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Research Article

AN EVALUATION OF MAXILLARY ANTERIOR TEETH FOR THE EXISTENCE OF GOLDEN PROPORTION IN JAIPUR POPULATION: A CLINICAL STUDY

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A B S T R A C T

An evaluation of maxillary anterior teeth for the existence of golden proportion in Jaipur **population:** A clinical study.

Existence of ideal golden proportion on Jaipur population is evaluated by a study on 300 subjects. The subjects were the students, patients and their attendants who visited the Jaipur dental college and hospital. All subjects belonged to Jaipur by birth. The width and height of maxillary and mandibular teeth were measured on the dental stone casts using a digital caliper. A grid was used to measure perceived widths of maxillary anterior teeth. The data were analyzed using Student's t-test with level of significance $p < 0.05$. Statistical analysis was done using SPSS for windows software (version 21). Statistically significant difference was found in perceived width ratio of lateral to central incisor and canine to lateral incisor ($p < 0.05$). Hence golden proportion did not serve as an adequate guideline for Jaipur population. Specific population and or ethnic characteristics should be considered to establish objectively quantifiable golden proportion.

INTRODUCTION

The analysis or examination of the human face and the ability to change its form to enhance esthetics has fascinated clinicians since many of years. An understanding of facial beauty, including the evaluation of facial esthetics, proportions and symmetry is required to change dentofacial form, whether through facial growth modification, orthodontics or by orthognathic surgical procedures.

In 1750, the philosophy of "esthetics" was created to designate the science of sensuous values, which appreciated beauty. This is in contrast to the science of logic, which valued truth. In later years, the term evolved to relate the fine arts as the theory of beauty (Furnas, 1936).

Esthetics includes the appreciation and response to the beauty in art and nature. Esthetics has been given many definitions in dentistry, but according to Young: "It is apparent that beauty, harmony, naturalness, and individuality are major qualities" of esthetics. The dentist must visualize esthetics in relation to the patient and then translate that visualization into an acceptable esthetic result. The success of these efforts depends upon artistic ability, powers of observation, and experience (Young, 1956).Lombardi (1973) was among the pioneers who suggested the application of the Golden Proportion in Dentistry.

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According to him the Golden Proportion was 'too strong' for use in determining tooth size. Golden Proportion is approximately 0.618. It means that the visible width of lateral incisor is 62% (0.618) of a central incisor and the visible width of canine is 62% (0.618) of a lateral incisor. Tooth shape ratio and Bolton's discrepancy are more important for diagnosis, treatment planning and retention as compared to esthetics. This Golden Proportion has been proposed in many articles and textbooks as an esthetic guideline for restoring and replacing maxillary anterior teeth (Levin, 2011).

In orthodontics treatment plan is decided by considering certain values or numbers, which were determined by studies conducted on specific populations. It is not fair to apply the same values for other populations because there may be differences in opinion in the perception of esthetics among others. Hence the professionals must be prepared to attend individuals from different ethnicities and be capable to anticipate these differences of size and shape of the dental arch, establishing a more personalized treatment (Burris and Harris 2000).

The Golden Proportion was determined by studies on foreign population. Hence it is not necessary that it will also be suitable for Indian population. India being big country and having a large population of different regional and ethnic origins needed a study to find out applicability of norms found on foreign population. This study was designed to find out the applicability of Golden Proportion on the population of Jaipur. This will help to determine specific values / proportions of a

specific population, which will result in successful treatment planning for orthodontic patients.

MATERIAL AND METHODS

The sample for this study consisted of study models of 300 subjects. The subjects were the students, patients and their attendants who visited the Jaipur dental college and hospital. All subjects belonged to Jaipur by birth. The ancestor origin was established after enquiring with concerned subjects.

The inclusion criteria were

1. Jaipur individuals.
2. Fully erupted all maxillary and mandibular teeth (except third molars).
3. Absence of spacing, intrusion, extrusion, rotation and crowding.
4. No periodontal disease.
5. No history of orthodontic treatment.
6. No dental prosthesis
7. Absence of tooth anomalies.

Following are the Exclusion Criteria

1. Gross restorations that affect tooth's mesiodistal diameter.
2. Any gingival alteration or dental irregularities.
3. Loss of tooth structure due to attrition, fracture or caries.

Perforated metal stock trays, rubber bowls, curved metal spatula, straight metal spatula, alginate impression material, dental stone, dental plaster, base formers, sand paper were used for making the impressions and preparing the casts.

A digital caliper (Fig 1) with precision reading to the nearest 0.01 mm was used to measure the size of teeth. The mesiodistal width was obtained by measuring the maximum distance between the mesial and distal contact points of the tooth.

A single investigator will measured each arch twice, from right first molar to left first molar. If the second measurement differed by more than 0.2 mm from the first measurement, the tooth was measured again and only the new measure was registered.

Method to Determine Golden Proportion From the Casts

The perceived width of anterior teeth as viewed from front was measured using a digital caliper to the nearest 0.01 mm. Evaluations regarding the occurrence of the golden proportion were conducted by drawing of grids that were obtained by placing the casts on a flat surface (graph paper) and drawing vertical lines representing the perceived mesiodistal widths of the teeth (Fig 2). Measurements were done for the spaces in the grids using the digital caliper (Fig 3). To calculate the golden proportion for each subject the apparent width of the central incisor was multiplied by 62% and compared with the width of adjacent lateral incisor. Similar values indicate that the width of the central incisor was in golden proportion to the width of the lateral incisor. Similarly by comparing the apparent width of the lateral incisor multiplied by 62% with that of the canine, it was determined whether the width of the lateral incisor is in golden proportion to the width of the canine (Al- Marzok MI, 2013).

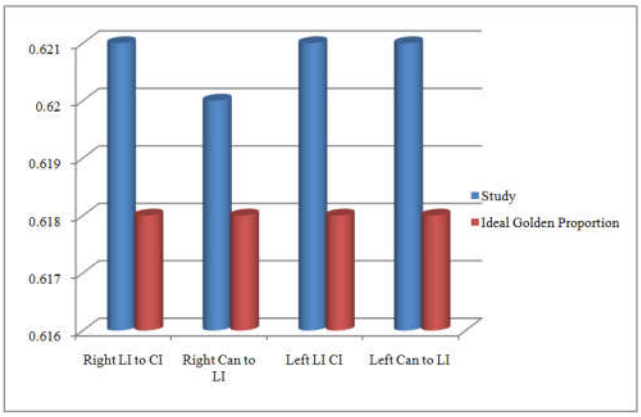
RESULTS

The study revealed perceived maxillary right lateral incisor to central incisor mean width ratio as 0.621 with 0.021 SD (standard deviation) and right canine to lateral incisor as 0.620 with 0.017 SD. The mean and SD of left lateral incisor to central incisor was 0.621 and 0.024 and the mean and SD of left canine to lateral incisor was 0.621 and 0.019 There was statistically significant difference ($p < 0.05$) in mean perceived width of maxillary right and left lateral incisor to central incisor and canine to lateral incisor as compared to golden proportion (Table 1, Graph 1).

Table 1 Comparison between the present study result and ideal golden proportion.

Teeth	Mean	SD	P value
Right Lateral incisor to central incisor	0.621	0.021	0.028
Ideal golden proportion	0.618		
Right Canine to lateral incisor	0.620	0.017	0.023
Ideal golden proportion	0.618		
Left Lateral incisor to central incisor	0.621	0.024	0.022
Ideal golden proportion	0.618		
Left Canine to lateral incisor	0.621	0.019	0.013
Ideal golden proportion	0.618		

SD: Standard deviation



Graph 1 Comparison between the present study result and ideal golden proportion.
CI: Central incisor,LI: Lateral incisor,Can: Canine

Fig 1 Digital caliper

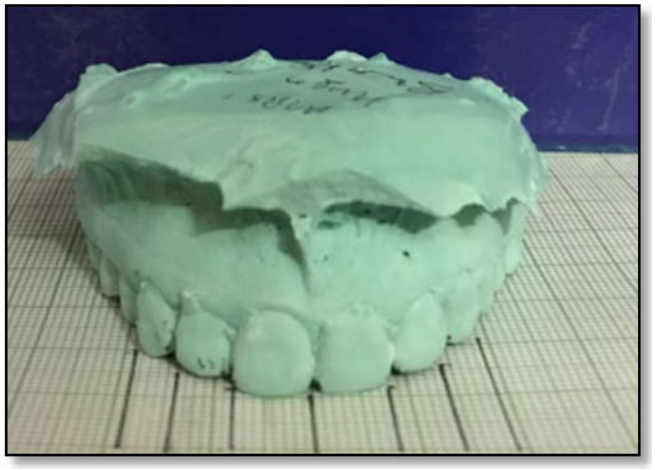


Fig 2 Grid to measure perceived mesiodistal width of teeth

Fig 3 Measurement of perceived width of teeth

DISCUSSION

It is important to determine a mathematical or geometrical relationship between teeth in order to achieve an esthetic restorative result. It would be helpful if statistical relationships existed to support the Golden Proportion theory. However, most of the studies do not support this theory (Preston, 1993; Gillen *et al.*, 1994). Magne *et al*. (2003) noted a limitation in using the Golden Proportion rule in the maxillary arch of natural anterior teeth. A strict adherence to the guidelines would result in an abnormal narrow arch with insufficient teeth visible as one progress distally in the arch.

The results of this study showed that golden proportion does not exist in Jaipur population. The ideal golden proportion is 0.618 ±0.62. In our study the perceived right lateral incisor to central incisor width ratio is 0.621± 0.021. It is greater than ideal golden proportion and this difference is found to be statistically significant ($p<0.05$). The perceived left lateral incisor to central incisor width ratio is 0.621± 0.024 which is greater than ideal golden proportion and the difference is found to be statistically significant ($p<0.05$) (Table 1, Graph 1). The perceived width ratio of right canine to lateral incisor 0.620 ± 0.017 and left canine to lateral incisor 0.621± 0.019 was higher than the ideal ratio and the difference between golden ratio in our study and ideal value is found to be statistically significant ($p<0.05$) (Table 1, Graph 1). Our results are in agreement with the previous studies. In their study on subjects with esthetic smile, they evaluated the existence of golden proportion by measuring the mesiodistal width of six anterior teeth, on scanned pictures of individuals. They arrived at the conclusion that golden proportion did not exist in natural dentition (Murthy *et al*., 2008; Ali *et al*, 2006; Mashid *et al*., 2004; George and Bhat, 2010). Our results was in partial disagreement with Al-Kaisyand Garib(2018) who concluded that the GP was found in both the Kurdish and Arab groups in the LI/CI (lateral incisor to central incisor) mean (0.62, 0.63), but not in the C/LI (canine to lateral incisor) mean (0.69, 0.73).

Other authors like Rosensteil *et al*. (2009), Javaheri and Shahnavaz1 (2002) , Jahanbin *et al*.(2008) , Decker(2004), Sarver and Ackerman (2003), Marguardt 2002), Howells and Shaw (1985), Amoric (1995), Phillips *et al*.(1992), Wolfart *et al*. (2005) consider golden proportion to be a superior aspect of esthetics but the proportion is more artistic, theoretical and impractical in nature. It is also inappropriate to anticipate for every patient to possess this precise relationship because humans are individuals with unique facial and dental features. Being one of the micro esthetics factors of esthetics it is not a major consideration whereas the other macro esthetic factors and principles play a significant role in determining esthetics (Hasanreisoglu *et al*., 2005).

CONCLUSION

In dentistry; esthetics cannot be justified mathematically; all the individuals should not be standardized in the same way. There is statistically significant difference in golden proportion between Jaipur population and standard golden proportion hence it is an inappropriate method to relate the successive widths of the maxillary anterior teeth in Jaipur population.

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