THE PERCEPTION OF GOLDEN PROPORTION OF TEETH BY LAYPERSON PRESENTING AT OUTPATIENT DEPARTMENT OF TERTIARY CARE HOSPITAL OF PESHAWAR

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ABSTRACT

Objective: *The objective of this research is to investigate how laypersons perceive the golden proportion in dental aesthetics.*

MaterialsandMethods: *A cross-sectional study was conducted at Peshawar Dental College after the Institutional Review Board (IRB) approval. Simple sample randomization was used to choose pairs of young adults (n = 40) who had completed orthodontic therapy but not yet received orthodontic treatment based on age and gender. ImageJ software was used to measure the maxillary anterior teeth's golden proportion. The Oral Aesthetic Subjective Impact Scale (OASIS) was a layperson-designed questionnaire that assessed dental aesthetic concerns. Using Student's t-test, the data were compared. We used the Mann-Whitney test to assess the OASIS scores. Logistic regression was used to examine relationships. α= 5% was used for all statistical calculations.*

Results: *The mesiodistal widths of the maxillary central incisors and canines were not assessed to have a golden ratio in either group (p0.05).*

Conclusion: *In individuals receiving orthodontic treatment, whose self-perception of oral beauty is higher, the central incisor perceived width is closer to the golden proportion.*

Keywords: *Orthodontics, Golden proportion, Layperson perception*

INTRODUCTION

Besides reflecting cultural influences and personal preferences, a beautiful smile expresses more than simply symmetrical teeth, which increases the need for orthodontics treatments.[1] Among these factors, golden proportion is an ideal standard for the relative widths of the maxillary anterior teeth, which is an ancient mathematical principle believed to epitomize harmony and aesthetic balance.[2] Golden proportion is a perceived width of the lateral incisor should be 62% of the central incisor, and the perceived width of the canine should be 62% of the lateral incisor.[3] Numerous research has questioned the validity and effectiveness of the golden proportion in natural dentition and smile design. Other proportions, such as 70%, 80%, or even 100%, may be preferable for various ethnicities and ethnic groups.[4] Additionally, several studies have shown that the observer's background, education, occupation, and personal preferences may also affect how they perceive dental esthetics.[5]

In recent years, there has been a prime focus in research on the quantification of both facial and dental aesthetics, with the overarching goal of enhancing the quality of prosthodontic, orthodontic, and periodontal treatments.[6] Consequently, clinicians have initiated the integration of aesthetic parameters into their professional practices.[7] These parameters encompass a spectrum including buccal corridor, smile line, smile arc, midline shift, angulation of teeth, midline diastema,

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golden proportion, incisal embrasure, black triangles, vertical lip length, symmetry and ratio of maxillary central incisors, tooth angulation, connector space, and contact areas. These established principles were established as a result of several study projects.[8]

The golden proportion has been strongly adopted by dental professionals as a standard for creating an optimal balance in the proportions of teeth, with the argument that adhering to this mathematical principle helps create an aesthetically beautiful smile.[9] However, the issue of how laypersons, who lack professional dental training, perceive and value the use of the golden proportion remains a crucial aspect that requires careful investigation.[10] The pursuit of an appealing smile has developed into a widespread social trend in the modern day. More than ever, patients seek dental procedures to improve their oral health as well as to confirm to conventional standards of beauty. However, this emerging trend encourages a crucial examination into the perceptual details that laypersons bring to their knowledge of the optimum smile proportions.[11]

Utilizing visual analogue scale to record the perception of laypersons, we aim to provide nuanced insights into key aesthetic parameters, including the golden proportion, and identify potential demographic variations. Ultimately, this research contributes valuable findings to inform dental practice, education, and policy, fostering a deeper understanding of the interplay between scientific principles and community preferences. The purpose of this research is to investigate how laypersons perceive the golden proportion in dental aesthetics. Our primary aim is to identify the subjective aspects that affect layperson's preferences while examining similarities or differences with professional standards.

METHODOLOGY

This case-control study was conducted Peshawar Dental College after the Institutional Review Board (IRB) approval. The duration of the study was 6 months after the approval from IRB. The sample was composed of individuals who met the following inclusion criteria: the presence of all maxillary anterior teeth without dental crowding, severe occlusal discrepancies, restorations, dental prostheses, and coronal malformations. Orthodontic treated group (n=40) included individuals who had concluded orthodontic treatment with fixed appliances presenting all permanent teeth in occlusion, excepting the third molars, with molar and canines in Class I relationship, overjet, and overbite of as much as 3 mm. The eligibility criteria for the orthodontic untreated group (n= 40) were the same as those used for the treated group, except that the participants had never been submitted to fixed orthodontic treatment. The mean age for the control and case groups was 26.5 and 28.9 years, respectively. The gender ratio for both

groups was 1:1. Sample size was determined by the test power analysis which determined that 36.4 individuals would be capable of detecting a difference in the golden proportion of over 0.8 with (α = 0.05).

Impressions of the maxillary anterior teeth were taken with Speedex Coltene condensation silicone using a simultaneous impression-taking technique. To obtain casts, the impressions were poured with Durone type IV stone plaster, in compliance with the plaster: water ratio of 100 g:19 ml proposed by the manufacturer.

Anthropometric analysis of maxillary anterior teeth was performed as described previously with fewer modifications described ahead. Briefly, the plaster casts were positioned on a Camper table with the angle of measurement of the device set to 0°. A front-view photograph of each plaster was taken by a professional Canon 5D MKII camera with a 24/105 mm lens. The photos were taken in manual mode at a standard distance of 30 cm, without flash, with a resolution set at 21.1 megapixels. All images were stored in RAW format.

To analyze the images and detect the mesiodistal width of the maxillary central incisors, lateral incisors, and canines, NIH ImageJ version 1.34e software packages were used. Vertical lines were demarcated on the mesial and distal perceived contours of each tooth in frontal view. The distance between the vertical lines of a certain tooth was considered its mesiodistal width in millimeters. Analysis was done in triplicate, and the mean value was considered for each mesiodistal distance.

To calculate the occurrence of the golden proportion, the following mesiodistal width measurement of the buccal surface of the six anterior maxillary teeth was taken into consideration. With the individual distances of the central incisor, lateral incisor, and canine obtained, the formula previously described by Jin et al (2016) was applied. Briefly, the formula establishes the maxillary anterior mesiodistal width ratios considering both, the right and left sides. Golden proportion occurs when the central incisor is shown to be 1.618 times wider than the lateral incisor, and the canine 0.618 times narrower than the lateral incisor.

To evaluate the self-perception of Lay persons, the volunteers answered the structured questionnaire used in this study. This instrument is composed of five pictures about dental appearance, with psychometric responses, and has a final score that may vary between 5 and 35. The higher the scores, the higher the esthetic concern. The results of the self-applied questionnaire were categorized using the median obtained (in the present study equal to 10). The questionnaires were evaluated by a single researcher blinded for the experimental groups.

Comparisons of the perceived dental proportions

between groups and with the golden proportion were carried out by using Student's t-test and t-test for one mean value, respectively. Differences between groups regarding OASIS scores were assessed by the Mann–Whitney test. The association of the independent variables (gender, orthodontic treatment, and dental proportions) with OASIS was analyzed by logistic regression, estimating the odds ratio with the respective confidence intervals of 95%. All analyses were performed in SAS software (SAS Institute Inc., Cary, NC, USA, Release 9.2, 2010) considering a level of significance of 5%.

RESULTS

No association was found between the self-perception of dental attractiveness and the golden proportion of the central incisors and canines (P>.05) (Table 1). Furthermore, as regards the self-perception of dental attractiveness, individuals who had received orthodontic treatment presented 3.46 (CI: 1.38–8.69) times more chance of their oral condition having a greater impact on their perception of attractiveness (P.05). The highest self-perception of dental beauty score was presented by the orthodontic treated group (12: 4–23; median: minimum–maximum) when compared with the untreated group (8: 5–18) (P=.0032).

Individuals submitted to orthodontic treatment presented significantly higher proportions of central incisors than those without orthodontic treatment (P<05), with values closer to those of the golden proportion, despite the two groups differing significantly from the golden proportion (P<.05). For the proportion of the canines, no significant difference was observed between the groups, with the two groups differing significantly from the golden proportion (P<.05) as may be observed in Table 2. Thus, the individuals who were submitted to

TABLE 1: RESULTS OF OASIS ASSOCIATIONS (ORAL AESTHETIC SUBJECTIVE IMPACT SCALE) WITH THE OTHER EVALUATED VARIABLES

Variable	Characteristics	n(%)	OASIS		*OR ($IC95%)	p-valor
			<10	>10		
Gender	Female	40 (50,0)	22 (55,0)	18 (45,0)	0,82 (0,34-1,97)	0,6545
	Male	40 (50,0)	20 (50,0)	20 (50,0)	Ref	
Orthodontically treated	No	40 (50,0)	27 (67,5)	13 (32,5)	Ref	0,0082
	Yes	40 (50,0)	15 (37,5)	25 (62,5)	3,46 (1,38-8,69)	
Central Incisors Proportion	1,51#	40 (50,0)	22 (55,0)	18 (45,0)	Ref	0,6545
	>1,51#	40 (50,0)	20 (50,0)	20 (50,0)	1,22 (0,51-2,94)	
Canines' proportions	0,77#	40 (50,0)	22 (55,0)	18 (45,0)	Ref	0,6545
	>0,77#	40 (50,0)	20 (50,0)	20 (50,0)	1,22 (0,51-2,94)	

*Odds ratio; $ confidence intervals of 95%. &Reference level - highest impact. # Mediana. OASIS: Oral Aesthetic Subjective Impact Score.

TABLE 2: MEAN (STANDARD DEVIATION) OF THE PROPORTION OF CENTRAL AND CANINE INCISORS, DEPENDING ON THE GROUP, COMPARED TO THE GOLDEN PROPORTION.

Group	Central incisors proportion	Canines' pro- portions
Not treated	1,44 (0,18)	0,80 (0,10)
Orthodontically treated	1,57 (0,14)	0,75 (0,12)
Golden proportion	1,618	0,618
p-value (between groups)	0,0009	0,0951
p-value (Golden proportion) – not treated	<0,0001	<0,0001
p-value (Golden proportion) – treated	0,0381	<0,0001

orthodontic treatment presented greater proximity to the golden proportion of their clinical crown dimensions of the maxillary anterior teeth concerning their apparent mesiodistal widths than those who had not undergone orthodontic treatment.

DISCUSSION

The golden proportion was not achieved in the sample population, by previous studies. Besides it has been suggested the use of mathematical canons as predictable parameters for obtaining pleasant maxillary anterior teeth, the golden proportion probably not occur in the major portion of the population due to the wide degree of interethnic variability, a remarkable characteristic of the Brazilian population.[12]

The results obtained demonstrate that the individuals submitted to orthodontic treatment, presented greater proximity to the golden proportion of the central incisors and canines (1.57: 1 : 0.75) when compared with the Control Group (1.44: 1 : 0.80). The mesiodistal width of the central incisors was slightly narrower and that of the canines slightly wider than the values suggested by the golden proportion, corroborating the data from previous observations.[13] The fact that the central incisor and canine ratios were shown to be closer to the values of the golden proportion may indicate that orthodontic treatment had only a small effect on the visible tooth surfaces proportions evaluated.[14]

Although the concepts of dental symmetry and proportionality are characteristics associated with greater predictability in the promotion of dental attractiveness, these are not systematically sought in orthodontic-treated patients. These evidences are of clinical significance since it reasserts that orthodontic therapy must exceed the simple application of morphometrical canons for the correction of occlusal dysplasia.[15]

Besides dental proportions play different roles in the perception of dental beauty by orthodontists and laypeople, asymmetrical proportions of the maxillary anterior teeth are considered unattractive and may even have a negative influence on the psychosocial condition of patients.[16] Nevertheless, in the present study, there was no significant association of the golden proportion with the self-perception of beauty (OASIS) (P>.05). The contribution of other determinants such as dental color and shape, mesiodistal coronal angulation, la bio lingual coronal angulation, lip position, gingival design and buccal corridor may be related to this non-association observed in the present study.[17] That is, the self-perception of dental aesthetics is not necessarily correlated with an ideal smile described in terms of anthropometric ratios, which may be evident by the absence of parameters considered promoters of dental attractiveness.[18]

The unachieved association of the golden proportion of maxillary anterior teeth with self-perception of dental beauty may also derive from the long- term of visual perception acceptance of malocclusion conditions. However, the disassociation of dental beauty cannons with laypersons dental beauty perception may not be considered. Shifting in maxillary visual proportions, even during the retention status, compromising the stability of orthodontic treatment outcome have shown to promote unsatisfactory perception of dental appearance.[19]

The results of the present case-control study indicate that individuals who were submitted to orthodontic treatment were noted to present 3.46 (CI: 1.38–8.69) times more chance of considering their dental aesthetics positive (P<.05), irrespective of gender or presence of the golden proportion. This could explain the assumption that irrespective of the degree of severity of occlusal disorders or orthodontic therapeutic approach, young adults have their self-perception of dental aesthetics enhanced by the simple fact of being submitted to orthodontic treatment.[20]

CONCLUSION

The present investigation demonstrates that the self-perception of dental attractiveness is not associated with the occurrence of the anthropometric ratios established by the golden proportion. In addition, the self-perception of dental attractiveness was higher in the population who had been submitted to orthodontic treatment. This outcome may be caused by the fact that the ratios of the apparent view of the maxillary anterior teeth were closer to the golden proportion.

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