

EVALUATION OF PRESENCE OF GOLDEN RATIO IN THE MAXILLARY ANTERIOR TEETH AND ITS SIGNIFICANCE IN ESTHETIC SMILES

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ABSTRACT

Introduction: Maxillary anterior teeth form an integral part of a beautiful smile. It is expected from an esthetic dentist to create harmonious proportions between widths of the maxillary anterior teeth. The golden ratio is one of the guidelines which helps dentist in recreating the esthetic smile. Thus, the study was designed to measure the ratios in maxillary anterior teeth of subjects which are said to be equal to the golden ratio. As, golden ratio is among the guidelines which are followed by esthetic dentists for developing esthetic smiles.

Materials and Method: 14 individual (4 males, 10 females) were enrolled in the study without any history of orthodontic treatment, anterior restorations, or missing teeth and who considered their smile esthetic. The patients were photographed from the front and the mesiodistal dimensions of their maxillary anteriors were measured on Adobe Photoshop CS3.

Results: Ratio A- ratio of the width of central incisor to the width of lateral incisor when viewed from the front. Only 5 subjects showed this ratio matching with the golden ratio. Ratio B- ratio of the cervico-incisal height of central incisor to the combined width of central and lateral incisor. Only 1 subject showed this ratio matching with the golden ratio

Discussion: The golden proportion was found to exist only in a small percentage of subjects with an esthetic smile. Standardization of esthetics by some ratios and proportions may not be able to help in developing a pleasing smile.

KEY WORDS: Esthetic Dentistry, Golden Ratio, Smile, Maxillary Central Incisor, Maxillary Lateral Incisor.

Introduction

A popular axiom concerning physical attractiveness is: "Beauty is in the eye of the beholder". Research in the area of facial perception has identified many different factors that contribute to a face being considered attractive. Among these factors is the concept of "Golden proportion" or "Golden ratio".

The golden ratio arises from dividing a line segment so that the ratio of the whole segment to the large piece is equal to the ratio of the larger piece to the smaller piece.¹ (Figure 1)

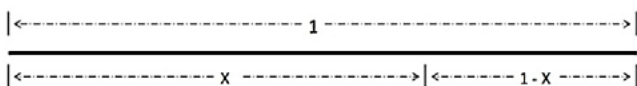


Figure : - Explains the concept of golden ratio where the ratio between 1 and X is same as between X and 1-X.

So if the bigger segment is X then $X = .618033\dots$ and $1/X = 1.618033\dots$.¹ Commonly the letter Φ is used to represent the golden ratio 1.61803... . This golden proportion is said to be present in all God's creations, from the Saturn rings to the spirals of a sea shell. This golden ratio is also seen in the human body, from the spirals of the DNA to the height of an individual.

Smile plays an extremely important role in the esthetic appearance of a person. Smiling is something that is understood by everyone despite culture, race, or religion; it is internationally known. Cross-cultural studies have shown that smiling is a means of communication throughout the world.

Anterior teeth, more importantly maxillary anterior teeth are commonly seen in a smile and contribute to the beauty

of a smile. Numerous studies have shown that people are more concerned about missing anterior teeth and their replacement than about posterior teeth as esthetics seem to be more important than the function of the teeth.² One of the most important tasks in esthetic dentistry is the creation of harmonious proportions between the widths of maxillary anterior teeth when restoring or replacing them.

Snow stated that 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.³ Some other authors have also mentioned the use of this proportion in anterior esthetics.^{4,5} On the other hand few studies have shown that the golden proportion was rarely seen in maxillary anteriors.^{6,7} Thus studies are present in the literature both favoring and opposing the use of golden proportions in esthetic dentistry.

Thus, the aim of the study was to investigate the existence of the golden proportion in the maxillary central incisor and lateral incisor when viewed from the front. The null hypothesis of this study was that there is no golden proportion for the perceived maxillary anterior teeth. The working hypothesis was that the golden proportion exists between the widths of the maxillary anterior teeth.

Materials And Method

In this prospective study, those individuals were involved who did not have missing teeth, except for 3rd molars or had not undergone any orthodontic or restorative treatment. Those individuals with maxillary anterior trauma or surgeries were also excluded from the study. Those individuals whose smile created visual tension and were

Table 1: - Ratios analyzed in 14 subjects enrolled in the study.

S. No.	Sex*	Ratio between the width of maxillary central and lateral incisor seen from the front (Ratio A)	Ratio between cervico-incisal height and combined width of maxillary central and lateral incisor (Ratio B)
1	M	1.58	1.53
2	M	1.54	1.69
3	F	1.73	1.54
4	F	1.20	1.74
5	F	1.45	1.74
6	F	1.55	1.87
7	M	1.25	1.21
8	F	1.45	1.45
9	F	1.45	1.66
10	F	1.75	1.74
11	M	1.57	1.68
12	F	1.50	1.73
13	F	1.58	1.64
14	F	1.39	1.45

uncomfortable with it were not enrolled in the study. The individuals whose natural smile did not develop visual tension with regard to the study's or their own criteria were considered esthetic and included in the study.

A frontal photograph was taken of each individual with an esthetic smile. The upper lip was retracted in all photographs to clearly display the maxillary anterior teeth as well as its respective gingival. Lighting and staging were kept constant. All measurements were done using Adobe Photoshop CS3 program. This digital measurement provided a more precise measurement.

The photographs were then analyzed for 2 ratios:

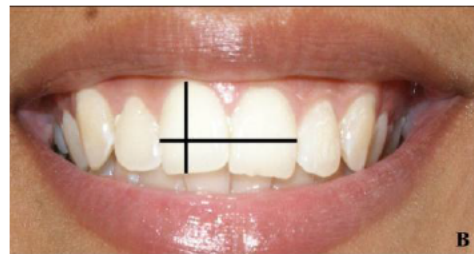
1. Ratio A : - Between the width of central incisor to the width of lateral incisor when viewed from the front. (Figure 2)



Figure 2: - Ratio A- ratio between the width of central incisor to the width of lateral incisor when viewed from the front.

2. Ratio B- Between the cervico-incisal height of central incisor to the combined width of central and lateral incisor. (Figure 3)

Figure 3: - Ratio B- ratio between the cervico-incisal height of central incisor to the combined width of central and lateral incisor.



The golden proportion (1.618) was calculated at 1.6. In the present study any ratio (Ratio A and Ratio B) calculated which was falling within the range of 1.55 to 1.64 were considered as golden ratio.

Results

14 individuals were enrolled in the study among which 4 were males and 10 were females. (Table 1) The ratio between the width of the maxillary central and lateral incisor when seen from the front (Ratio A) ranged between 1.20 and 1.75. Out of the 14 subjects the golden ratio of 1.6 was found in 5 subjects (35%).

The ratio between the cervico-incisal height of central incisor with the combined width of maxillary central and lateral incisor (Ratio B) ranged between 1.21 and 1.87. Out of the 14 subjects the golden ratio of 1.6 was found in 1 subject (7%).

Discussion

The concept of golden ratio has been studied and used in architecture since ancient times. Aristotle observed the value of it in esthetics in the 400 BC. The Egyptians had found the golden number and set it as the width to length ratio in the Egyptian rectangle.⁸ The golden ratio was used in ancient Greek architecture to design the Parthenon, and also in the da Vinci's classic drawings of human anatomy.

Lombardi was the first one to propose the application of the golden proportion in dentistry.⁹ Levin said that the width of the maxillary central incisor and maxillary lateral incisor

were in golden ratio, and also the width of maxillary canine to the maxillary lateral incisor are in golden ratio, when viewed from the front.¹⁰ Snow stated that 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.³

The present study tried to analyze the presence of golden ratio in the maxillary anterior teeth which are the main teeth visible in a smile. The perception of the subjects own smile was taken as a criteria for determining an esthetic smile.

Many studies have estimated the esthetic quality of smiles by employing a panel of experts (including non-dentist volunteers¹¹, or dentists and fine art professors¹²). The difference of opinion between dentist and non-dentist groups suggest that it is wise to seek patient's own opinion regarding dental appearance.

In our short study only 14 individuals were enrolled which included 4 males and 10 females. Their smiles were photographed and 2 ratios (Ratio A and Ratio B) were analyzed.

In our study, majority of the subjects showed the above dental ratios not equal to the golden ratio of 1.6. Out of 14 subjects only 5 subjects (35%) had the Ratio A equal to the golden ratio. And only 1 subject (7%) had the Ratio B equal to the golden ratio. Our findings support the ideas of Ward, who refused the use of golden proportion.¹³

Gillen et al also found a poor correlation between tooth dimensions and the golden proportion. However, as their measurements were made directly on casts, those findings could not be compared to findings in the current study. This is because the golden ratio in the maxillary teeth has been explained when the teeth are viewed from the front and not the actual width of the teeth.

The study supports the view that esthetics cannot be quantified. Golden ratio is a concept known for centuries and has been used in architectures and paintings. The ratio has been seen in various body parts and is usually associated with esthetics. In our study we could not find the golden ratio in the maxillary anterior teeth which form an integral part of an esthetic smile. For esthetic dentists these findings may be important so that they do not give over-emphasis on the following the golden ratio guidelines. Numerous factors are present which influence a beautiful smile like the dentofacial specificities, cultural characteristics, racial background and importantly the individual's own perception. All these factors should be given more importance as esthetic dentistry is more of a subjective than an objective science. Therefore, standardization of esthetics by some ratios and proportions may not be able to help in developing a pleasing smile.

The small sample size limits the impact of the study and further studies should be done in people of different backgrounds. This would give a better picture regarding the importance an efficiency of golden rule in esthetic dentistry.

Conclusion

Currently many of the textbooks advise the use of the golden ratio in developing pleasing proportions. The present study did not find the golden ratio in the width of the maxillary anterior teeth to exist in smiles which were considered esthetic. The results may show us that esthetics cannot be mathematically quantified. As stated earlier "beauty is in the eye of the beholder", emphasizing that beauty cannot be standardized. It is important that dentists follow certain fundamental guidelines in esthetic treatment planning, it should be understood that esthetics varies greatly from person to person. Thus, factors like individual's dentofacial specificities, cultural characteristics, racial background and most importantly their own perception should be considered.

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