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Influence of Maxillary Canine Gingival Margin Asymmetries on Smile Aesthetics: A Comparative Study Among Dental Specialists

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ABSTRACT

The first essential step in designing appealing grins is comprehending the elements that influence smile attractiveness. The study aimed to evaluate how four distinct groups—orthodontists, prosthodontists, endodontists, and laypeople—perceived the aesthetics of smiles regarding asymmetry in the gingival margins of the maxillary canines. Two subjects—one male and one female—were photographed with their frontal smiles in both full-face and close-up views. Digital adjustments were made to the images to produce asymmetrical pictures that matched the central incisors' gingival margin levels with the maxillary canines. Four phases of changes were done to the right canine's gingival margin using this new picture, with 1-mm increments and decrements. Using visual analog scales, 40 orthodontists, 40 prosthodontists, 40 endodontists, and 40 laypeople evaluated the smiles' final full-face and close-up photos. In most cases, a statistically significant difference was observed, with orthodontists being more accurate than endodontists, prosthodontists, and laypeople in identifying grin asymmetries. This study suggests that prosthodontists, endodontists, and orthodontists may detect gingival marginal asymmetry of the maxillary canine as small as 1 mm.

Keywords: Smile perception, Endodontist, Orthodontist, Prosthodontist, Asymmetric gingival contour

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Introduction

Globally, patients' demands for aesthetics have grown, and those needing dental adjustments increasingly want smiles that seem younger and more appealing. This is also true in the realm of orthodontics. More visually attractive smiles are what patients want from orthodontic treatment, not only better tooth alignment. Orthodontists' goals have also broadened, and they are working to include several methods in their clinical practice that will improve the appearance of smiles [1]. Harmonious gingival margins of the central incisors [2, 3], sufficient gingival indication [4, 5], suitable buccal corridor spaces [6], an ideal smile arc with the curvature of the maxillary anterior incisal edges following the lower lip border, and adequate shape and zenith of the gingival margins in the region of aesthetics [7, 8] are all signs of an aesthetically pleasing smile. The grin analysis, however, is arbitrary and may alter for other demographic groups. Several studies assessed the aesthetic impact of asymmetries in various grin components [9–12].

Numerous research studies on the elements determining grin aesthetics and how different groups of individuals perceive them have been carried out by Kokich *et al*. [13]. In one research study, they changed the length of the maxillary central incisor crown and the gingival margins of the maxillary lateral incisors. They then evaluated how general dentists, orthodontists, and laypeople perceived the aesthetics of the changes. When it came to central incisor crown size, orthodontists could see changes as little as 1 mm, general dentists could see changes as small as 1.5 mm,

and laypeople could see differences as large as 2 mm. Similar characteristics were examined in a related study by Kokich *et al*. [14]; however, asymmetries were hard to find and were in increments of 0.5 mm. A similar outcome was reached in this study: ordinary dentists and laypeople were less accurate in detecting subtle changes, but orthodontists were more sensitive and able to detect a difference of even 0.5 mm. Canines, the foundation of the grin arch, were not taken into account in the aforementioned research, which concentrated on the impact of central and lateral incisors on smile aesthetics. As a result, the findings of this research cannot be applied to dogs and how they affect the appearance of smiles [15].

The asymmetries of maxillary canine incisal edges and how orthodontists, prosthodontists, and laypeople perceive them were also assessed by Pinho *et al*. [16]. According to their findings, the difference could not be detected by either group up to 2 mm [16]. Similar to the research on the impact of canine incisal edge asymmetry, there were not many studies that attempted to document the impact of canine gingival marginal asymmetries on smile aesthetic perception [10]. Clinical gingival margin asymmetries are frequently observed, so it's critical to evaluate their impact on a smile's aesthetic result [17]. Particularly in situations where premolars are replaced with canines, gingival marginal symmetry is crucial [18]. When there is a gingival margin asymmetry in canines, it has been proposed to intrude on one of the canines and repair the tooth to produce a harmonious gingival margin level with the contralateral canine [19, 20]. Nevertheless, such attempts will be insignificant if they cannot be discovered. The issue arises whether such imbalances necessitate any action. In certain cases, orthodontic therapy requires a multidisciplinary approach. Many orthodontic patients require crowns, veneers, or restorations once their therapy is completed. Patients are usually sent to orthodontics to rectify occlusion-gingival crown height. We are forced to consider if it is important to address finer issues when such precise adjustments are not understood by the general public. Does correcting small gingival asymmetries serve an aesthetic purpose, or is it just overdoing it? There can be a difference of opinion on the same. How successful will multidisciplinary therapy be if various specializations have differing opinions? Assessing the three disciplines' perceptions of the gingival border asymmetry of maxillary canines—orthodontists, prosthodontists, endodontists, and laypeople—was the aim of this study. The null hypothesis was that all four groups would give equal weight to smiles with gingival asymmetry in terms of their attractiveness.

Materials and Methods

This study was conducted in the Department of Orthodontics, of a private university. A sample size of 40 participants per group was calculated using G*Power with a power of 95% and alpha at 0.05.

Sample selection

There were 40 participants in each of the four examiner groups—endodontists, prosthodontists, orthodontists, and laypeople—in the sample. Judgmental sampling was used to choose the participants. Twenty pictures of two people's smiles were utilized, ten of which were full-face and ten of which were close-ups. Both participants were 25 years old, postgraduate students in the orthodontics department, and had lovely smiles without any noticeable facial asymmetry.

Based on prior research, the following traits of a basic smile were examined: symmetrical smile, consonant smile arc, gingival display of less than 2.0 mm, and suitable buccal corridor space.

Photo album

The same photographer (N.M.) took all of the photos with a high-definition digital camera with an 18*55 lens (Canon, Tokyo, Japan). Both researchers agreed on the choice of pictures for the survey, and Photoshop (CS5.1; Adobe Photoshop, San Jose, Calif.) was employed to modify the pictures to create gingival asymmetry; color contrast and brightness were improved, and pigmentation of lips and skin was masked off. Four changes were made to the level of the canine gingival margins on one side, resulting in 1 mm and 2 mm high and low differences about the contralateral tooth. Five pictures were collected for each person **(Figure 1)**. Each picture was then condensed to produce an image with dimensions equal to those of the actual patient. These were printed on standard A3-sized sheets.

a)

b)

c)

d)

e)

Figure 1. Altered gingival margins of maxillary canine; a) Neutral/unaltered, b) 2 mm high gingival margin, c) 1 mm high gingival margin, d) 2 mm low gingival margin, and e) 2 mm low gingival margin.

Questionnaire

Each of the 160 participants—40 orthodontists, 40 prosthodontists, 40 endodontists, and 40 laypeople with a basic education unrelated to dentistry—was given a different album. A 5-cm-long VAS scale was printed with each image, and each participant was given an explanation of the survey and asked to rate the images' attractiveness. The far left of the scale had the lowest score of 1, which was “very unattractive”, while the far right had the greatest score of 5, which was “very attractive”.

Statistical analysis

The SPSS statistics software version 23.0 was used to analyze the data. The replies of the participants were reported using descriptive statistics. Four groups' means were compared using ANOVA.

Results and Discussion

After calculating the scores for each smile, the one with a 1 mm high gingival margin received the highest overall score (mean score = 4.22), followed by the one without gingival asymmetry (mean = 4.01). In all four rater groups, smiles with asymmetries of 2.0 mm low gingival margin received the lowest scores **(Table 1)**.

Table 1. Overall mean score for each smile as given by participants.

Gingival margin level (Asymmetry in mm)	Overall mean score	SD
1 mm high	4.22	0.79
1 mm low	3.36	0.99
Neutral	4.10	0.62
2 mm high	2.23	0.91
2 mm low	3.38	1.17

Smiles without asymmetries were deemed the most aesthetically pleasing by prosthodontists and orthodontists. The grin with a 1 mm high gingival asymmetry received the highest mark from the endodontist. Smiles with gingival asymmetry of 1.0 mm received higher marks from laypeople. All rater groups gave the discrepancy of 2.0 mm low gingival asymmetry the lowest marks. All four groups' ratings differed significantly from one another. The grin without asymmetry received the greatest score from orthodontists (P-value = 0.037*). An endodontist assigned the highest score to a smile with 1 mm high gingival asymmetry (P-value = 0.001*). The layman group scored considerably higher on smiles with 2 mm low gingival asymmetry (P-value = 0.001*) **(Table 2)**.

Table 2. The mean and standard deviation for each smile as rated by four groups of examiners.

Gingival asymmetry (mm)	Orthodontist		Endodontist		Prosthodontist		Layperson		ANOVA (P-value)
1 mm high	4.25	0.71	4.75	0.44	3.70	0.92	4.20	0.69	0.0001*
1 mm low	3.40	0.50	3.55	0.88	2.65	1.13	4.20	0.83	0.0001*

Neutral	4.40	0.75	4.15	0.67	3.80	0.61	4.05	0.51	0.037*
2 mm high	1.90	0.71	3.40	0.50	2.30	0.92	4.30	0.57	0.0001*
2 mm low	1.85	0.67	2.05	0.68	1.95	1.09	3.10	0.64	0.0001*

*Statistically significant at P > 0.05

One of the main elements influencing overall small aesthetics is the symmetry of the grin or the symmetry between the right and left sides of the smile. While laypeople could only recognize asymmetry up to 2 mm, participants in the current study who were members of the three dental specialties—orthodontists, endodontists, and prosthodontists—were able to detect asymmetries within 1 mm of modification. The results of Kokich *et al*. who altered the maxillary central incisors and assessed the smile's aesthetics, are consistent with this conclusion. In contrast to a layman who could only detect discrepancies of 2.0 mm, their investigation found that orthodontists were able to notice discrepancies as tiny as 1.0 mm [14]. In related research, Kokich *et al*. assessed the subject groups' sagacity on the changed gingival margins of the central incisors' maxillary and its relationship to the contralateral tooth and came to a similar conclusion. While laypeople were less astute and could only notice changes over 2.0 mm, orthodontic professionals were more adept at spotting differences up to 1 mm [13].

In contrast, Pinho *et al*. [16] investigation found that both laypeople and orthodontists were unable to detect unilateral asymmetry of the maxillary gingival edge up to 2 mm [16]. Both the current study's findings and those of other authors can provide light on aesthetic management when a multidisciplinary approach is used. Several clinical circumstances can cause variations in the gingival margins of canines, including congenital anatomical or morphologic variation, supra-eruption after occlusal wear of crown structure, gingival conditions like recession or hyperplasia, and subjects whose lateral incisors/canines are congenitally absent and must be replaced with canines/premolars. Uneven canine gingival margins might result in an unsightly grin when lateral conditions happen unilaterally. The asymmetrical gingival marginal features may also occasionally result from the disparity in bracket location, variable torque expression, and tip expression. Many treatment methods may be used to fix the same, including torquing the wire and moving the brackets. However, in some circumstances, interdisciplinary methods may be necessary, such as periodontal procedures [21, 22], tooth intrusion and incisal composite building, or extrusion of the contralateral tooth and incisal contour reshaping. The current study's findings indicate that the magnitude of gingival margin asymmetry should be taken into account before developing any treatment plan. Since the asymmetry is imperceptible to laypeople, a comprehensive multidisciplinary approach might not be necessary.

Veneers, crowns, implants, and restorations are all necessary for orthodontic treatment to be completed, so an interdisciplinary approach is frequently required. The current study's findings indicate that there is a discrepancy in the scores given by three groups representing three distinct specialties.

It may seem to the dentist that meticulously adjusting the gingival margins of the maxillary canines is more of a cosmetic issue than a patient concern. This is further supported by the findings of the current study, which showed that laypeople were unable to perceive asymmetries as subtle as 2 mm. Orthodontists' evaluations were harsher in most cases, as seen by their low scores for asymmetrical grins. As a result, it is reasonable for an orthodontist to talk with the patient about the course of treatment and its progress. In cases when an interdisciplinary approach is necessary, specialists must agree. No discernible changes were seen between full-face and close-up grin photos (P = 0.05). The findings of previous investigations [10, 23, 24] are consistent with this one. It is possible to infer from this result that facial features such as the nose, eyes, and hair do not affect the appearance of a grin. Flores-Mir *et al*. [25] found that laypeople's evaluations of full-face and close-up photos differed. No research has yet been done comparing how different specializations perceive asymmetry. The components of a grin, however, need to be properly measured and standardized in light of the growing demand for aesthetics and the availability of multidisciplinary treatment options.

We utilized pictures of two adults—one male and one female—with appropriate grin traits for our investigation. Few research studies have employed more than one subject's image, which offers a larger variety of characteristics that can impact the perception of a smile [26, 27]. Previous studies reporting on the perception of smile aesthetics used just one image, often the grin of a white lady [13, 28]. Two participants—one male and one female—with two distinct ethnic origins were included in a recent study, and their perceptions of the features of smiles did not appear to be influenced. The findings and conclusions, however, are based on average scores, and applying

them to each patient is challenging because every grin is different and susceptible to review. Thus, in the end, it's critical to reach a consensus with the patient to either leave or fix the asymmetry in their grin.

Conclusion

The outcomes of this study demonstrate the following.

1. In general, orthodontists found that smiles with a 1 mm high gingival margin and those without asymmetries were the most appealing. Smiles without asymmetries and those with asymmetries of 1 mm high gingiva were deemed the most appealing by prosthodontists. Smiles with asymmetries were almost as attractive to laypeople, but endodontists found that smiles with a 1 mm high gingival margin were the most appealing. The smiles with a low gingival line of 2.0 mm received the lowest marks from all four rater groups.
2. In the majority of cases, orthodontists evaluated patients more acutely, identifying a larger proportion of asymmetrical smiles.

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