

Perception of Acceptable Range of Smiles by Specialists, General Dentists and Lay Persons and Evaluation of Different Aesthetic Paradigms

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ABSTRACT

Introduction: One of the most important goals of restorative dentistry is to restore the patient's aesthetic. Smile analysis is subjective and it differs from person to person. An aesthetic smile involves a harmonious relationship between various parameters including the hard and soft tissues.

Aim: The aim of the study was to identify the acceptable range of several smiles (alone and in conjunction with the face) by specialists, general dentists as well as lay persons; and to identify the values of different criteria i.e., the Golden Proportion (GP), the Recurrent Esthetic Dental proportion (RED), Width to Height ratio (W/H ratio), the Apparent Contact Dimension (ACD), and lateral incisor position in a smile.

Materials and Methods: Hundred photographs of 50 subjects were taken, 50 of the smile alone and 50 of the individual's frontal view of face. The photographs of the smiles and the faces were assessed for the aesthetic acceptability by 30 evaluators including 10 specialists with advanced training, 10 general dentists and 10 lay persons. Irreversible hydrocolloid impressions were made of the dentitions of all the

individuals using stock trays and were poured in dental stone. Measurements were made on the facial surface of the teeth on the models and were recorded in millimeters using a sharp tipped digital vernier calliper. Data was analyzed to evaluate the presence of different parameters assessed in the smiles. Mean and standard deviation values for the percentage of only the agreeable smiles were calculated in both individual smile analysis and in conjunction with the face. The non agreeable smiles were excluded from further statistical analysis. Pearson Correlation Coefficient was calculated to compare the values obtained in all the three groups.

Results: More number of smiles were considered agreeable by the general dentists when compared to the specialists and the number even increased in case of evaluation by lay persons. Greater number of smiles was found to be agreeable when they were evaluated in conjunction with the face.

Conclusion: Rather than assessment of individual numeric parameter that defines an ideal aesthetic smile, a smile to be aesthetic should harmonize with the composition of the face.

Keywords: Apparent contact dimension, Golden proportion, Lateral incisor position, Recurrent esthetic dental proportion, Width: height ratio

INTRODUCTION

Modern dentistry places paramount importance on the enhancement of aesthetics which has lead to a precise and meticulous analysis of the components that determine the attractiveness of a smile [1]. Beauty is constantly found in an individual's face, especially in the smile [2]. Attractiveness or aesthetic appearance is an extremely subjective element and it relates to beauty and harmony of the individual body parts. An aesthetic smile can be considered as one in which the size, shape, position, and color of teeth are in relative proportion, in symmetry to each other and in harmony with the facial features as a whole [3].

According to the GP, for two related objects to appear natural and harmonious, the larger to the smaller should form a ratio of 1.618:1. In dentistry, GP represents a 62% regression from mesial to distal when viewed from front [4]. The W/H ratio of individual teeth, specifically the maxillary central incisors, is a very important intra tooth proportion with significant influence on the balance and aesthetics of a smile [4]. W/H ratio is calculated by dividing the width of individual tooth by its height. The RED proportion which is another parameter defining the aesthetics of a smile, as proposed by Ward, is the proportion of the successive widths of the maxillary teeth as viewed from the front and this ratio should remain constant progressing distally from the midline [5]. RED proportion of 70% has been recommended for teeth with normal length. The "connector-zone" or the ACD of the maxillary anterior teeth is the area where

two adjacent teeth contact each other [1,6]. In an aesthetic smile, it is suggested that maxillary central incisors and canines should be positioned approximately at the same incisal level with each other, with the incisal edges of the lateral incisors positioned approximately 1 to 1.5 mm superior to the occlusal plane [7]. Thus the aim of this cross sectional study was to identify the acceptability of all the evaluated smiles (alone and in conjunction with the face) by specialists, general dentists and lay persons, and to identify the values of different criteria i.e., the GP, W/H ratio, the RED, the ACD and the relative lateral incisor position in a smile.

MATERIALS AND METHODS

Sample Selection: The present cross-sectional study was conducted at College Of Dental Sciences And Hospital, Rau, Indore, Madhya Pradesh, India with a sample size of 50 individuals. Purposive sampling of 50 individuals (34 females and 16 males, from Madhya Pradesh, India) was done for the study and the individuals aged between 18 to 25 years with intact natural dentition. Ethical clearance was obtained from the institutional ethical committee which was in accordance with the Declaration of Helsinki. The patients were thoroughly informed of the complete procedure and a written informed consent was obtained.

Individuals with no missing anterior maxillary or mandibular teeth, no gingival or periodontal pathology or therapy that would undermine a healthy tissue to tooth relationship, no interdental spacing or

crowding, no history of orthodontic treatment or trauma, no anterior restoration and with Angle's type I occlusion were included in the study.

The individuals with any type of malocclusion, evidence of gingival alteration or dental irregularities, apparent loss of tooth structure due to attrition, caries, fracture or restorations or the presence of any removable or fixed prosthesis were excluded from the present study.

Obtaining the Photographs: Two photographs of each individual were clicked by the same examiner; one of the smile and another of the smile in conjunction with the frontal view of face. All the photographs were taken indoors under similar lighting conditions maintaining the same background and same distance of 1.5 meters between the subject and the camera (Canon EOS 700D). Camera was in the automatic mode with macro, the photographs of the faces were taken without zooming and 5x zoom for the photographs of the smiles.

Obtaining the Impressions: Irreversible hydrocolloid impressions were made for all the individuals using stock trays and were poured in dental stone to obtain the casts.

Selection of the Evaluators: Thirty evaluators comprising of 10 specialists (Group I) with advanced training (individuals with post graduate degrees or diplomas in the field of conservative dentistry, prosthodontics, and orthodontics or aesthetic dentistry), 10 general dentists (Group II) and 10 lay persons (Group III) were made to individually analyze the photographs. Fifty photographs of the smiles were randomly assessed by all the 30 evaluators classifying the smiles as aesthetically agreeable or not and 50 photographs of the faces were also assessed similarly by the same 30 evaluators. Evaluation of photographs was done based on the individual's subjective assessment.

Analysis of the Photographs: For analysis of RED on the photographs, width of the maxillary anterior teeth was determined using a vernier calliper, and the proportion of the successive width of the maxillary teeth was calculated, which should remain constant progressing distally for the principle of RED to be followed. For golden proportion, the widths of central incisor, lateral incisor and canine were compared and checked whether it is according to the perceived ratio of golden proportion (1.618:1) or not.

Analysis of the Casts: Measurements of the width of the tooth (widest mesio-distal area), height of the tooth (from incisal edge to zenith point), and contact position were made on the cast using a sharp-tipped digital vernier caliper (Sealey Ltd, UK). All the measurements were made on the facial surface of the teeth and were recorded in millimeters. W/H ratio was measured by dividing each tooth's width by its height. The position of the incisal plane was determined by resting the cast on a flat plane and the distance between the incisal edges of the lateral incisor to the incisal plane was measured using a vernier caliper considering that the incisal edges of central incisor and canine are in the same incisal plane in most cases.

STATISTICAL ANALYSIS

Mean and standard deviation for individual smiles and in conjugation with face was evaluated. Pearson Correlation Coefficient was calculated to compare the values obtained by specialists, general dentists and lay persons in individual smile analysis using STSS software package for social sciences version 20.

RESULTS

[Table/Fig-1] denotes the mean and standard deviation values for the agreeable smiles in individual smile analysis.

The number of agreeable smiles (48.40%) found by the general dentists was more than that of specialists (40.96%). The number

further increased when the smile was assessed in conjunction with the face. The mean and standard deviation values were based on the percentage of only the agreeable smiles. The smiles classified as not agreeable were not taken in to account for statistical

Group	Mean	Std. Deviation	N
Specialist (Group I)	40.96	7.637	50
General dentists (Group II)	48.40	6.465	50
Lay persons (Group III)	56.80	6.376	50

[Table/Fig-1]: Mean and standard deviation values for the percentage of agreeable smiles during individual smile analysis.

Group		General Dentists (Group II)	Lay Persons (Group III)
Specialists (Group I)	Pearson Correlation (r)	0.918**	0.842**
	p-value	0.000	0.000
General dentists (Group II)	Pearson Correlation (r)		0.933**
	p-value		0.000

[Table/Fig-2]: Inter group comparison using pearson correlation coefficient, between specialists (Group I), general dentists (Group II), and lay persons (Group III); for individual smile analysis.

p-value = 0.000, highly significant (p ≤ 0.05: statistically significant)

If r is b/w 0 to -1: negative relationship

0 to 1: positive relationship**

0: no relationship

Group	Mean	Std. Deviation	N
Specialists (Group I)	53.68	7.617	50
General dentists (Group II)	62.32	6.212	50
Lay persons (Group III)	71.04	5.646	50

[Table/Fig-3]: Mean and standard deviation values for the percentage of agreeable smiles during smile analysis in conjunction with the face.

Group		General dentists (Group II)	Lay persons (Group III)
Specialist (Group I)	Pearson Correlation (r)	0.920**	0.879**
	p-value	0.000	0.000
General Dentist (Group II)	Pearson Correlation (r)		0.912**
	p-value		0.000

[Table/Fig-4]: Inter group comparison using pearson correlation coefficient, between specialists and general dentists, specialist and lay persons, general dentists and lay persons; for smile analysis in conjunction with the face.

p-value = 0.000, highly significant (p ≤ 0.05: statistically significant)

If r is b/w 0 to -1: negative relationship

0 to 1: positive relationship**

0: no relationship

Aesthetic Paradigm	Mean	Standard Deviation
The width:height ratio	0.6816	± 0.9763
The RED proportion	72.36 %	± 7.256 %
The lateral incisor position (above the occlusal surface)	0.924 mm	± 0.3865 mm
The apparent contact dimension (between CIs, CI and LI, LI and canine)	47:39:26	

[Table/Fig-5]: Mean obtained values for width:height ratio, the RED proportion, the lateral incisor position and the apparent contact dimension.

analysis. A 53.68% smiles were found to be agreeable by the specialists when assessed in conjunction with the face, with the percentage increasing to 62.32% when assessed by the general dentists. Agreeable smiles found by the lay persons were even more in numbers than that of the general dentists; both in individual smile analysis (56.80%) and in conjunction with the face (71.04%). Pearson Correlation Coefficient was calculated to compare the values obtained by specialists, general dentists and lay persons in individual smile analysis using STSS software package for social sciences version 20 [Table/Fig-2] (p=00, highly significant, p ≤ 0.05: statistically significant). [Table/Fig-3] shows the mean and standard deviation values for the agreeable smile in the analysis with the

conjunction of face. Pearson Correlation Coefficient was calculated the same way for analysis of the smiles in conjunction with the face [Table/Fig-4]. Mean and standard deviation was calculated for the values obtained for different aesthetic paradigms [Table/Fig-5].

The golden proportion was followed in only 11.4% of the overall aesthetically agreeable smiles.

DISCUSSION

Basic knowledge of the aesthetic aspects of natural dentition may contribute in a simple, yet, effective manner towards reducing miscommunications between the dentist and the patient with regard to the patient's smile, aesthetic appearance and psychological impact [8]. However, it must be kept in mind that aesthetics is not absolute; rather is extremely subjective and variable. According to Tjan et al., beauty is generally dictated by ethnic and cultural factors and individual preferences [9].

The present study revealed a statistically significant difference in the comparative analysis of agreeable smiles between general dentist, specialists and lay persons in cases of the smile alone and in conjunction with the face. In the group evaluated by specialists, a greater number of smiles were considered agreeable (53.68%) when it was assessed in conjunction with the face than the individual smile analysis (40.96%). The analysis by general dentists also revealed a similar pattern in the results with 62.32% of the smiles being agreeable when evaluated in association with the face, with the percentage dropping down to 48.40% when the smiles were assessed in isolation. The observed data showed a further increase in percentages when evaluated by lay persons. It is imperative to note that a greater number of smiles were considered as being agreeable by general dentists when compared to specialists, both in the individual assessment of the smile and in conjunction with the face. Positive correlation was found using Pearson Correlation Coefficient in the values obtained by specialists, general dentists and lay persons in both individual smile analysis and in conjunction with face. ($p=00$, highly significant, r between 0 to +1 = positive relationship). It is suggested therefore, that the knowledge acquired by specialists, both in their training and their clinical experience, make them more demanding and critical when assessing the aesthetics of a smile. The acquired data in conjunction with face also suggest that the other facial components may exert an influence on the aesthetics of a smile.

In the present study it was observed that the GP was followed in only 11.4% of the aesthetically agreeable smiles. The number of aesthetically agreeable smiles in the computation of GP was considered from all the three groups. Although, GP has been proposed in the literature as a useful application for achieving proportions and aesthetics [10-12], none of the previous studies has yet established this proportion as being an absolutely mandatory parameter featuring in all aesthetically acceptable smiles. Gillen RJ et al., evaluated a poor correlation between tooth dimensions and the golden proportion when assessing aesthetically pleasing smiles [13]. Rosenstiel SF et al., found that golden proportion was preferred only in cases of tall teeth [14].

Results of the present study showed that the RED proportion was 72.36% with the standard deviation of ± 7.256 . The smiles which were according to the principles of the RED proportion were found to be more appealing than the smiles which were according to the golden proportion [5]. When applying the principle of the RED proportion, the taller the teeth, the smaller should be the RED proportion used, and the shorter the teeth, the larger should be the RED proportion. According to Rosenstiel et al., smiles with tall teeth should be created using a RED proportion that is smaller than 70% [14]. Gradation within the range of 62% to 80% RED proportion may be used based on the amount of deviation from the normal length [5].

The mean value of W/H ratio of teeth in the present study was found to be 0.6816 ± 0.9763 , which is in accordance with the result obtained by Olson M et al., who evaluated the a W:H ratio of the maxillary anterior teeth in 108 volunteers and reported W:H ratio ranging from 0.66 to 0.76 [15]. Sterrett JD et al., evaluated the W:H ratio of unworn maxillary teeth and reported a mean ratio of 0.81 [16].

Bukhry SM et al., suggested that a maxillary lateral incisor position is 1 to 1.5 mm shorter than the maxillary central incisor and canine was the most preferred situation [17]. The result of the present study showed that lateral incisor was placed 0.924 ± 0.3865 mm above the central incisor and canine gives the most acceptable results, which is in accordance with results obtained in the study conducted by King KL et al., who suggested that the maxillary lateral incisors be set about 0.5 mm above the incisal plane and not at the level of central incisors and canines [18].

The apparent contact dimension between the central incisors, the central and lateral incisors, and the lateral incisor and canine in the present study was found to be 47:39:26, which is in accordance with the results of the study by Raj V et al, where it was 49:38:27, [1]. This proportion was also very similar to the 50:40:30 ratio proposed by Morely J and Eubank J and was also consistent with the concept of progressive increase in incisal embrasure dimensions from the midline to the canine [19].

LIMITATION

One of the limitations of the present study was that purposive sampling was done and no statistical determination of the sample size was done. Further studies can be done by statistically evaluating the sample size.

Some new parameters and aesthetic paradigms might develop in future for smile designing but for critically analysing the smile both subjective and objective analysis should be done.

CONCLUSION

It may be concluded that smiles should be analysed in conjunction with the face to be classified as agreeable or not agreeable, since it is not possible to dissociate the smile from the patient's other facial components. It was possible to note that a greater number of smiles were considered as being agreeable by general dentists, both in the individual assessment of the smile and in conjunction with the face. It is suggested that the knowledge acquired by specialists, and their clinical experience, make them more critical in appraisal of the aesthetics of smile.

As the saying goes "beauty lies in the eyes of the beholder", aesthetics in dentistry cannot be numerically quantified but should rather be assessed for its harmonious conjugation with the facial components.

CLINICAL IMPLICATIONS

While designing a smile of an individual in clinical practice, subjective analysis should be considered rather than strictly adhering to mathematical values and different perceived ratios. Individual's other facial components should also be taken into account along with the dental components.

REFERENCES

- [1] Raj V, Heymann HO, Hershey HG, Ritter AV, Casco JS. The apparent contact dimension and covariates among orthodontically treated and nontreated subjects. *J Aesthet Restor Dent*. 2009;21:96-112.
- [2] de Castro MV, Santos NC, Ricardo LH. Assessment of the "golden proportion" in agreeable smiles. *Quintessence Int*. 2006;37(8):597-604.
- [3] Moskowitz ME, Nayyar A. Determination of dental aesthetics: A rationale for smile analysis and treatment. *Compend Contin Educ Dent*. 1995;16(12):1164-86.
- [4] Bhuvaneshwaran M. Principles of smile design. *J Conserv Dent*. 2010;13(4):225-32.

- [5] Ward DH. A study of dentist's preferred maxillary anterior tooth width proportions: Comparing the recurring aesthetic dental proportion to other mathematical and naturally occurring proportions. *J Aesthet Restor Dent.* 2007;19:324-39.
- [6] Ker AJ, Chan R, Fields HW, Beck M, Rosenstiel S. Aesthetics and smile characteristics from the layperson's perspective: A computer-based survey study. *J Am Dent Assoc.* 2008;139(10):1318-27.
- [7] Raj V. Aesthetic paradigms in the interdisciplinary management of maxillary anterior dentition: A review. *J Aesthet Restor Dent.* 2013;25(5):295-304.
- [8] Basting RT, da Trindade Rde C, Flório FM. Comparative study of smile analysis by subjective and computerized methods. *Oper Dent.* 2006;31(6):652-59.
- [9] Tjan AH, Miller GD, The JG. Some aesthetic factors in a smile. *J Prosthet Dent.* 1984;51(1):24-8.
- [10] Lavelle CL. Maxillary and mandibular tooth size in different racial groups and in different occlusal categories. *AM J Orthod.* 1972;61:29-37.
- [11] Rufenacht CR. *Fundamentals of aesthetics.* 2nd ed. Chicago. Quintessence International 1990.
- [12] Goldstein RE. *Aesthetics in dentistry.* 2nd ed. Hamilton. Decker 1998;189-91.
- [13] Gillen RJ, Schwartz RS, Hilton TJ, Evans DB. An analysis of selected normative tooth proportion. *Int J Prosthodont.* 1994;7:410-17.
- [14] Rosenstiel SF, Ward DH, Rashid RG. Dentist's preferences of anterior tooth proportion-a web-based study. *J Prosthodont.* 2000;9(3):123-36.
- [15] Olsson M, Lindhe J, Marinello CP. On the relationship between crown form and clinical features of the gingival in adolescents. *J Clin Periodontol.* 1993;20(8):570-77.
- [16] Sterret JD, Oliver T, Robinson F, Fortson W, Knaak B, Russell CM. Width/length ratios of normal clinical crowns of the maxillary anterior dentition in man. *J Clin Periodontol.* 1999;26(3):153-57.
- [17] Bukhary SM, Gill DS, Trendwin CJ, Moles DR. The influence of varying maxillary lateral incisor dimensions on perceived smile aesthetics. *Br Dent J.* 2007;203(12):687-93.
- [18] King KL, Evans CA, Viana G, BeGole E, Obrez A. Preferences for vertical position of the maxillary lateral incisors. *World J Orthod.* 2008;9(2):147-54.
- [19] Morley J, Eubank J. Macroaesthetic elements of smile design. *J Am Dent Assoc.* 2001;132(1):39-45.

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Date of Submission: **Aug 05, 2016**

Date of Peer Review: **Sep 12, 2016**

Date of Acceptance: **Nov 15, 2016**

Date of Publishing: **Feb 01, 2017**

FINANCIAL OR OTHER COMPETING INTERESTS: None.