Influence of symmetric and asymmetric alterations of maxillary canine gingival margin on the perception of smile esthetics among orthodontists, dentists, and laypersons

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ABSTRACT

Introduction: Esthetics is one of the major concerns among people seeking orthodontic treatment, and its perception varies from person to person. Our objective was to determine the differences in the perception of smile esthetics among orthodontists, general dentists, and laypersons with respect to alteration in the maxillary canine gingival margin in close-up smile analyses.

Materials and Methods: Close-up photograph of an ideal Indian female smile was selected. The images were digitally altered to create symmetrical images with the gingival margin levels of maxillary canine matching the central incisors. Twelve alterations were created in the gingival margin of the canine with discrepancies of 1, 2, and 3 mm in relation to the most superior point on the labial gingival margin of patient’s central incisor and divided under four groups. Finally, close-up images of the smile were assessed by orthodontist, general dentist, and layperson who indicated the level of attractiveness of each smile on a visual analogue score. The data collected were then statistically analyzed by one-way analysis of variance followed by Newman–Keul’s range test.

Results: Most evaluators considered all the three components, i.e., lips, teeth, and gingiva while assessing the smile’s attractiveness. Statistically significant differences were observed between different evaluator groups when considering bilateral increase in crown height by 2 and 3 mm. The perceptions of asymmetries in the gingival margin levels of the maxillary canines were 1.0 mm for orthodontists and 2.0 mm for laypersons.

Conclusion: The result of this study suggested that the orthodontists were more critical than dentist and layperson in evaluating smile esthetics.

Key words: Esthetics, perception, smile

Aristotle said, “Beauty is a greater recommendation than any letter of introduction.” A statement that holds true, especially in the present world where attractive people have a much better chance of being successful. Dentists and orthodontists can greatly enhance a patient’s smile. Smile designing is a multifactorial decision-making process that allows treating patients with an individualized approach. A pleasing smile can be created by the best possible arrangement of facial symmetry and proportions, smile framework, and tooth–gingival characteristics in the esthetic zone. Optimization of the shape and proportions of the teeth and the associated gingival contours have also been emphasized a lot recently.

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The most apical point of the free gingival margin is the gingival zenith point (GZP), and a line tangent to GZP is the gingival zenith level (GZL). In the most ideal situations, GZL of lateral incisors lies approximately 1 mm coronal relative to the GZL of its adjacent teeth. Canines play a critical role in creating a pleasing smile. However, only the mesial half of the canine is visible during smile from the frontal view which might limit the need for correcting the gingival margin of the canine if the patient does not perceive this as unaesthetic.

Esthetic perception varies from person to person. Miller stated that the trained and observant eyes readily detect the asymmetry. Therefore, a professional’s opinions regarding facial esthetics may not coincide with the perceptions and expectations of patients or laypersons. Clinicians often come across canines which are buccally or lingually placed which affects the position of gingival zenith and smile esthetics.

There is sparse literature regarding gingival esthetics of the canine and its perception among laypersons and professionals. Correa et al. have evaluated the effect of unilateral alterations of the gingival margin on the perception of the smile esthetics. The purpose of this study was to evaluate the differences in the perception of smile esthetics in symmetric and asymmetric alterations of maxillary canine by orthodontists, general dentists, and laypersons.

**MATERIALS AND METHODS**

Photograph of an ideal Indian female smile was selected and was modified and retouched in different ways to adjust color, brightness, and contrast and to remove any discolorations on the lips and skin to produce an ideal, symmetrical image using Adobe Photoshop (V7, Adobe Systems, San Jose, CA, USA). GZL of central incisors was used as a reference, and the canines’ GZL were matched with this line, keeping GZL of lateral incisor 0.5 mm below. Mandibular teeth were removed from the images.

The gingival margins of the maxillary canines were altered unilaterally or bilaterally with discrepancies of 1, 2, and 3 mm by either increasing or decreasing the height in relation to the most superior point on the labial gingival margin of the patient’s central incisor and 12 alterations were created and these alterations were divided into four groups.

In Group 1, the crown length of maxillary right canine was unilaterally increased (UI) by 1 mm (UI1), 2 mm (UI2), and 3 mm (UI3) by adjusting the level of the gingival margin. Similar alterations were done in Group 2 bilaterally (BL1, BL2, BL3). In Group 3, the crown length was unilaterally decreased (UD) by 1 mm (UD1), 2 mm (UD2), and 3 mm (UD3). Similar alterations were done in Group 4 bilaterally (BD1, BD2, BD3).

This study was approved by the Institutional Ethics Committee of the Rungta College of Dental Sciences and Research, Bhilai. Seventy-five evaluators were divided into three groups: Group O (n = 25 orthodontists, 19 males and 6 females), Group D (n = 25 general dentists, 10 males and 15 females), and Group L (n = 25 laypersons, 14 males and 11 females) assessed smile using questionnaires. The attractiveness of smile in the original image and each of the altered images was assessed by the three groups of evaluators and scored using a 10-point visual analogue score (VAS) with “0” indicating the least attractive smile and “10” the most attractive smile. Evaluators were also asked their opinion on which components of the smile (lip, teeth, gingiva, or all of these) were given consideration when assessing smile attractiveness.
Statistical analysis
Data was gathered and analyzed using SPSS software (Version 19, IBM Corporation, Illinois, USA). The mean and standard deviation of VAS scores were calculated for each photograph in the three groups. The paired $t$-test was used to compare the VAS scores of the male and female evaluators. One-way analysis of variance was used to determine the difference between the mean VAS scores among different groups and Newman–Keul’s range test was used for step-wise multiple comparisons of these groups. Eight evaluators were randomly selected, and they reassessed each photograph and intraexaminer error associated with the study was determined by intraclass coefficient by comparing the first and the second VAS scores. The level of significance was set at 0.05.
RESULTS

The visual analog scores (VASs) for four different alterations of a smile (Groups 1–4) given by different evaluators are illustrated in Tables 1-4. The paired t-test showed that there was no gender dimorphism regarding VAS scores in all the three groups of evaluators; therefore, the VAS scores were pooled together in these groups ($P < 0.05$). There was a significant difference in the ratings between orthodontists, dentists, and laypersons when the gingival margin of the maxillary canine was altered unilaterally or bilaterally by 1, 2, and 3 mm ($P < 0.05$).

The multiple comparisons among the different groups are illustrated in Table 5. For bilateral increase of 1 mm in crown height, there was no significant difference in the scores given by orthodontists and dentists ($P < 0.05$). For a unilateral increase of 3 mm and bilateral increase of 1 mm in crown height, there was a significant difference between the scores given by dentists and laypersons ($P < 0.05$). Orthodontists were more critical when evaluating smile esthetics. Most evaluators considered all three components, i.e., lips, teeth, and gingiva while assessing smile’s attractiveness.

The threshold levels at which each group could distinguish between esthetic and less esthetic dental features are shown in Table 6. For orthodontist up to 1 mm of alteration and for dentist and layperson 2 mm alteration in gingival margin in all the four groups were considered as esthetic and any alteration beyond that were considered as unaesthetic.

DISCUSSION

A synergy between macro-, mini-, and micro-esthetic factors is necessary for optimizing smile esthetics. The canines are the cornerstone of the dentition and play an important role in designing smile esthetics. Very often, these are malaligned in the buccolingual plane, and its correction offer challenges to the clinicians as the gingival margins is gingival or occlusal to what is desired because of long or short clinical crown. Other important criteria are the symmetry between the right and left sides. Therefore, this study emphasized the symmetric and asymmetric alterations in the gingival margin of maxillary canine by increasing and decreasing the crown length on smile esthetics.

The perception of smile esthetics varies from individual to individual. As reported in literature, a professional’s opinions regarding facial esthetics may not coincide with the perceptions and expectations of patients or laypersons. Keeping this in mind, three groups of evaluators were selected: Layperson, dentist, and orthodontist reflecting three different kinds of mindsets.
Table 1: Mean visual analog scores for altered images in Group 1

| Group | Orthodontists | Dentists | Laypersons |
|-------|---------------|----------|------------|
|       | n  | UI1 | UI2 | UI3 | n  | UI1 | UI2 | UI3 | n  | UI1 | UI2 | UI3 |
| Mean±SD | 7.80±0.71 | 6.48±0.92 | 5.44±1.19 | 4.96±1.02 | 8.28±0.89 | 7.36±0.99 | 6.68±1.06 | 6.12±1.50 | 8.36±0.81 | 7.92±1.04 | 7.48±1.12 | 7.04±1.02 |
| F     | 13.69 | 18.31 | 4.30 |
| P     | 0.000* | 0.000* | 0.017* |

*Very highly significant, †Significant. UI=Unilaterally increased, SD=Standard deviation

Table 2: Mean visual analog scores for altered images in Group 2

| Group | Orthodontists | Dentists | Laypersons |
|-------|---------------|----------|------------|
|       | n  | BI1 | BI2 | BI3 | n  | BI1 | BI2 | BI3 | n  | BI1 | BI2 | BI3 |
| Mean±SD | 7.80±0.71 | 7.44±1.19 | 6.37±1.21 | 4.04±1.20 | 8.28±0.89 | 7.04±1.81 | 7.48±1.00 | 7.20±1.32 | 8.36±0.81 | 7.92±0.75 | 7.16±0.69 | 6.32±0.96 |
| F     | 67.17 | 0.74 | 40.72 |
| P     | 0.000* | 0.483 | 0.000* |

*Very highly significant. SD=Standard deviation, BI=Bilaterally increased

Table 3: Mean visual analog scores for altered images in Group 3

| Group | Orthodontists | Dentists | Laypersons |
|-------|---------------|----------|------------|
|       | n  | UD1 | UD2 | UD3 | n  | UD1 | UD2 | UD3 | n  | UD1 | UD2 | UD3 |
| Mean±SD | 7.80±0.71 | 6.80±0.82 | 5.48±0.92 | 5.12±1.30 | 8.28±0.89 | 7.36±0.86 | 6.52±0.65 | 6.72±0.79 | 8.36±0.81 | 7.92±0.75 | 6.32±0.96 |
| F     | 18.31 | 0.000* | 0.001* |
| P     | 0.000* | 0.014 | 0.000* |

*Very highly significant, †Highly significant. SD=Standard deviation, UD=Unilaterally decreased

Table 4: Mean visual analog scores for altered images in Group 4

| Group | Orthodontists | Dentists | Laypersons |
|-------|---------------|----------|------------|
|       | n  | BD1 | BD2 | BD3 | n  | BD1 | BD2 | BD3 | n  | BD1 | BD2 | BD3 |
| Mean±SD | 7.80±0.71 | 7.00±0.95 | 5.60±1.20 | 4.52±1.48 | 8.28±0.89 | 7.48±0.92 | 7.64±0.70 | 6.84±0.75 | 8.36±0.81 | 7.92±0.75 | 6.40±0.80 |
| F     | 33.03 | 7.11 | 28.37 |
| P     | 0.000* | 0.021 | 0.000* |

*Very highly significant, †Highly significant. SD=Standard deviation, BD=Bilaterally decreased

Table 5: Multiple comparisons at different level of alterations

| Groups | Orthodontists | Dentists | Laypersons |
|-------|---------------|----------|------------|
| O and D | 0.002* | 0.000* | 0.001* | 0.880 | 0.026* | 0.000* | 0.001* | 0.000* | 0.000* | 0.000* | 0.000* |
| O and L | 0.000* | 0.000* | 0.000* | 0.037* | 0.000* | 0.000* | 0.000* | 0.000* | 0.000* | 0.000* | 0.000* |
| D and L | 0.48 | 0.15 | 0.009* | 0.05* | 0.168 | 0.831 | 0.062 | 0.057 | 0.014* | 0.227 | 0.021* |

Significant, †Highly significant, *Very highly significant. O=Orthodontists, D=Dentists, L=Laypersons, UD=Unilaterally decreased, UI=Unilaterally increased, BD=Bilaterally decreased

Table 6: Threshold level of significance difference for altered images (in mm)

| Groups | Orthodontists | Dentists | Laypersons |
|-------|---------------|----------|------------|
| Group 1 | 1 | ND | ND |
| Group 2 | 1 | 2 | ND |
| Group 3 | 1 | 2 | 2 |
| Group 4 | 1 | 2 | 2 |

ND=Not determined

Among each group of evaluators, both males and females were included in this study. The VAS scores of the male and female evaluators were clubbed together as there was no significant difference among them. Geron and Atalia[6] found out that females were more tolerant of upper gingival exposure. This is contradictory to our findings.

A harmonious and symmetric relationship between various facial and oral tissues contributes to the esthetics of a smile. Hence, the present study assessed the relative influence of different smile components (lip, gingiva, and teeth) on the three groups of evaluators while judging smile images. It was observed that all these components were given equal importance while assessing the smile photographs. This is similar to the study of Kumar et al.[7]

Perception of smile attractiveness is significantly influenced by the variations in the Vermillion heights of the upper and lower lips.[8] To minimize such possible confounding influences, a single image was used in the present study to generate different alterations in the smile.

It was found that symmetric alterations of canine were scored higher as compared to asymmetric alterations by all the three group of evaluators. Kokich et al.[9] evaluated symmetrical alterations in the gingival
margins of the maxillary central incisors and had found similar results.

In the present study, it was found that orthodontists did not perceive asymmetries between maxillary canine gingival margins up to 1.0 mm and any alteration beyond this was considered unaesthetic, whereas dentists and laypeople did not perceive asymmetries up to 2.0 mm and any alteration beyond 2 mm were considered unaesthetic. Correa et al.\(^2\) determined the perception of smile esthetics among orthodontists and laypeople with respect to asymmetries in the maxillary canine gingival margin in full-face and close-up smile analyses and found out that the perceptions of unilateral asymmetries in the gingival margin levels of the maxillary canines were 1.0 mm for orthodontists and 1.5–2.0 mm for laypersons. These findings are similar to the present study. Therefore, correction of slight gingival discrepancies between the maxillary canines might reflect an excessive concern by dental specialists rather than an esthetic need.

Asymmetries between maxillary canine gingival margins may occur due to anatomic or morphologic differences, tooth wear causing overeruption, gingival hyperplasia or recession, or replacement of canines by premolars. Several treatment approaches such as periodontal plastic surgery, intrusion followed by restoration of the incisal edge or extrusion of the contralateral tooth and incisal grinding and composite restorations have been suggested to correct it.\(^8\) Therefore, orthodontic treatment planning must be thoroughly discussed with the patient and treatment be decided according to the patient’s esthetic demands.

**CONCLUSION**

Orthodontists were more critical than the dentists and layperson in evaluating the gingival margin of maxillary canine symmetric and asymmetric alterations. It was found out that symmetric alterations were more acceptable than asymmetric alterations of maxillary canine gingival margins. Orthodontists were able to detect asymmetry up to 1 mm and dentists and laypersons could detect asymmetry up to 2 mm.

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**Conflicts of interest**

There are no conflicts of interest.

**REFERENCES**

1. Rabie AB, Wong RW, King NM. Aesthetic dentistry and orthodontics. Dent Bull 2006;11:7-10.
2. Correa BD, Vieira Bittencourt MA, Machado AW. Influence of maxillary canine gingival margin asymmetries on the perception of smile esthetics among orthodontists and laypersons. Am J Orthod Dentofacial Orthop 2014;145:55-63.
3. Chu SJ, Tan JH, Stappert CF, Tarnow DP. Gingival zenith positions and levels of the maxillary anterior dentition. J Esthet Restor Dent 2009;21:113-20.
4. Rosa M, Olimpo A, Fastuca R, Caprioglio A. Perceptions of dental professionals and laypeople to altered dental esthetics in cases with congenitally missing maxillary lateral incisors. Prog Orthod 2013;14:34.
5. Miller C. The smile line as a guide to anterior esthetics. Dent Clin North Am 1989;33:157-64.
6. Geron S, Atalia W. Influence of sex on the perception of oral and smile esthetics with different gingival display and incisal plane inclination. Angle Orthod 2005;75:778-84.
7. Kumar S, Gandhi S, Valiathan A. Perception of smile esthetics among Indian dental professionals and laypersons. Indian J Dent Res 2012;23:295.
8. Scott CR, Goonewardene MS, Murray K. Influence of lips on the perception of malocclusion. Am J Orthod Dentofacial Orthop 2006;130:152-62.
9. Kokich VO, Kokich VG, Kiyak HA. Perceptions of dental professionals and laypersons to altered dental esthetics: Asymmetric and symmetric situations. Am J Orthod Dentofacial Orthop 2006;130:141-51.
10. Kovitch V. Esthetics and anterior tooth position: An orthodontic perspective. Part I: Crown length. J Esthet Dent 1993;5:19-23.
11. Garber DA, Salama MA. The aesthetic smile: Diagnosis and treatment. Periodontol 2000 1996;11:11-28.
12. Kokich VG, Nappen DL, Shapiro PA. Gingival contour and clinical crown lengths: Their effect on the aesthetic appearance of maxillary anterior teeth. Am J Orthod 1984;86:89-94.
13. Montanaro L, Campoccia D, Rizzi S, Donati ME, Breschi L, Prati C, et al. Evaluation of bacterial adhesion of Streptococcus mutans on dental restorative materials. Biomaterials 2004;25:4457-63.
14. Lima FG, Romano AR, Correa MB, Demarco FF. Influence of microleakage, surface roughness and biofilm control on secondary caries formation around composite resin restorations: An in situ evaluation. J Appl Oral Sci 2009;17:61-5.