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RESEARCH ARTICLE

Effect of Canine Dimensions on Smile Aesthetics among General Dentists, Dental Students and Laypersons

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Abstract:

Objectives:

Canines and their dimensions play a major role in the appearance of the smile. The aim of the study was to determine the perception of smile aesthetics among General dentists, Dental students, and laypersons, with respect to different levels of maxillary canine (canine tip height and gingival height in reference with central incisors) and Golden Proportions in regards to lateral incisor.

Materials and Methods:

This was a cross-sectional study conducted amongst three different populations; students of dentistry, general dentists and laypersons. A convenient sample size of 109 participants was accepted for the present study, out of which there were 41 students of dentistry, 38 general dentists and 30 laypersons. We used digitally altered photographs (n=15) for data collection.

Statistical analysis:

Kruskal Wallis Test was applied as a test of significance and the level of significance was set at <0.05.

Results:

The most of the dental students found the canine tip (-0.5), the gingival height of (+0.5) and the Golden Proportion 62% attractive. The majority of general dentists found the canine tip (-0.5), the gingival height of (+1) and the Golden Proportion 72% attractive. In comparison, laypersons found the canine tip (+0.5), the gingival height of (0) and the Golden Proportion 57% attractive.

Conclusion:

The study demonstrated that the perceptions of dental students, general dentists and laypersons had a significant difference.

Keywords: Aesthetics, Canine Tooth, Perception, Smiling, Gingival height, Golden proportion.

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1. INTRODUCTION

Visual impression while interpersonal communication plays a major role in human society and the smile is an important part of this impression. Although the perception of the smile is a highly subjective matter, over the years, a number of efforts are made to quantify this perception. The quantification of smile aesthetics has lead dentistry to a whole new level. The smile not only affects the social and interpersonal interactions, but also affects the self-confidence

of a person [1]. A lot of studies have shown that the aesthetics of smile affect various aspects of social life, which include finding a relationship partner, personality development, performance at workplace and kinship opportunity [2]. Canines and their dimensions play a major role in the appearance of the smile. Apart from that, the relationship of canine width with lateral incisors, which is known as “Golden Proportion”, also has a great impact on the perception of the observer. A smile ‘designed’ perfectly and according to the textbook, by the orthodontist, may not be the ideal smile for a layperson. Therefore, it is critical to identify the perspective of the client before offering him any services for smile aesthetics.

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With advances in dentistry, it has been possible to ‘design’ the smile of an individual. However, in many instances, the perception of an ideal smile varies in people with different demographic backgrounds [3]. However, by understanding the perception of a patient, an orthodontist can optimise the shape of the teeth and height of gingival contours to provide the ‘best smile’ [4]. While smiling, central and lateral incisors are most visible and, therefore, have the maximum effect on the appearance. However, it has to be remembered that the mesial part of maxillary canines is also visible and can have an important effect on the smile aesthetics. The majority of the researches about smile aesthetics are based on the dimensions of central and lateral incisors. There exists a relative vacuum in terms of research on the role of maxillary canines on smile aesthetics. Changing gingival height can also influence the appearance of the smile, but the gingival margin of canines has little influence on it. But again, not many studies are done to evaluate this hypothesis. Therefore, the current study is based on the effect of dimensions of maxillary canines and gingival height on smile aesthetics. The study aims to determine the perception of smile aesthetics among general dentists, dental students, and laypersons, with respect to different levels of maxillary canine (canine tip height and gingival height in reference with central incisors) and Golden Proportions in regards to lateral incisor.

2. MATERIALS AND METHODS

The current study was a cross-sectional study conducted amongst three different populations; students of dentistry, general dentists and laypersons. A convenient sample size (in line with other similar studies) of 109 participants was accepted for the present study, out of which there were 41 students of dentistry, 38 general dentists (with no specialization) and 30 laypersons (college educated). Written informed consent was obtained from all participants.

2.1. Data Collection Tools

A photograph of smiling female patient was utilized to know the perceptions of study groups (students of dentistry, general dentists and laypersons) about the smile aesthetics. Multiple photographs were taken of a smiling female patient with a Nikon D750 DSLR camera. It is a camera with 24.3 megapixel resolution, CMOS image sensor, EXPEED image processor, 10 mm macro lens (Tokina Co.) and Sigma Flash ring EM 140-DG. An Sb-r200 twin flash system (Nikon Corp. Japan) was attached using an adjustable scorpion medical bracket (Agno’s Tech Engineering Co.). To assure the high quality of photograph, the camera was set up with the following options: ISO 100, 100 mm, $f/45$, and $1/60$ s exposure time. The photograph was taken at the same height as that of the subject and from a distance of 0.5 meters.

From 10 photographs, one photograph was selected based on the quality and study criteria by the investigators. It was ensured that the photograph was closest to the natural appearance, right positioned and taken in a good light. From this photograph, the only portion containing lips, gingiva and teeth was kept and other features of the face were removed. This photograph was modified using Adobe Photoshop CS6 photo-editing software (Adobe Systems Inc., San Jose, CA,

USA). The length and gingival height of canines in relation to central incisors and width of canines (to follow the rules of Golden Proportions) were altered in relation to the lateral incisors. Based on modifications, three sets of photographs were prepared and these digitally altered photographs were used for data collection Figs. (1-3).



Fig. (1). Set one of the smile photographs with various lengths of canines. **A.** Canine tip of the same height as the central incisor edge (0), **B.** Canine tip longer by 1 mm in relation to the central incisor edge (+1), **C.** Canine tip shorter by 1 mm in relation to the central incisor edge (-1), **D.** Canine tip shorter by 0.5mm in relation to the central incisor edge (-0.5), **E.** Canine tip longer by 0.5 mm in relation to the central incisor edge (+0.5).



Fig. (2). Set two of smile photographs with various heights of gingiva of canines. **A.** Gingival height longer by 1 mm in relation to the central incisor (+1), **B.** Gingival height of the same height as the central incisor (0), **C.** Gingival height longer by 0.5 mm in relation to the central incisor (+0.5), **D.** Gingival height shorter by 1 mm in relation to the central incisor (-1), **E.** Gingival height shorter by 0.5 mm in relation to the central incisor (-0.5).



Fig. (3). Set three of the smile photographs with various Golden Proportions. **A.** Golden proportion of 52%, **B.** Golden proportion of 57%, **C.** Golden proportion of 62%, **D.** Golden proportion of 67%, **E.** Golden proportion of 72%.

2.2. Method of Data Collection

Each photograph was printed in a 4 inch x 6 inch paper with matt finish. All of them were provided unique identification numbers and shown to study participants. That way, each participant had to evaluate 5 photographs. Initially, the photographs were given in random order to each

participant. They were asked to observe each photograph for 10 seconds and rate them out of 5 according to their perception. More rating would mean the participant finds the photograph aesthetically more attractive. The participants were instructed to organize the images with ascending order of ratings until they have achieved a final rank order within the given time and disregard the code at the back of each picture.

2.3. Definitions Used

2.3.1. Golden Proportion

Golden proportion means the percentage width of canine in relation to the lateral incisor. For example, a Golden Proportion of 52 means the visible width of canine in the photograph is 52%, compared to the visible width of the lateral incisor.

2.3.2. Data Entry and Analysis

The data were entered in MS Excel 2010 and analysed with SPSS v23. The means and Standard Deviations (SD) of ratings were calculated and compared between different groups to identify if there was any significant difference between their perceptions. Kruskal Wallis Test and Mann Whitney U Test were applied as a test of significance (where ever applicable) and the level of significance was set at <0.05.

3. RESULTS

Table 1 describes the study groups. The mean age of students was 22.12 years. As expected, the mean age of general dentists was higher than the students (29.63 years). The mean age of laypersons was 28.9 years. The majority of the participants amongst students and laypersons were males (about 53%). About 68.4% of general dentists had work experience of more than 3 years. The majority (61.0%) of the dentistry students were from the 4th profession.

Table 2 shows the rating of perception regarding canine length in comparison to central incisors. As it is evident, the statistically significant difference was seen only with the photograph where the canine tip was longer by 0.5mm in relation to the central incisor edge. Laypersons gave the highest

rating for this photograph (mean of 3.53 with SD of 1.33). The students of dentistry and General dentists found smiles with the canine tip of the same height as the central incisor edge (0) as most attractive. Compared to that, the laypersons found the canine tip longer by 0.5 mm in relation to the central incisor edge (+0.5) as the most attractive.

Table 3 demonstrates that there was a significant difference in perceptions of three study populations regarding the gingival height [for (-1), (-0.5),0, (+0.5) and (+1)]. In case of the photograph with the gingival height of the same height as the central incisor (0), the highest mean score was given by the students of dentistry (3.61), while in case of the photograph with the gingival height longer by 1 mm (+1) in relation to the central incisor, the highest mean score was given by general dentists (3.26). Similarly, for photographs (-1), (-0.5) and (+0.5), the highest scores were given by laypersons (3.27), general dentists (3.26) and laypersons (4.20), respectively. The students of dentistry found the smiles with the gingival height of the same height as the central incisor (0) as the most attractive, while general dentists and laypersons found the gingival height longer by 0.5 mm in relation to the central incisor (+0.5) as the most attractive.

Table 1. Characteristics of the study sample.

Characteristics	Dental Students (N = 41)	General Dental Practitioners(N = 38)	Lay Persons (N = 30)
Age (Mean ± SD) in completed years	22.12 ± 1.70	29.63 ± 3.44	28.90 ± 3.0
Gender			
Males	22 (53.7%)	16 (42.1%)	16 (53.3%)
Females	19 (46.3%)	22 (57.9%)	14 (46.7%)
Experience			
1-3 years	-	12 (31.6%)	-
More than 3 years	-	26 (68.4%)	-
Levels			
4th	25 (61.0%)	-	-
5th	16 (39.0%)	-	-

Table 2. Comparison of perception scores about the canine tip in different study groups.

Characteristics	Dental Students (Mean ± SD)	General Dental Practitioners (Mean ± SD)	Lay Persons (Mean ± SD)	p Value*
Canine tip shorter by 1 mm in relation to the central incisor edge (-1)	3.12 ± 1.63	2.84 ± 1.53	2.40 ± 1.38	0.168
Canine tip shorter by 0.5mm in relation to the central incisor edge (-0.5)	3.32 ± 1.40	3.13 ± 1.61	2.70 ± 1.51	0.274
Canine tip of the same height as the central incisor edge (0)	3.46 ± 0.95	3.18 ± 1.08	3.03 ± 1.03	0.095
Canine tip longer by 0.5mm in relation to the central incisor edge (+0.5)	2.71 ± 1.19	3.16 ± 1.05	3.53 ± 1.33	0.014
Canine tip longer by 1 mm in relation to the central incisor edge (+1)	2.39 ± 1.58	2.61 ± 1.64	3.33 ± 1.56	0.061

*Kruskal Wallis Test.

Table 3. Comparison of perception scores about the gingival height in different study groups.

Characteristics	Dental Students (Mean ± SD)	General Dental Practitioners (Mean ± SD)	Lay Persons (Mean ± SD)	p Value*
Gingival height shorter by 1 mm in relation to the central incisor (-1)	2.54 ± 1.46	3.05 ± 1.43	3.27 ± 0.98	0.02
Gingival height shorter by 0.5 mm in relation to the central incisor (-0.5)	3.05 ± 2.28	3.26 ± 1.00	2.33 ± 0.80	<0.001

(Table 3) cont....

Characteristics	Dental Students	General Dental Practitioners	Lay Persons	p Value*
	(Mean ± SD)	(Mean ± SD)	(Mean ± SD)	
Gingival height of the same height as the central incisor (0)	3.61 ± 1.12	2.11 ± 1.35	3.23 ± 1.31	<0.001
Gingival height longer by 0.5 mm in relation to the central incisor (+0.5)	3.54 ± 1.33	3.32 ± 1.71	4.20 ± 1.24	0.033
Gingival height longer by 1 mm in relation to the central incisor(+1)	2.27 ± 1.42	3.26 ± 1.18	1.97 ± 1.52	0.001

*Kruskal Wallis H Test.

As evident from Table 4, the Golden Proportion of 52% was given mean scores of less than 3 by all three groups. No significant difference in the perception of smile aesthetics was observed except in the case of the Golden Proportion of 72%. In the case of the Golden Proportion of 72%, the highest mean score was given by general dentists. The dental students found Golden Proportion of 62% as the most attractive, while general dentists and laypersons found Golden Proportions of 72% and 57% as the most attractive, respectively.

Table 5 shows a comparison of perceptions about smile aesthetics between different groups. The perceptions of students of dentistry and general dentists were almost similar (with no statistical difference) in case of photographs with varying lengths of maxillary canines. However, a significant

difference between these two groups was found for the photograph with “gingival height similar to that of the central incisors” and “higher than central incisors by 1 mm”. Similarly, a significant difference was also found for the photograph with a Golden Proportion of 72%. When perceptions of general dentists were compared with laypersons, significant differences in the perceptions were observed, especially for photographs with varying gingival heights. The significant difference between these two groups was also found for the photographs with the canine length of (+1) and the Golden Proportion of 72%. Upon comparing the perceptions of dental students with laypersons, significant differences were observed for canine lengths of (0), (+0.5) and (+1), and the gingival height of (-1), (-0.05) and (+0.05).

Table 4. Comparison of perception scores about the Golden Proportion in different study groups.

Golden Proportion (%)	Dental Students	General Dental Practitioners	Lay Persons	p Value*
52	2.78 ± 1.26	2.50 ± 1.27	2.67 ± 1.84	0.58
57	3.41 ± 1.34	2.87 ± 1.40	3.53 ± 1.66	0.103
62	3.63 ± 1.22	3.16 ± 1.75	2.87 ± 1.61	0.174
67	2.85 ± 1.39	2.84 ± 1.37	3.00 ± 1.36	0.92
72	2.32 ± 1.52	3.63 ± 1.02	2.90 ± 1.09	<0.001

*Kruskal Wallis H Test.

Table 5. Comparison of the perception of the smile as “attractive” between different groups.

Characteristics	Comparison of Dental Students and General Dentists (p value*)	Comparison of General Dentists and Lay Persons (p value*)	Comparison of Dental Students and Lay Persons (p value*)
Canine length			
-1	0.531	0.107	0.07
-0.5	0.704	0.102	0.099
0	0.206	0.473	0.041
0.5	0.063	<0.001	0.011
1	0.693	0.086	0.025
Gingival Height			
-1	0.091	0.199	0.01
-0.5	0.449	<0.001	0.013
0	<0.001	0.001	0.385
0.5	0.828	0.036	0.021
1	0.002	0.001	0.197
Golden Proportion (%)			
52	0.341	0.48	0.86
57	0.098	0.068	0.55
62	0.37	0.511	0.051
67	0.933	0.857	0.652
72	<0.001	0.013	0.028

*Mann-Whitney U Test.

Table 6 shows how much proportions of subjects found the photographs with different dimensions of canines as “attractive”, in each study group. The overall mean scores (with SD) across all three groups were calculated. It was found that the highest score was found with a canine length of (0) with a mean score of 3.25 ± 1.03 . Similarly, in the case of gingival heights, the highest score was with a height of (+0.5) (mean score of 3.64 ± 1.48). The Golden Proportions of 57% and 62% fetched almost similar scores of 3.26 ± 1.47 and 3.26 ± 1.55 , respectively. The scores above 2.5 were considered as an indication of finding the smile as “attractive” and scores lower than 2.5 were considered as “not attractive”. Based on these criteria, interesting results were found. In the case of the canine length, maximum students of dentistry (87.8%) found the length of (0) as attractive. Similarly, amongst general dentists, the majority (76.3%) found the length of (0) as attractive. These findings differed in the group of laypersons, majority of them (73.3%) found canine lengths of (0) and (+1) as attractive. In the case of the gingival height, maximum students (82.9%) found the height of (0) as attractive. Compared to that, the majority of dentists (84.2%) found the height of (-0.5) as attractive. In the case of laypersons, the majority of them (93.3%) found (+0.5) as attractive. About 82.9% of the students found the Golden Proportion of 62% as attractive, which constituted the majority. Amongst general dentists, the majority (86.8%) found the Golden Proportion of 67% as attractive. While, the majority of laypersons (73.3%) preferred Golden Proportions of 52% and 57% as attractive.

4. DISCUSSION

The role of dentists has expanded from mere correction of mal-occluding or mal-positioned teeth to “architects” of a smile. Maxillary canines have a major impact on the appearance of the smile. Little changes in their dimensions can give a patient much needed self-confidence. The perception of an ideal smile varies from person to person. However, there cannot be uniform dimensions of teeth, which can be perceived as the ideal smile, as the perception has a subjective component and it varies from person to person. In fact, it is affected by a number of factors [1, 5]. It is not necessary that the perception of an orthodontic professional should coincide with that of laypersons [4, 6]. The current study has emphasised on the role of maxillary canines in smile aesthetics and perception of

socio-demographically different groups towards varying dimensions of canines.

The current study demonstrated that the perceptions of different groups involved in the study, about smile aesthetics, varied for various dimensions of canine. A study conducted by Correa *et al.* also demonstrated a vast difference between perceptions of orthodontists and laypersons.⁴ This difference in the perception is not limited to the lengths of canine, but also observed in the case of incisors’ dimensions [7 - 9]. Overall, it was found that all three groups found the canine tips longer than central incisors more attractive. The current study found that the students of dentistry and general dentists found smiles with a canine tip of the same height as the central incisor edge (0) as most attractive. A similar result was also found by Li *et al.*, who compared perceptions of orthodontists with laypersons, but they compared the canine height with the central incisor [10]. They also found that the laypersons gave a maximum score for the canine tip (0). This result differed from the findings of the current study, which demonstrated that the laypersons gave a maximum score to photographs with the canine tip longer by 0.5mm in relation to the central incisor edge (+0.5).

In the current study, dental students and general dentists have given maximum scores to 62% and 72% Golden Proportions, respectively. It is also demonstrated that general dentists were able to perceive the 72% Golden Proportion as most attractive, compared to laypersons. This again goes to show that the perception of laypersons can be drastically different from an orthodontist. One of the major factors for this is the inability of laypersons to perceive a difference in various Golden Proportions [8, 11, 12,].

This study is unique as not many studies have evaluated the effect of dimensions of canines on smile aesthetics. The current study was conducted with a convenient sample size due to the limited number of resources, which is a major limitation of the study. The study used photographs of a female to find the perceptions of participants. It can be assumed that using photographs of males may produce different results. Being an upcoming aspect of dentistry, smile aesthetics require further research with larger sample sizes to identify subjective perceptions.

Table 6. Perceptions of dimensions of canines on the smile as “attractive” by different groups.

Characteristics	Mean Score \pm Standard Deviation	Students of Dentistry	General Dental Practitioners	Lay Persons
		N (%)	N (%)	N (%)
Canine length				
-1	2.83 ± 1.55	26 (63.4)	19 (50.0)	12 (40.0)
-0.5	3.08 ± 1.52	28 (68.3)	21 (55.7)	13 (43.3)
0	3.25 ± 1.03	36 (87.8)	29 (76.3)	22 (73.3)
0.5	3.09 ± 1.22	20 (48.8)	26 (68.4)	21 (70.0)
1	2.72 ± 1.63	13 (31.7)	22 (57.9)	22 (73.3)
Gingival Height				
-1	2.92 ± 1.36	17 (41.5)	18 (47.4)	25 (83.3)
-0.5	2.93 ± 1.13	20 (48.8)	32 (84.2)	7 (23.3)
0	2.98 ± 1.41	34 (82.9)	14 (36.8)	21 (70.0)
0.5	3.64 ± 1.48	31 (75.6)	21 (55.3)	28 (93.3)

(Table 6) cont....

Characteristics	Mean Score ± Standard Deviation	Students of Dentistry	General Dental Practitioners	Lay Persons
		N (%)	N (%)	N (%)
1	2.53 ± 1.46	15 (36.6)	29 (76.3)	9 (30.0)
Golden Proportion (%)				
52	2.65 ± 1.24	23 (56.1)	20 (52.4)	22 (73.3)
57	3.26 ± 1.47	30 (73.1)	26 (68.4)	22 (73.3)
62	3.26 ± 1.55	34 (82.9)	21 (5.3)	16 (53.4)
67	2.89 ± 1.36	22 (53.7)	14 (36.8)	16 (53.4)
72	2.94 ± 1.36	14 (34.2)	33 (86.8)	14 (46.6)

CONCLUSION

The study concluded that the study of dentistry affects the perception to identify and perceive different dimensions of canines, in terms of attractiveness, when compared to laypersons (who do not have studied dentistry). The most of the dental students found the canine tip (0), the gingival height of (0) and the Golden Proportion 62% as attractive. The majority of general dentists found the canine tip (0), the gingival height of (-0.5) and the Golden Proportion 72% as attractive. In comparison, laypersons found the canine tip (0), the gingival height of (+0.5) and Golden Proportions of 52% and 57% as attractive.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This article does not contain any studies with human participants or animals performed by any of the authors.

HUMAN AND ANIMAL RIGHTS

Not applicable.

CONSENT FOR PUBLICATION

Written informed consent was obtained from all participants.

AVAILABILITY OF DATA AND MATERIALS

The data that support the findings of this study are available from the corresponding author, [A.A.T], upon reasonable request.

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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