Original Article

PERCEPTION OF SMILE AESTHETICS AS INFLUENCED BY GINGIVAL MARGIN ASYMMETRIES OF MAXILLARY CANINE AMONG DIFFERENT SPECIALITIES

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ABSTRACT

An understanding of the factors influencing the attractiveness of a smile is an important step in creating attractive smiles. The objective of the study was to assess the perception of smile aesthetics among four different groups, which included orthodontists, prosthodontists, endodontists, and laypeople concerning asymmetries in the maxillary canines' gingival margins. Full-face and close-up photographs of the frontal smiles of 2 subjects (1 Female and 1 Male subject) were used. The images were altered digitally to create asymmetrical images with that of the gingival margin levels of the maxillary canines matching the central incisors. From this new image, 4 stages of alterations were made in the gingival margin of the right canine in 1-mm increments and decrements. Final full-face and close-up images of the smiles were assessed by 40 orthodontists, 40 prosthodontists, 40 endodontists, and 40 laypeople, who rated the level of attractiveness of each smile on visual analog scales. In most situations, a statistically significant difference was found, with orthodontists being more accurate followed by endodontists then prosthodontists and laypersons in detecting smile asymmetries. It can be concluded through this study that orthodontists, endodontists, and prosthodontists could detect gingival marginal asymmetry of maxillary canine up to 1mm.

Key words: Smile perception, Endodontist, Orthodontist, Prosthodontist, Asymmetric gingival contour.

Introduction

Aesthetic demands have increased around the globe and patients seeking dental corrections also demand attractive and younger-looking smiles. The field of orthodontics is no exception. Patients' expectation from orthodontic treatment is not limited to the mere alignment of teeth but rather more aesthetically pleasing smiles. The aim of orthodontists has also expanded and they are attempting to include several techniques into their clinical routine which would enhance the smile aesthetics [1]. An aesthetically attractive smile should include characteristics such as harmonious gingival margins of central incisors [2, 3], adequate gingival show [4, 5], appropriate 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 zone of aesthetics [7, 8]. However, the smile analysis is subjective and may vary amongst different groups of people. Several studies evaluated the influence of asymmetries in different components of a smile on aesthetics [9-12].

Kokich *et al*. have conducted several studies on factors influencing smile aesthetics and the level of perception of the same among different groups of people [13]. In a study, they altered the length of maxillary central incisor crown along with alterations in gingival margins of maxillary lateral incisors following which they assessed the aesthetic perception of general dentists, orthodontists, and laypersons. With respect to the crown size of central incisors, the orthodontists perceived alteration up to 1 mm, whereas general dentists could perceive discrepancy up to 1.5 mm, whereas laypersons could perceive the discrepancy when the variation was above 2 mm. In similar research by Kokich *et al*. [14] similar parameters were investigated; this time asymmetries were in an increment of 0.5 mm and difficult to detect. In this study, a similar conclusion was drawn with orthodontists being more sensitive as they were able to perceive a discrepancy of even 0.5 mm, general dentists and laypeople were less accurate in perceiving fine alterations. The aforementioned studies focused on the influence of central and lateral incisors on smile aesthetics, whereas canines being the cornerstone of smile arch was not taken into consideration. Therefore, the results of these studies cannot be implemented for canines and their influence on smile aesthetics [15].

Similarly, asymmetries of incisal edges of maxillary canines and their perception by orthodontists, prosthodontists, and laypeople were evaluated by Pinho *et al*. Their finding concluded that neither of the groups was able to perceive the discrepancy up to 2mm [16]. As the influence of incisal edge asymmetry of canines was studied, similarly few studies also attempted to report on the influence of gingival marginal asymmetries of canines on the perception of smile aesthetics. [10]. Gingival margin asymmetries are common to appear

clinically and therefore it's important to assess the influence of the same on the aesthetic outcome of a smile [17]. Gingival marginal symmetry is of importance, especially in cases where premolars are substituted as canines [18]. When there is a gingival margin asymmetry of canines, it has been suggested to intrude on one of the canines and restore the tooth to establish a harmonious gingival margin level with the contralateral canine [19, 20]. However, such attempts will be insignificant if they cannot be detected. The question arises that do such asymmetries require any intervention. Orthodontic treatment may require an interdisciplinary approach in certain situations. Many orthodontic patients need a crown/veneer/restoration post-orthodontic treatment completion. Also, frequently patients are referred to orthodontics for correction of occluso-gingival crown height. Such detailed corrections, if, aren't appreciated by a layperson force us to ponder that weather addressing finer details is necessary? Is addressing minor gingival asymmetries is an aesthetic need or merely an overtreatment? A difference in opinion for the same may exist. If there is a difference in opinion amongst different specialties, will interdisciplinary treatment be a success? The purpose of this study was to assess the perception of gingival margin asymmetry of maxillary canines amongst the three disciplines namely orthodontists, prosthodontists, endodontists, and laypersons. The null hypothesis was that all four groups will rate the attractiveness of smiles with gingival asymmetries equally.

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

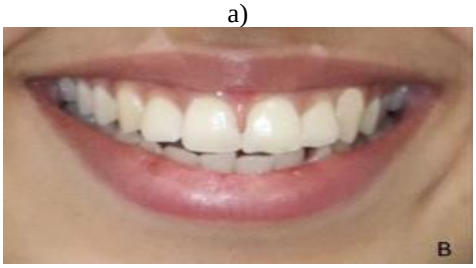
The sample included 40 participants each in 4 groups of examiners, which were endodontists, prosthodontists, orthodontists, and layperson. Participants were selected by judgmental sampling. Twenty images —10 full-face views and 10 close-up views—of the smile were used from 2 subjects. Both the subjects were postgraduate students in the Department of Orthodontics; both subjects were 25 years old with no gross facial asymmetry attractive smiles.

Following basic smile, characteristics were looked upon based on previous literature: symmetrical smile, consonant smile arc, gingival display of less than 2.0 mm, and appropriate buccal corridor space.

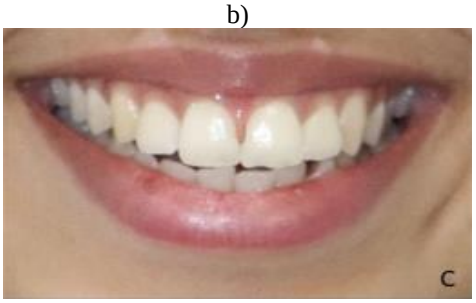
Photo album

All the photographs were captured by the same photographer (N.M) using the high-definition digital camera with an 18*55 lens (Canon, Tokyo, Japan). Image selection for the survey was done with the agreement of both the investigators. Photoshop (CS5.1; Adobe Photoshop, San Jose, Calif) was used for altering the images. The photos were altered to produce the gingival asymmetry; color contrast and brightness were enhanced, pigmentation of lips and skin were masked off. Four alterations were made in the level of gingival margins of the canines on one side, keeping discrepancies of 1mm and 2mm high and low in relation to their contralateral tooth. 5 images per subject were obtained **(Figures 1a-1e)**. Each image was then condensed to achieve an image with measurements identical to those on the actual patient. These were printed on standard A3 size sheets.

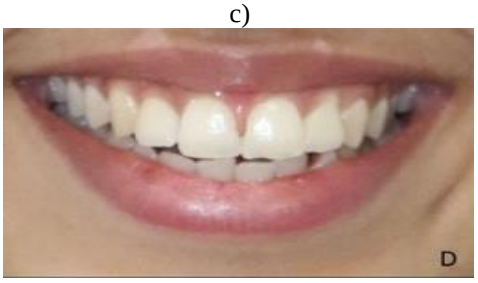
a)



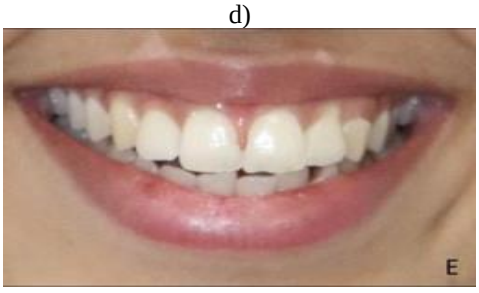
b)



c)



d)



e)

Figure 1. Altered gingival margins of maxillary canine. a) Neutral/unaltered. b) 2mm High Gingival Margin. c)1mm High Gingival Margin. d) 2mm Low Gingival Margin. e) 2mm Low Gingival Margin.

Questionnaire

A separate album was given to the 160 participants (40 orthodontists, 40 prosthodontists, 40 endodontists, and 40 laypeople with a basic education not pertaining to dentistry). Each participant was explained about the survey and asked to evaluate the attractiveness of the images using a 5-cm long VAS scale, which was printed along with each image. The scale ranged from "very unattractive" towards the extreme left with the least score of 1 and on the far right was "very attractive" with the highest score of 5.

Statistical analysis

Data was analyzed using SPSS Statistics Software-Version 23.0. Descriptive Statistics was done to report the responses of participants. ANOVA was used to compare the means of four groups.

Results and Discussion

Assessment of scores for all the smiles showed that overall highest score was given to smiling with a 1mm high gingival margin (Mean Score=4.22) followed by one with no gingival asymmetry (Mean = 4.01). For all four groups of raters, the lowest scores were assigned for the smiles with asymmetries of 2.0 mm low gingival margin **(Table 1)**.

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

Gingival Margin Level (Asymmetry in mm)	Overall Mean Score	S.D
1mm High	4.22	0.79
1mm Low	3.36	0.99
Neutral	4.10	0.62
2mm High	2.23	0.91
2mm Low	3.38	1.17

Orthodontists and prosthodontists rated smile without asymmetries as most aesthetic. The endodontist assigned the highest score to smile with 1mm high gingival asymmetry. Layperson gave higher scores to the smiles with gingival asymmetries of 1.0 mm. The lowest scores were for discrepancies of 2.0 mm low gingival asymmetry by all groups of raters. There was a significant difference in rating amongst all four groups. Orthodontists gave the highest score to smile without asymmetry (P-value= 0.037*). Smile with 1mm High gingival asymmetry was given the highest score by an endodontist (P-Value=0.001*). Smile with 2mm Low gingival asymmetry was given a significantly higher score by the layperson group (P-Value=0.001*) **(Table 2)**.

Table 2. Mean and Standard Deviation for each smile as rated by four groups of examiners.

Gingival Asymmetry (mm)	Orthodontist		Endodontist		Prosthodontist		Layperson		ANOVA (P-Value)
1mm High	4.25	0.71	4.75	0.44	3.70	0.92	4.20	0.69	0.0001*
1mm 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*
2mm High	1.90	0.71	3.40	0.50	2.30	0.92	4.30	0.57	0.0001*
2mm 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									

The symmetry between the right and left sides of the smile, i.e., a symmetrical smile is considered a major factor that influences overall small aesthetics. In the current study, participants of the three dental specialties i.e., orthodontists, endodontists, prosthodontists were able to perceive asymmetries within 1mm alteration, whereas laypersons could only appreciate the asymmetry if it was up to 2mm. This finding is in line with the findings of Kokich *et al*., where alteration was done with respect to maxillary central incisors and the smile aesthetics was evaluated. Their study concluded that discrepancy as fine as within 1.0-mm was perceived well by an orthodontist compared to a layperson who could only perceive the discrepancy of 2.0 mm [14]. In a similar study, Kokich *et al.* evaluated sagacity of different subject groups towards altered gingival margins of maxillary of central incisors and its relation to contralateral tooth found and concluded a similar result outcome Orthodontists were more acute in detecting discrepancy up to 1mm, whereas laypeople were less sagacious and could only perceive only alterations above 2.0 mm [13].

The study by Pinho *et al*. concluded a different result, wherein both orthodontists and laypeople could not perceive unilateral asymmetry of maxillary gingival margin up to 2mm [16]. These findings by different authors and the results of the current study can provide insight for aesthetic management in cases involving a multi-disciplinary approach. Gingival margins of canine can vary in several clinical situations like congenital anatomical / morphologic variation, supra-eruption following occlusal wear of crown structure, conditions affecting gingival such as recession or hyperplasia, and in subjects where lateral incisors/ canines are congenitally missing and have to be substituted for canines/ premolars. When lateral situations occur unilaterally, asymmetric gingival margins of canines may cause an unaesthetic smile. Occasionally, the discrepancy in

bracket positioning, variable torque expression, and tip expression might also lead to asymmetrical gingival marginal characteristics. The correction for the same can be done using several treatment approaches such as re-positioning of brackets and torquing the wire. However, sometimes inter-disciplinary approaches may be required such as periodontal surgeries [21, 22], intrusion of the tooth and composite buildup of the incisal, or in certain cases extrusion of the contralateral tooth and reshaping incisal contour. According to the finding of the current study, the immensity of the gingival margin asymmetry must be considered before planning on any clinical treatment protocol. Because the asymmetry cannot be perceived by laypeople an extensive multidisciplinary approach may not be required.

An interdisciplinary approach is often needed in orthodontic practice, where veneers/crowns/implants/restoration is required for completion of orthodontic treatment. The results of the current study show that there is a disparity between scores assigned by three groups belonging to three different specialties.

Detailed correction of gingival margins of maxillary canines might appear more of an aesthetic concern by the dentist rather than being the patient's concern. This is demonstrated by the results of the current study as well where laypersons did not have a fine perception of asymmetries up to 2mm. In a majority of scenarios, evaluation by orthodontists was more critical as reflected by their low scoring of asymmetric smiles. This, therefore, makes it justifiable for an orthodontist to discuss the treatment progress and process with the patient and in situations where an interdisciplinary approach is required, a consensus between specialties is required. Comparison of full-face photographs with close-up smile photographs revealed no significant differences (P =0.05). This finding is in line with the results of other studies [10, 23, 24]. A hypothesis can be drawn from this finding that elements of the face like eyes, nose, and hair do not have an impact on smile aesthetics as such. Flores-Mir *et al.* reported a difference in perceptions when laypeople assessed full-face photographs compared to close-up photographs [25]. Studies comparing the perception of asymmetry amongst various specialties have not been conducted yet. But, with increased aesthetic demand and interdisciplinary treatment alternatives, the components of a smile must be assessed precisely and must be standardized.

In our study, we used photographs from 2 adults (1 Male, 1 Female) with acceptable smile characteristics. Previous studies reporting on the perception of smile aesthetics used only 1 image, usually a white woman's smile [13, 26], and few studies have used more than 1 subject's image which provides a wider range of variables that might influence the perception of a smile [27, 28]. In a recent study 2 subjects were included,1 male and 1 female of two different racial backgrounds which did not seem to influence the perception towards smile characteristics. The results and conclusion are however the averages of the score and to implement these on any patient is difficult because each smile is subjective to evaluation and unique in its sense. Therefore, ultimately an agreement with the patient to leave or treat the smile asymmetry is important.

Conclusion

The outcomes of this study demonstrate the following.

1. In general, the most attractive smiles for orthodontists were the ones without asymmetries and the ones with a 1mm high gingival margin. For prosthodontists, the most attractive smiles were those without asymmetries and with asymmetries of 1mm high gingiva. For an endodontist smile with a 1mm high gingival margin was most attractive, for layperson symmetrical and smiles with asymmetries were nearly attractive. For all four groups of raters, the lowest scores were assigned to the smiles of 2.0 mm of low gingival line.
2. In most scenarios, orthodontists were more acute in their evaluations, with a higher percentage of perceived asymmetric smile

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