

Frequency of Golden Proportion and Golden Percentages in Maxillary Anterior Teeth Widths

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Golden Proportion And Percentages In Maxillary Anterior Teeth Widths

ABSTRACT

Objective: To determine the frequency of Golden Proportion and Golden Percentages in maxillary anterior teeth widths.

Study Design: A Cross-Sectional Descriptive Study

Place and Duration of Study: This study was conducted at the Department of Prosthodontics, FMH College of Medicine and Dentistry, Lahore from October 2015 till April 2016 for a period of six months.

Materials and Methods: Standardized digital photographs of 115 participants, of both genders were captured during smile displaying maxillary anterior teeth. The apparent tooth width of maxillary anterior teeth was measured with the help of the software. The calculations were done to determine golden proportion and golden percentages. The data was subjected to statistical analysis, (descriptive statistics and chi -square test, level of significance was set at $p < 0.05$).

Results: The golden proportion was found to be existed only 7% of the participants between the widths of right central incisor and right lateral incisor. Among them 2.6 % male and 4.3% female. The results revealed that golden percentages existed in maxillary anterior tooth widths in natural dentition of our population. The value of golden percentage for each maxillary anterior tooth is 22% for central incisors, 15% for lateral incisors and 12% for canines of the total canine to canine width. There was statistically significant difference existed between the ages and genders for golden proportions and golden percentages.

Conclusion: The golden percentage theory can be utilized to develop proportion and symmetry in maxillary anterior teeth widths to achieve aesthetically pleasing restorations. It can be taken as an aesthetic guideline if the percentages of tooth widths are adjusted according to the ethnicity of the population.

Key Words: Golden proportion, Golden percentages, aesthetics dentistry.

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INTRODUCTION

A prosthodontist replaces the missing teeth and associated oral structures to restore the facial aesthetics primarily. ^{1,2} Perception of esthetically pleasing smile may vary in different populations. The facial aesthetics of patients is greatly affected by the proportional display of maxillary anterior teeth to label the smile as attractive. ^{1,3,4,5} There are some mathematical parameters, such as the Golden Proportion, the Golden Percentages, Recurring Esthetic Dental Proportion or

Width: Height ratios which provide useful guidance to determine tooth dimension. ^{2,4} The objects which follow the golden proportion fall in the category of being esthetically pleasant and beautiful to human psyche. This ratio is 1.618:1 approximately ^{6,7,8} to evaluate and to develop the attractive relationship between the various facial structures Ricketts invented a golden caliper ^{9,10} Many clinicians favored the use of the Golden proportion in determining tooth size in dentistry and its systematic application to determine tooth size (width) and improve dental aesthetic in predictable ways. ^{11,12,13} The apparent mesiodistal width of a maxillary central incisor is **0.62 or 62%** greater than the adjacent lateral incisor. Same relationship exists when comparing the maxillary lateral incisor to the canine. According to a research conducted by Preston only a small proportion of the American population had the ratio of golden proportion in their teeth. ^{2, 14} In 2007, another study by Ward illustrated that seventy- five percent of North American dentists when designing smiles with normal-length teeth preferred using the RED proportion over the golden proportion, ^{15,16} He recommended a ratio of 70 % (0.7) to be more

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useful than the traditional 62 % (0.62) of golden proportion.^{2,15 2-4}

MATERIALS AND METHODS

Type of Study: Cross sectional descriptive study.
Place of Study: Department of Prosthodontics, FMH College of Medicine & Dentistry, Lahore.
Duration of Study: Starting from 6th October 2015 to 5th April 2016
Sampling Technique: Non probability consecutive sampling
Sample Size: Sample size is of 115 cases with 95% confidence level, 7% margin of error and taking expected ‘%’ percentage of golden proportion present i.e. 17%⁽²⁾ of patients with maxillary anterior teeth widths.

The study was conducted after the approval from the Institutional Review Board (IRB) of FMH College of Medicine and Dentistry, Lahore. A total of 115 subjects were included. Demographic data of the subjects was gathered A digital photograph of each subject’s lower 1/3rd of face during smile displaying maxillary anterior teeth was taken, using digital camera by following a standardized procedure. The subject was seated in a relaxed upright position and was asked to look straight ahead focusing at a distance of 152 cm at the eye level.¹⁹ The mid-sagittal plane of the head aligned with the center of camera. The subject was asked to smile and the image was captured and then transferred to a personal computer. The apparent widths of each maxillary anterior tooth was measured in millimeters (mm) from right canine to left canine with the help of the software Adobe Photoshop 7.A specific alphabet was given to each measurement of the apparent width of tooth.

X = Total apparent width of maxillary anterior teeth (canine – canine) = _____ mm

A= Apparent width of right central incisor = _____mm

B = Apparent width of right lateral incisor = _____mm

C = Apparent width of right canine = _____mm

D = Apparent width of left central incisor = _____mm

E = Apparent width of left lateral incisor = _____mm

F = Apparent width of left canine = _____mm

Calculations:

For The Golden Proportion:

62% of the apparent width of the maxillary central incisor was compared with the apparent width of adjacent lateral incisor and the apparent width the lateral incisor was compared with the adjacent canine. Both right and left side teeth were evaluated in the same way.

A: For The Golden Percentages (GP %):

It was calculated by dividing the apparent width of each maxillary tooth by the total width of maxillary anterior teeth and multiplying the resulting value by 100.

(GP %) for right central incisor	=	$\frac{A}{\text{Total apparent width of max ant teeth}}$	x100 =	_____
(GP %) for right lateral incisor	=	$\frac{B}{\text{Total apparent width of max ant teeth}}$	x100 =	_____
(GP %) for right canine	=	$\frac{C}{\text{Total apparent width of max ant teeth}}$	x100 =	_____
(GP %) for left central incisor	=	$\frac{D}{\text{Total apparent width of max ant teeth}}$	x100 =	_____
(GP %) for left lateral incisor	=	$\frac{E}{\text{Total apparent width of max ant teeth}}$	x100 =	_____
(GP %) for left canine	=	$\frac{F}{\text{Total apparent width of max ant teeth}}$	x100 =	_____

Data Analysis: All the collected data was analyzed through SPSS version 20. Descriptive statistics including the mean and SD was calculated for all measurements.

RESULTS

The study included 115 participants out of which 58 were males i.e. 50.4 % and 57 females i.e. 49.6%. The mean age of the participants was found to be 22.06 SD (± 2.036) years.The results of the data revealed that 8out of 115 participants(i.e. only 7%) had the width of their right central incisors in golden proportion to the width of their right lateral incisors, right lateral incisors to the width of right canines is 4.3%, 5.2% had the width of their left central incisors in golden proportion to the width of their left lateral incisors, 115(100%) participants had the width of their left lateral incisors in golden proportion to the width of their left canines.

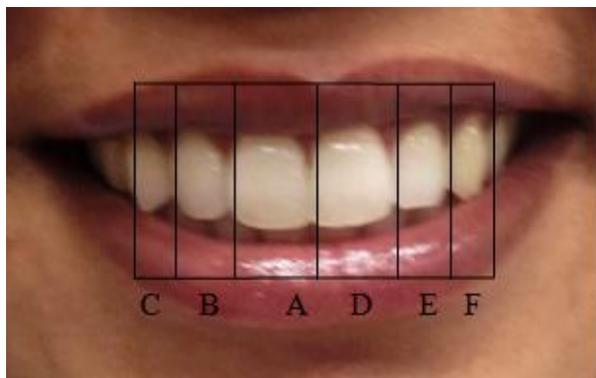
One sample T-test had shown statistically significant difference between the actual Golden Percentage for each maxillary anterior tooth calculated in the current study and the Golden Percentages suggested by Snow (p-value =0.00 with 95% of confidence level). This is true for both genders males (p=0.00) and females (p=0.00) and both age groups A (p=0.00) and B (p=0.00)

Table No.1:Golden Proportion relationship among right lateral incisors width

Goldern proportion of	Yes	No
Right Central to Lateral Incisor	8 (7%)	107 (93%)
Right Lateral Incisor to Canine	5 (4.3%)	110 (95%)
Left Central to Lateral Incisor	6 (5.2%)	109 (94%)
Left Lateral Incisor to Canine	0 (0%)	115 (100%)

Table No.2:Golden Proportion relationship among maxillary anterior teeth width

Golden percentages of	Mean
Right Central Incisor	22.22±0.93
Right Lateral Incisor	15.53±0.89
Right Canine	12.18±1.05
Left Central Incisor	22.16±1.00
Left Lateral Incisor	15.64±1.31
Left Canine	11.97±1.18

**Figure No.1:Photograph showing the method of measurements.**

DISCUSSION

The Golden Proportion and Golden Percentages are considered best aesthetic guidelines to evaluate and produce symmetry and proportions in the relative widths of the maxillary anterior teeth.¹²

In the current study, the highest percentage of the Golden Proportion (i.e. 7%) was observed between right central and right lateral incisors among maxillary anterior teeth. Same findings have been reported by Preston et al. in a study conducted on Americans.¹⁴ Murthy et al have reported the highest percentage of Golden Proportion between left lateral incisor and left canine widths¹¹. The results of the current study for the Golden Proportion relationship among right central and right lateral incisors is 8 out of 115 participants (7%). This is in agreement with the results of the studies of de Castro et al. and Sabir Shah et al.^{21,20} de Castro et al.²¹. Both studies have concluded that Golden Proportion did not present among maxillary anterior teeth width. They measured apparent teeth widths directly on the subjects' natural teeth with the help of device like Vernier caliper²² and Boley guage.²³ In the current study, findings for the Golden Proportion between the width of right lateral incisors to the width of right canines is

4.3% (i.e. 5 out of 115 participants). This is similar to the findings of the study of Mahshid et al.²² But this is a low percentage value when compared with the result of the study of Sulaiman E. and Yaakub M.S.²³. The data of the current study also revealed that Golden Proportion was totally absent between the widths of left lateral incisor to left canine (i.e. 0 %).This is similar to the findings of the study of Preston et al.¹⁴

In the present study, the results for both genders i.e. male and female were similar statistically²⁰. Some researchers have concluded that Golden Percentage theory is a reliable and applicable parameter in evaluation, diagnosis and treatment planning for aesthetic anterior restorations than Golden Proportion.²⁰ The results of the present study are in agreement with the results of the previous studies.^{20,25}

The mean value observed in the current study for Golden Percentage of central incisors is 22%. These percentages of central incisors are slightly lower than the values proposed by Snow (i.e. 25 % for Central Incisor).³ But this is in accordance with the results of Murthy et al (i.e. 22 % Central Incisor).⁶ Similar values have been reported by other authors.^{20,25} With respect to the lateral incisors, the mean value of Golden Percentage obtained in this study is 15%. This value in agreement with the values proposed by Snow (i.e. 15% for Lateral Incisor).²⁶ This is also verified by other studies of Fayyed et al, Murthy and Rumani and Azam Set al. (15 %).^{20,25} The mean value of Golden Percentage for canine is 12.2 % observed in the present study. Similar results have been reported by Murthy et al (i.e. 12.5 %), Fayyad et al (i.e. 12%), and Azam S et al.(i.e.12 %).

CONCLUSION

The Golden Percentage theory can be utilized to develop proportion and symmetry among maxillary anterior tooth widths to achieve aesthetically pleasing restorations than the Golden Proportion ratio.

Author's Contribution:

Concept & Design of Study:	Hina Naz
Drafting:	Zartashia Arooj, Varda Jalil
Data Analysis:	Shahlisa Hameedi
Revisiting Critically:	Zartashia Arooj
Final Approval of version:	Hina Naz

Conflict of Interest: The study has no conflict of interest to declare by any author.

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