.^{1,2} Therefore, understanding of the various ratios and proportions becomes crucial for dental surgeons. They act as an aid in planning their cases based on preexisting findings and template which are well supported by the literature.

The relationship between mathematical proportions and esthetic principles has been described by numerous individuals, like Leonardo da Vinci, H. Ward and Snow.³ Different tooth proportions have been discussed and analyzed globally, yet no definite concept follows all the mathematical rules of proportional smile designing norms.⁴ Measuring size of maxillary anteriors as references to determine the esthetic

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proportion has been carried out in the past by various authors.^{5,6}

The recurring esthetic dental (RED) proportion proposed by Ward was based on the result of his study where he conceptualized the use of 70% RED.^{7,8} He also concluded in his survey among dentist in north America that most dentists do prefer this RED proportion over other esthetic dental proportions.

Golden mean is another theory of smile design proposed by Snow, which states that maxillary central incisor, lateral incisor, and canine should compromise of 25, 15, and 10% of the total intercanine width of the maxillary arch.⁹

There have been numerous studies done in the past comparing different proportions in different age groups, at different locations, between different gender. But none of the mathematical proportion proved to be universally superior to the rest. This can be attributed to the fact that different age, sex, and race create difference in teeth significant enough that cannot be predicted by a single mathematical equation yet.

This study was conducted with the aim to evaluate the preponderance of golden percentage and RED proportion among natural smile of young individuals in Dakshina Karnataka district. This can assist dentist by providing a template to deliver esthetically superior smile to their patients in the future.

Materials and Methodology

Source of the Data

This in vivo study was performed in the Department of Prosthodontics and Crown and Bridge of A.B. Shetty Memorial Institute of Dental Sciences NITTE (Deemed to be University), Deralakatte, Mangaluru, on a total of 100 individuals.



Fig. 1 Positioning of the subject.

Sample size was determined using the estimates from the parent article and using a single proportion formula.

Criteria for Selection

Inclusion Criteria

Individuals in the age group of 18 to 35 years with all natural dentition in the esthetic zone were included.

Exclusion Criteria

Individuals with the history of orthodontic treatment, cleft lip/palate, absence of teeth in anterior maxilla, generalized diastema, and crowding were excluded.

Methodology

In total, 100 patients visiting the outpatient department and the students belonging to the institute that fall in the inclusion criteria were selected. All observations were made by the single examiner. Written informed consent was obtained from the subjects for the study. The subjects were made to sit in an upright position. The head was positioned without support, the interpupillary line was kept parallel to the horizontal facial plane, and subjects were asked to look straight ahead. Images were captured using a Standardized camera Canon 700D with 35-105 mm focal length. The subjects were positioned at a distance of 30 cm from the source with standard lighting conditions. Two sets of photographs were obtained—a full face photograph with a natural smile and frontal photographs with upper lip retracted to display maxillary anterior teeth and its gingiva. When the subject smiled, an image was captured. (→ **Figs. 1** and **2**). Images were analyzed on Adobe Photoshop for measurements of the teeth by a single investigator. The image was rotated such that it was parallel to a common horizontal axis and, thereby, was aligned parallel to the framework of the screen. The zoom function was used to enable measurement of the apparent mesiodistal width and length of each tooth from canine to canine.

Golden Percentage

It was calculated by dividing the width of each central incisor, lateral incisor, and canine by the total width of all six maxillary anterior teeth and multiplying the resulting



Fig. 2 Photograph of the smile.

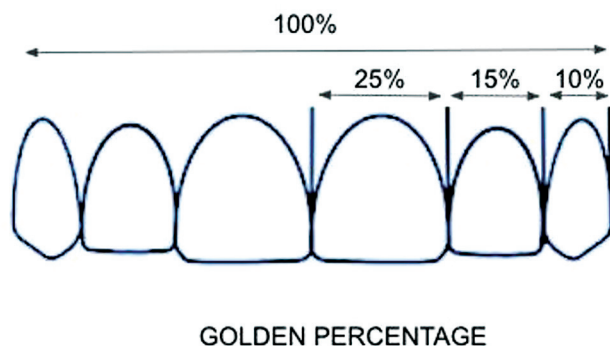


Fig. 3 Golden percentage dividing the width of each central incisor, lateral incisor, and canine by the total width of all six maxillary anterior teeth and multiplying the resulting value by 100.

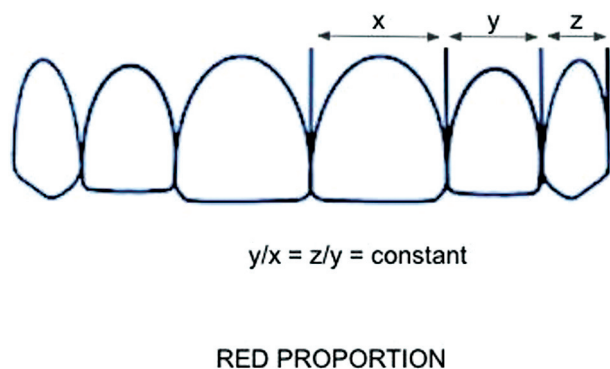


Fig. 4 RED proportion: the width proportion between two adjacent teeth as viewed from the frontal should remain constant, progressing successively distally.

value by 100, in order to obtain the golden percentage for each tooth. If the values were 10, 15, 25, 25, 15, 10%, it indicates that the six maxillary anterior teeth are in golden mean proportion (► Fig. 3).

Red Proportion

Red proportion states that the proportion of the successive widths of the maxillary teeth as viewed from the front should remain constant, progressing distally. Dentist has freedom to select any percentage as constant according to each case (► Fig. 4).

Statistical Method for Analysis

Following data collection, data were entered into Microsoft excel worksheet (Microsoft, USA). Data analysis was done using IBM Statistical Package for Social Sciences (Statistics for

Windows, Version 21.0. Armonk, NY, United States: IBM Corp.). Categorical data were described in terms of frequencies and percentages. Continuous data were presented by mean and standard deviation.

Results

► **Table 1** shows the gender-wise distribution of golden percentage and RED proportion among the study samples. Golden percentage was reported to be 18% in females and only 4% in males, whereas RED proportion was seen in 38% males and 19% females. Among females both the proportion had almost similar occurrence, but RED proportion was significantly higher in males (38%) compared to golden percentage in males (4%).

The recurring esthetic dental proportion was found to be most prevalent with 57%. The golden percentage existed in 22% of the population. Twenty-one percent of the population did not show any correlation with either of the proportions. Thus, RED proportion was most prevalent.

Discussion

Various philosophers and clinicians have long been trying to evaluate the relationship between mathematics and nature. In an attempt to create esthetically harmonious restorations, considerable authors recommended the use of mathematical proportions to represent the relationship among all maxillary anterior teeth. Lombardi was one of the first individuals to suggest the dental application of the golden proportion, whereas pioneers such as Ward and Snow, suggested the use of RED proportion and golden mean, respectively.⁸

The RED proportion of 70% was concluded as the most favored by patients and dentists in North America according to the study by Ward et al in 2007.^{7,8} Golden percentage suggested the composition of the smile at 25, 15, and 10% of the total intercanine distance when moving from central incisor distally toward the canine. This golden percentage evaluates the width of an individual tooth for its contribution to three factor dominance, proportion, and symmetry of the entire anterior segment.

Thus, the present literature creates a dilemma for clinicians to make a suitable choice of proportion for harmonizing a smile. Hence, the study was undertaken to study the prevalence of golden percentage and RED proportion among the young individuals in Dakshina Kannada district using photographs and digital measurements.

In this study, the frontal image of 100 subjects' with their smile was taken in a standardized manner using a digital single-lens reflex camera which was later transferred to a

Table 1 Gender-wise distribution of golden percentage and RED proportion among the study samples

Gender	Golden percentage	Red proportion	p-Value
Male	4	38	0.001 ^a (s)
Female	18	19	

Abbreviation: RED, recurring esthetic dental.

laptop and the measurements were made using a digital ruler on Adobe. The values were then used to determine the existence of either of the mathematical ratios. Statistical analysis was done for the data thus obtained.

Among the existence of various tooth proportions in the south coastal population, the prevalence of RED proportion was found to be the maximum (72.2%) as compared to golden percentage (27.8%) and this was in contrast with an earlier study done in south Indian population stating that golden proportion indeed was the more prevalent ratio for esthetically pleasing smiles. The RED proportion proposed that the successive width of maxillary anterior on viewing from the frontal plane remained constant, on progressing distally. The difference and choice of 70 to 80% could be based on ethnic differences and the racial background. Thus, more studies are needed in this context.

Thus, the results led to the rejection of null hypothesis and the acceptance of the alternate hypothesis that RED proportion was most prevalent in young individuals of Dakshina Kannada district.

Snow had ascertained that the combined width of the anterior teeth could be used as the determinant for the width of centrals, laterals, and canines and called it the golden percentage.⁹ Accordingly, Fayyad et al documented the promising applicability of golden percentage theory, taking into consideration the ethnicity of their population.¹⁰ In our study, the prevalence was higher among females for the golden percentage. These results are comparable to the study performed by Kaur wherein golden percentage was found to be more prevalent in females in Himachal region.¹¹ The results are in accordance with the study results of Prakash and Bahri, where the prevalence of golden percentage was higher in females as compared to males than the other mathematical ratios and proportions used in the study. But the overall results of the study suggested golden percentage to be the dominant proportion in the smiles analyzed among Maharashtrian population.¹² These were not consistent with this study which may be attributed to the difference in the demographic and ethnic origin of the population on which the study was conducted.

Condon et al also recorded that the width of central incisors and lateral incisors could be higher in males compared to females. The results in the present study could be correlated with the maxillary anteriors being slightly larger in males compared to females, hence giving a greater wider ratio.¹³ Tsukiyama et al's study also emphasized on the fact that ethnicity and demographics should be considered before performing either surgical or restorative treatments on the anterior sextant of an individual from a specific ethnic group.¹⁴

Hence, the results of this study may be conflicting and varied due to several factors such as differences in research methodology along with the different ethnicities of the subjects. Our study obtained data only from Dakshina Kannada district which make the population more exclusive,

whereas other studies have been conducted on a more diverse population.

Conclusion

Within the conceivable limitations of the present study, it was concluded that RED proportion was more prevalent compared to golden percentage in the population of Dakshina Kannada, with the golden percentage being higher in females and RED proportion being higher in males.

Funding

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Conflict of Interest

None declared.

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