

Evaluation of Smile by Golden Proportion, Golden Percentage and Red Proportion of Maxillary Anterior Teeth Width in Gujarati Population

Dipti S Shah¹ Kalpesh Vaishnav² Pankaj Patel³ Niti Bansal^{4*} Mausami Vaja⁵

¹Professor and Head, Department of Prosthodontics, Karnavati School of Dentistry, Gandhinagar, Gujarat, India.

²Professor, Department of Prosthodontics, Karnavati School of Dentistry, Gandhinagar, Gujarat, India.

³Professor, Department of Prosthodontics, Karnavati School of Dentistry, Gandhinagar, Gujarat, India.

⁴Post Graduate Student, Department of Prosthodontics, Karnavati School of Dentistry, Gandhinagar, Gujarat, India.

⁵Post Graduate Student, Department of Prosthodontics, Karnavati School of Dentistry, Gandhinagar, Gujarat, India.

ABSTRACT

Aim: To investigate the effectiveness and appropriateness of Golden proportion, Golden Percentage and Recurring Esthetic Dental, with respect to the widths of maxillary anterior teeth in individuals with natural dentition in Gujarati population, with the assistance of digital photographs and computer analysis

Material and method: Standardized frontal images of 50 subjects were captured apart from measuring the width of maxillary anterior teeth. Thereafter, the three theories were applied, and the data was analyzed statistically.

Results: The golden proportion was found to exist only in 10-36% of the subjects, between apparent maxillary anterior teeth in natural dentition. The value of the RED proportion increased as one moved from mesial to distal. Likewise, the results showed that golden percentage was rather constant in terms of relative tooth width. Central incisor represented 23%, lateral incisor 15% and canine 12% of the width of six maxillary anterior teeth, as viewed from the frontal aspect.

Conclusion: According to the study conducted, both, the theories of golden proportion and RED proportion were not found to be satisfactory for calculating the proportion of the successive widths of maxillary anterior teeth in the given population. Nonetheless, the golden percentage theory can be applied when the percentages are accustomed according to the ethnicity of the population. More studies need to be conducted with a greater number of subjects to reach to this inference.

Keywords: correlation, intercanine distance, bizygomatic width, intercanthal width, Nigeria.

INTRODUCTION

The labial aspects of maxillary anterior teeth are visible prominently, when a person smiles; therefore, they have a noteworthy effect in cosmetic dentistry. In aesthetic dentistry, to create a harmonious proportion while fabricating or restoring anterior maxillary teeth is the chief and analytical job. Lombardi was the first to suggest that golden proportion was an important factor in

determining the tooth size. He also described the use of a repeated ratio in the maxillary anterior teeth. This implied that an enriched dento-facial composition of lateral to central incisor width and the canine to lateral incisor width are repeated in proportion¹.

Levin suggested to use the theory of Golden proportion to calculate the successive width of anterior teeth, as viewed from the labial aspect².

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*Correspondence Dr. Niti Bansal.

Department of Prosthodontics, Karnavati School of Dentistry, Gandhinagar, Gujarat, India.

Email: Not Disclosed

According to Levin, when the maxillary anterior teeth are viewed from the frontal aspect, the width of the central incisor should be in golden proportion to the width of the lateral incisor and that the lateral incisor should be in golden proportion to the width of the canine, respectively.

In addition, he formulated a grid with the spaces equivalent to golden proportion and encouraged the use of this grid for evaluation and development of harmonious proportions of teeth. Each subject's golden proportion was measured: after multiplying the width of the central incisor by 62, it was compared with the width of the adjacent lateral incisor. Same method was carried out to calculate the width of lateral incisor and canine.

However, in a more recent study, it was reported that in individuals with esthetic smile, the golden proportion did not exist between the widths of the maxillary anterior teeth. Ward suggested recurring esthetic dental (RED) proportion⁴. His suggestion were based on the result of his study in which he described that when progressing distally from the midline, the proportion of the successive width of the teeth remain constant and he termed this as RED proportion. By dividing the width of each lateral incisor by the width of the adjacent central incisor and multiplying the resulting number by 100, RED proportion was measured. Similarly, it was measured for lateral incisor with canine and if the ratio obtained was constant, the teeth are said to be in RED proportion.

According to Snow, the concept of the golden percentage is a useful application in the diagnosis and development of symmetry, dominance, and proportion for an esthetically pleasing smile. Snow considered, another method, bilateral analysis of apparent individual tooth width as a percentage of the total apparent width of the six anterior teeth. He proposed the golden percentage, wherein the proportional width of each tooth was: canine 10%, lateral 15%, central 25%, central 25%, lateral 15%, and canine 10% of the total distance across the anterior segment, to achieve an esthetically pleasing smile⁵.

MATERIAL AND METHOD

The study was performed in accordance with ethical standards and with the approval of ethical

committee of the institute. 50 Patients were selected in the age group of 18-30 yrs.

Inclusion criteria

- The subjects should have Gujarati origin.
- Natural dentition in maxillary anterior teeth.

Exclusion criteria

- Subjects who have undertaken orthodontic treatment.
- Any maxillary anterior tooth size modifications.

Materials:

Digital camera NIKON D5300

Method:

Image capture

Standardized frontal image of each subject's smile were taken, using digital camera NIKON D5300, in the following manner:

- Subjects were asked to stand in the natural head position, with head forward and eyes looking straight.
- Once the camera was set to a suitable position, an image of the face was taken from the tip of the nose to the tip of the chin.
- 60 cm distance was fixed between camera and the subject.
- The image was captured once the patient smiled naturally.
- The captured images were then downloaded to a private computer. The measurements were taken by the software Adobe Photoshop 7.0 with one investigator.

The data was collected and tabulated as shown in Table 1 and 2.

MEASUREMENTS:

- Each subject's Golden proportion was measured: the width of the central incisor was multiplied by 62% and compared with the width of adjacent lateral incisor, i.e., the central incisor is 1.618 times larger than the lateral incisor. Similar values indicate that the width of the central incisor is in golden proportion to the width of the lateral incisor. It can be

determined whether the width of the lateral incisor is in golden proportion to the width of the canine, by comparing the width of the lateral incisor multiplied by 62% with that of the canine. Similarly, the lateral incisor is 1.618 times larger than the visible part of the canine seen from the vertical axis.

- For RED proportion calculations, the width of lateral incisor was divided by width of adjacent central incisor, and the obtained value was multiplied by 100, to get the RED proportion. Likewise, the width of each canine was divided by the width of adjacent lateral incisor and the resulting number was multiplied by 100. Constant values meant, that the central incisor, lateral incisor and canine are in RED proportion.
- For golden percentage calculation for each tooth, the width of each individual tooth i.e. the central incisor, lateral incisor and canine, was divided by the total combined width of all maxillary anterior teeth, and the resulting value, when multiplied by 100, gave us the golden percentage value for each tooth. According to Snow, the values obtained from canine of one side to canine on other side of arch is 10, 15, 25, 25, 15 and 10%, then the maxillary anterior teeth are said to have golden percentage.

RESULTS

0.6 golden proportion was found in 36% of the perceived lateral-to-central incisor ratios and in < 10% of the perceived canine- to-lateral incisor ratios, within the 0.55 to 0.64 range. Within Preston's range (0.61–0.63)³, the proportion was found in 13.4% of lateral-to-central incisor widths and < 7% of canine-to-lateral incisor widths. Furthermore, the existence of the golden proportion was found to be similar in the left and right side and for both sexes.

Out of the total subjects, the following are the results,

- a) 31.%(female) and 42.8% (male) had right central incisor in golden proportion to right lateral incisor [Graphs 1 and 2 respectively].
- b) 13.7% (female) and 9.2% (male) of the subjects had right lateral incisor in golden proportion to right canines [Graphs 3 and 4 respectively].
- c) The percentage that showed left central incisor in golden proportion to left lateral incisor [Graphs 5 and 6 respectively] was 44.2% (female) and 33.2% (male).
- d) The number of subjects with left lateral incisor in golden proportion left canine [Graphs 7 and 8 respectively] was 6.8% (female) and 4.7% (male) of the total.

For RED proportion, the mean values and standard deviation, obtained, are tabulated in Table 3. The study showed the result, that RED proportion between central incisor and lateral incisor lies in the range of 65.2- 67.4% , while for canine and lateral incisor it lies in the range of 78.25- 81.9%. The values as acquired for golden percentage in this study, starting with the right canine to the left canine, were 12, 15, 23, 23, 15 and 12%. These values are shown in Graphs 9 and 10. These graphs show the original value of Golden percentage which was proposed by Snow and the obtained values from this study for the taken population.

DISCUSSION

Although golden proportion has been proposed in the literature as a useful application for achieving proportion and esthetics, no one has yet evaluated this proportion in esthetically accepted cases. The present study tried to use defined criteria of the study and the subjects, rather than the judgment of a panel. The aim was to augment the objectivity and reduce the subjectivity of selecting esthetic smiles. This study was conducted on 50 subjects, 21 being male subjects and 29 female subjects. The Golden proportion for each subject was measured as: the width of the central incisor was multiplied by a factor of 62 and compared with the width of adjacent lateral incisor. Similar values indicate that the width of the central incisor is in golden proportion to the width of the lateral incisor.

The suitable results in this study were seen only in relation to apparent left lateral incisor width and apparent left central incisor width as seen from front, when theory of golden proportion was applied. This was witnessed in a total of 40% of 50

subjects. In general, when it considered, the golden proportion did not exist in the population considered for study. This was in accordance with the studies conducted by Minoo Mahshid *et al*⁶ and Fayyad MA *et al*⁷, where, with the help of scanned photos of individual, the presence of golden proportion was calculated by measuring the mesio-distal width of maxillary anterior teeth.

For RED proportion calculations, the width of lateral incisor was divided by width of adjacent central incisor, and the obtained value was multiplied by 100, to get the RED proportion. Likewise, the width of each canine was divided by the width of adjacent lateral incisor and the resulting number was multiplied by 100. If constant values are obtained by these calculations, then the anterior teeth are said to be in RED proportion.

The results obtained in this study when RED proportion was applied was 65.2- 67.4% for the width of lateral incisor to central incisor, and 78.25- 81.9% for the widths of canine to lateral incisor. This shows that the values are not constant, as moves from midline to distal, as proposed by Ward. Also, it increases from central incisor to canine. Hence, there is no indication in this study to back up the RED proportion theory, as and when applied to natural dentition.

For golden percentage calculation for each tooth, the width of each individual tooth i.e. the central incisor, lateral incisor and canine, was divided by the total combined width of all maxillary anterior teeth, and the resulting value, when multiplied by 100, gave us the golden percentage value for each tooth. According to Snow, the values obtained from canine of one side to canine on other side of arch is 10, 15, 25, 25, 15 and 10%, then the maxillary anterior teeth are said to have golden percentage.

When the golden percentage theory is applied to relate the width of six anterior teeth, from the present study it can be deduced, that the mean values of golden percentage for central incisor is 23%, for lateral incisor is 15.3-15.5%, and for canine is 11.89-12.1%.

CONCLUSION

Within the limitations of this study, it can be concluded that:

- 1) Out of all the three theories, the golden percentage theory was found to be more pertinent to the population considered in this study.
- 2) When the maxillary anterior teeth were viewed from frontal aspect, and the apparent width of maxillary anterior teeth were considered, golden proportion theory was not applicable.
- 3) RED proportion theory was not found to be valid among the maxillary anterior teeth. And in oppose to Ward's suggestion, the RED proportion increased as one moved from midline to distal.
- 4) Ethnic differences should be a concern, in order to establish demonstrably reckonable width ratio between maxillary anterior teeth.

CONFLICT OF INTEREST

No potential academic conflict of interest relevant to the above article was reported.

REFERENCES

1. Lombardi RE. The principles of visual perception and their clinical application to denture esthetics. J Prosthet Dent 1973;29:358-82.
2. Levin EL. Dental esthetics and the golden proportion. J Prosthet Dent 1978;40:244-52.
3. Preston JD. The golden proportion revisited. J Esthet Dent 1993;5:247-51.
4. Ward DH. Proportional smile design using the recurring esthetic dental (RED) proportion. Dent Clin North Am 2001;45:143-54.
5. Snow SR. Esthetic smile analysis of anterior tooth width: The golden percentage. J Esthet Dent 1999;11:177-84.
6. Mashid M, Khoshvaghti A, Varshosaz M, Vallaei N. Evaluation of "Golden Proportion" in individuals with an esthetic smile. J Esthet Restor Dent 2004;16:185-92.
7. Fayyad MA, Jaman KD, Aqrabawi J. Geometric and mathematical proportions and their

- relations to maxillary anterior teeth. J Contemp Dent Pract 2006;7:1-10
8. Ricketts RD, The biologic significance of the divine proportion and Fibonacci series. Am J Orthod 1982;81:351-69.
 9. BV Sreenivasan Murthy, Niketa Ramani. Evaluation of natural smile: Golden proportion and Golden percentage. J Conserv Dent 2008; 11(1):16-21.
 10. Tripuravaram VK Reddy, Sihivahanan Dhanasekaran. The Golden Proportion. Journal of Operative Dentistry and Endodontics 2017;2(2):79-83.
 11. S Vidhya Shankari, R Vinoo Subramaniam, K Karpagavinayagam, R Vaishnavi. Smile Design using Recurring Esthetic Dental Proportion. Journal of Operative Dentistry and Endodontics 2018;3(1):33-37.
 12. S.M. Laxmikanth, S.R. Raghavendra. Golden Proportion: A review. Journal of Advanced Clinical & Research Insights 2014; 1(1):25-29.
 13. Anjana Maharjan, Sarita Joshi. Clinical Evaluation of Maxillary Anterior Teeth in Relation to Golden Proportion, Red Proportion and Golden Percentage. JNHRC 2018; 16 (1):11-15.
 14. Kazem Dalaie, Mohammad Behnaz, Hoori Mirmohamadsadeghi and Mahmood Dashti. Maxillary Anterior Teeth Width Proportion a Literature Review. EC Dental Science 2017;16(5): 197- 206.
 15. Amal Ali Swelem, Eman Mohamed Zaghoul Al-Rafah. Evaluation of "Golden Proportion" in Saudi individuals with natural smiles The Saudi Dental Journal 2019;13(1):583.
 16. Neda Al-Kaisy, Balkees Taha Garib. Analysis of the golden proportion and width/height ratios of maxillary anterior teeth in Arab and Kurdish populations. JPD 2018; 119(6): 981-986.