Original Article

Maxillary Teeth

Evaluation of Golden Proportion Between Maxillary Anterior Teeth

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ABSTRACT

Objective: The study has been made to scrutinize the occurrence of Golden proportion between maxillary anterior teeth in a group of Pakistani population.

Study Design: Cross sectional study

Place and Duration of the Study: This study was conducted at the Oral Biology Department at Dr. Ishrat ul Ebad Khan Institute of Oral Health Science Dow University for a period of 6 months from August 2014 to January 2015.

Materials and Methods: This study comprised 500 volunteers of satisfactory aesthetics, out of which 394 were females and 105 were males between 21 to 30 years of age.

First the impression of the subjects was taken with Alginate and cast was made with hard plaster. This was followed by measuring the width of maxillary anterior teeth of both quadrants at the mesio-distal contact point using a Digital caliper. Next, the Golden proportion for all subjects was calculated by multiplying the width of the larger factor by 62% and compared with the width of the smaller factor for proportion to be evaluated.

Results: The data highlighted the statistical significant result in the ratio of Golden proportions depending upon gender. 11.2% of the samples have the width of their central incisors in golden proportion to the width of their lateral incisors.9.6% of the subjects had the width of their lateral incisors in golden proportion to the width of their canines. Age showed no significant difference.

Conclusion: It is not always correct to assert that golden proportion exists between widths of maxillary anterior teeth in a subject of Pakistani population.

Key Words: Golden Proportion, Aesthetics, Maxillary Anterior Teeth

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INTRODUCTION

Maxillary anterior teeth stand an important influence in aesthetic dentistry because of their noticeably visible facial view during smiling. Creating harmonious relationship is one of the critical tasks in aesthetic dentistry while dealing with restorations or replacement of these teeth[1]. During treatment planning of missing and grossly damaged anterior, operator must determine the tooth shape and size proportion to achieve favorable aesthetics[2]. The golden ratio is a coefficient that exists amongst the larger and a smaller component. This geometric proportion has been recommended as standard in creating harmonious restorations. The constant value for golden ratio is almost 1.618:1, i.e. if the relationship between B and A is in golden proportion, then B is 1.618 times wider than A. This explains that the smaller sized tooth is almost 62% of the size of the larger tooth. For instance, if we compare the ratio of a maxillary central incisor to a maxillary lateral incisor, the central incisor is 0.618 times wider or 62% greater in the dimension than that of the lateral incisor[3]. In restoring maxillary anterior teeth this constant proportion helps to achieve aesthetic outcomes. It was described back in 1973 that the proportional width of lateral incisors compared to central incisor and width of lateral incisor to the canines follows a constant ratio[4], and proposed the use of the golden ratio in dental sciences. Levin is also of the opinion that the golden proportion could be used to correlate the successive width of maxillary anterior teeth when viewed facially[5]. According to Levin's concept the width of the central incisor to the width of the lateral incisor and likewise, the width of lateral incisor to the width of the canine should be in golden proportion.

However, it was observed that only a minor percentage of people having aesthetic smiles had the golden proportion[6]. The prevalence of the golden proportion among the widths of maxillary anterior teeth varies among different populations and ethnic groups[7-11]. As only a few studies have evaluated this relationship in Pakistani subjects[12]. The objective of this study was to determine the prevalence of the golden proportion in a set of Pakistani subjects.

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MATERIALS AND METHODS

The current study was performed at Department of Oral biology in Dr. Ishrat ul Ebad Khan Institute of Oral Health Science Dow University. Study sample for this cross-sectional study comprised 500 volunteers of satisfactory aesthetics, out of which 394 were females and 105 were males, with ages ranging from 21 to 30 years. Informed consent was taken. The inclusion criteria was set as the participating subjects must have all their natural anterior i.e both maxillary and mandibular teeth. Teeth with any history of orthodontic intervention, restoration for alteration in tooth size, spacing or crowding and restoration or any periodontal condition were excluded from the study.

Irreversible hydrocolloid impression was obtained from all the selected subjects and dental cast was prepared using dental stone. The digital Vernier caliper with the accuracy of 0.01mm was used for measuring the mesiodistal widths of maxillary central incisor, lateral incisor and canine. The perceived dimensions of the teeth were assessed at the mesiodistal contacts of teeth. Each measurement was made three times by the single calibrated examiner and the mean value was calculated for accurate results.

The golden ratio was evaluated for each cast by multiplying the mesiodistal width of the maxillary central incisor with 0.618. Likewise the width of the maxillary lateral incisor and maxillary canine were checked for golden proportion.

The obtained data was managed and analyzed using SPSS version No. 16. Descriptive statistical analysis was performed to calculate the mean perceived mesiodistal width of maxillary anterior and for gender distribution.

Chi square test was applied in order to find the relationship between gender and different golden proportions.

The golden proportion for maxillary central, maxillary lateral and maxillary canines was calculated by multiplication of perceived mean mesiodistal width with 0.618.

RESULTS

The data collected from 500, 349 females and 141 male subjects revealed that 11.2% of the samples have the width of their central incisors in golden proportion to the width of their lateral incisors. 12.05 % of males and 7.80% of females have the width of their central incisors in golden proportion to the width of their lateral incisors. 9.6% of the subjects had the width of their lateral incisors in golden proportion to the width of their canines. 4.9% of males and 30.4% of females have the width of their lateral incisors in golden proportion to the width of their canines.

The mean value for central incisor, lateral incisors, and canine is listed in Table: 1 while 62% of central incisors and 62% of lateral incisors and 62% of canine is listed in Table 2. Frequency and percentage of Golden Proportion between Maxillary Central to Lateral Incisor is shown in Table 3 and Frequency and percentage of Golden Proportion between Maxillary Canine to Lateral Incisor is shown in Table 4.

Table No.1: Mesiodistal diameter of maxillary anterior teeth

N=500	Rt_ Canine	Rt_ Lateral	Rt_ Central	Lt_ Central	Lt_ Lateral	Lt_ Canine
Mean(mm)	7.86	6.67	8.22	8.46	6.75	7.51
Median (mm)	8.00	6.50	8.00	8.50	7.00	7.50
Mode(mm)	7.00	6.00	8.00	8.00	6.00	7.00
Std. Deviation (mm)	0.97	0.69	0.74	0.69	0.71	0.77
Min(mm)	6.00	5.20	7.25	7.25	5.20	6.00
Max(mm)	11.00	8.75	09.12	10.96	8.80	11.00

Table No.2: Computed proportion for central and lateral incisor and canine:

N=500	Min (mm)	Max (mm)	Mean (mm)	Std Deviation (mm)
62% of M-D width of central incisor	4.50	5.57	5.08	0.42
62% of M-D width of lateral incisor	3.22	5.42	4.12	0.46
62% of M-D Canine	3.72	6.51	4.86	0.5

Table No.3: Frequency and percentage of Golden Proportion: Maxillary Central to Lateral Incisor

Ratio	N	%age
1.1	79	14.2
1.2	33	6.6
1.3	22	4.4
1.4	21	4.2
1.5	30	6
1.6	28	11.2
1.7	37	7.4
1.8	33	6.6
1.9	28	5.6
2.0	35	7.0
2.1	10	20

Table No.4: Frequency and percentage of Golden Proportion: Maxillary Canine to Lateral Incisor

Ratio	N	%
1.1	59	11.8
1.2	18	3.6
1.3	23	4.6
1.4	29	5.8
1.5	20	4
1.6	48	9.6
1.7	5	1
1.8	27	5.4
1.9	12	2.4
2.0	25	5
2.1	28	5.6

Chi square-test showed that there was a statistically significance difference between male and female means

of lateral incisors (<=0.00) and 62% of central incisors as well as between the canines and 62% of the lateral incisors (p <0.00). Age showed no significant difference (p>0.00).

DISCUSSION

The literature has described the golden proportion as a useful tool for accomplishing aesthetics. This golden proportion is a constant (1.618: 1.0) relating the two measurements with a greater and a lesser length. Many previous researches have explained both against and in the favor of this concept along with the use of geometric this ratio in dentistry.

The statistical finding from this paper revealed that golden proportion was not the common occurrence in most of the populace i.e. 11.2% of the samples have the width of their central incisors in golden proportion to the width of their lateral incisors among which 12.05 % of males and 7.80% of females. 9.6% of the subjects had the width of their lateral incisors in golden proportion to the width of their canines among which 4.9% of males and 30.4% of females. However it is the second most common occurrence after 1.1.

The ratio of 1.1 was more frequently perceived that was in maxillary central to lateral incisor is 14.2% and in maxillary canine to lateral incisor is 11.8% of the sample than 1.618. While the literatures give similar finding with ratio of 1.2 was most commonly observed[13-17]. In American subjects it was evaluated that only 17% of the orthodontic casts showed golden proportion among the width of maxillary anteriors**Error! Bookmark not defined.**. Another study demonstrated that the golden proportion is not significant among the widths of maxillary anterior teeth in the Iranian population**Error! Bookmark not defined.**. A recent study conducted on Arabs concluded that the golden proportion was not a suitable technique for relating the succeeding width of maxillary anterior teeth**Error! Bookmark not defined.**. It was also demonstrated that there was no correlation between any ratio studied (length: width, width: width and length: length) to the golden proportion between the width of maxillary anterior teeth**Error! Bookmark not defined.**. One study showed that when the golden ratio was considered, the lateral incisor appeared too slender and masks the dominance of canine**Error! Bookmark not defined.**. However, another study conducted in Pakistan population which is parallel to the findings of the present study, concluded that golden proportion should not be considered as a critical feature in formation of the dental aesthetics. It exists as a range to a certain extent than a particular value**Error! Bookmark not defined.**.

In the present study there was a statistically significance difference between male and female means of lateral incisors (<=0.00) and 62% of central incisors as well as between the canines and 62% of the lateral incisors (p <0.00). Hence it showed that golden proportion is more common in females than males. Analysis from this study was parallel to other investigations in relation to gender differences[18,19]. Age showed no significant difference (p>0.00).

Golden proportion being a micro component of aesthetics is not a major principle to play a important role in regulating esthetics[20]. And hence linking to a specific ratio universally for all individuals is unreasonable.

CONCLUSION

The interpretation of the outcomes from this paper has concluded that golden ratio is not a major occurrence in the study sample of Pakistani Population. However the measurements of anterior teeth widths were prepared to clinical accuracy, there could be a 0.5 mm or more deviation exists in the contact area which can be a constraint in the research. The golden ratio was not observed among maxillary anterior teeth in most of the study samples while the ratio of 1.1 was most frequently observed. There was statistical significant difference in the golden proportions between genders of teeth in the study population.

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

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