

# Perceptions of gingival display aesthetics among orthodontists, maxillofacial surgeons and laypersons

## Estudo comparativo da percepção estética do sorriso gengival por ortodontistas, cirurgiões buco-maxilo-faciais e leigos

### Abstract

**Purpose:** The purpose of this study was to compare the influence of maxillary gingival exposure on the aesthetic perception of smiles among different groups of individuals.

**Methods:** Single smile photographs were taken of a Caucasian man, a Caucasian woman, an Afro-Brazilian man and an Afro-Brazilian woman. All photographs were processed with a computer; five images were constructed from each original photograph to depict different amounts of gingival display: 0, 1, 3, 5 and 7 mm. Pictures created from the same group were randomly arranged and submitted for evaluation by 60 subjects in three groups (orthodontists, maxillofacial surgeons and laypersons) who were asked to rate the attractiveness of each image on an analogical visual scale.

**Results:** The three groups of subjects all rated the 0 and 1 mm gingival display images similarly, suggesting that they had the same aesthetic perception of this smile type ( $P < .05$ ). However, orthodontists and maxillofacial surgeons rated gingival displays of 3, 5 and 7 mm less highly than did the layperson group. There was no statistical difference between the orthodontist and maxillofacial surgeon groups.

**Conclusion:** This study showed that the aesthetic perception of gummy smiles statistically differed among studied subjects, with laypersons assigning the greatest scores and orthodontists assigning the lowest scores.

**Key words:** Smile; gingival; perception; aesthetics

### Resumo

**Objetivo:** O objetivo desse trabalho foi comparar a percepção estética do sorriso gengival por diferentes categorias de indivíduos.

**Metodologia:** Foram utilizadas fotografias do sorriso de quatro indivíduos, um homem e uma mulher afro-descendentes e um homem e uma mulher leucodermas. Cada fotografia original foi manipulada no computador, para a criação de cinco imagens, com diferentes graus de exposições gengivais: 0, 1, 3, 5 e 7 mm. Em seguida, as imagens foram submetidas à avaliação de 60 indivíduos, divididos igualmente em três categorias, ortodontistas, cirurgiões buco-maxilo-faciais e leigos, que atribuíram notas de zero a dez em uma escala visual analógica.

**Resultados:** Os resultados demonstraram que, nas exposições gengivais de 0 e 1 mm, não houve diferença estatística significativa entre os avaliadores, mostrando que a percepção estética foi semelhante. Nas exposições de 3, 5 e 7 mm o comportamento dos cirurgiões foi estatisticamente semelhante ao dos ortodontistas; o grupo de leigos diferiu estatisticamente, tendo atribuído maiores notas que os ortodontistas ( $P < 0,05$ ).

**Conclusão:** Este estudo demonstrou que a percepção estética do sorriso gengival dos grupos pesquisados foi estatisticamente diferente e, em geral, os leigos atribuíram as maiores notas e os ortodontistas, as menores.

**Palavras-chave:** Sorriso; gengiva; percepção; estética

**Larissa Suzuki<sup>a</sup>**  
**André Wilson Machado<sup>b</sup>**  
**Marcos Alan Vieira Bittencourt<sup>b</sup>**

<sup>a</sup> Private practice, Ribeirão Preto, SP, Brazil

<sup>b</sup> Department of Orthodontics, Federal University of Bahia, Salvador, BA, Brazil

### Correspondence:

André Wilson Machado  
R. Eduardo José dos Santos, 147, salas 810/811  
Salvador, BA – Brazil  
41940-455  
E-mail: andre@andrewmachado.com.br

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## Introduction

In recent years, facial aesthetics has become a major focus for the public worldwide. Having a beautiful, youthful smile is among patients' main concerns, and aesthetic improvements are routinely requested in dental offices. In this context, the amount of gingival exposure is fundamentally important for a pleasant smile, while most people consider a gummy smile to be unaesthetic (1). The ability to show gingiva when smiling is related to many factors. Thus, orthodontic correction to allow optimal gingival display is frequently hard to achieve because it requires the identification and correction of the exact cause of the problem, which can be skeletal, dental or both (2-4).

Certain guidelines must be followed in planning a treatment to recover or restore smile aesthetics (5). However, the standards in the literature are based upon either the clinical perceptions of particular authors or subjective evaluations. Furthermore, aesthetic preferences may differ among dental professionals such as orthodontists and maxillofacial surgeons and the general public. Peck and Peck (6) defined the "aesthetic" concept as the appreciation of the good-looking or the beautiful. Its identification is related to a pleasurable sensation upon exposure to an object, a sound or a person. Therefore, the concept of beauty is unique to each individual, and is established based on values related to gender, race, education and personal experiences. The comparison between individual standards over time is responsible for the globalization of the beauty concept (7).

Some studies report that dentists, mainly orthodontists, are less tolerant than laypersons when evaluating certain dento-facial characteristics (8-11). Johnston et al. (8) investigated the perception of deviations between the facial and dental midline by orthodontists and laypeople. In that study, a photo of a woman's smile was modified by moving the dental midline relative to the facial midline. Twenty orthodontists and twenty lay people, divided equally among men and women, scored the attractiveness of the smile in the original picture and in each of the modified pictures on a 10-point scale. The results showed that the orthodontists were more critical of minor discrepancies between the dental and facial midlines than were the laypersons.

Kokich et al. (9) evaluated eight aesthetic criteria, among them the perception of the amount of gingival exposure, using smile photographs that were intentionally modified with a computer. Variations between the distance from the upper lip to the upper incisors (gingival margin) were introduced, generating five types of images: 2 mm of the incisors covered by the lips, lips touching the gingival margin of the incisors (0 mm of gingival exposure) and 2 mm, 4 mm and 6 mm of gingival exposure. The images were evaluated by orthodontists, laypersons and general dentists. The results showed that gingival exposure up to 4 mm was considered acceptable by the last two groups of individuals, but the orthodontists considered exposure of more than 2 mm to be unaesthetic.

Pinho et al. (10) evaluated the impact of asymmetrical anterior teeth on the aesthetics of the smile, according to the opinions of laypersons, orthodontists and prosthodontists. The authors concluded that the augment of the canine cuspid did not affect the aesthetic evaluations of any of the groups of examiners. Meanwhile, orthodontists and prosthodontists were more critical than laypeople of midline deviation and changes in the gingival margin of the upper central incisors. In another study, Scott et al. (11) used digitally created images of different malocclusions with three variations in the thickness of the vermillion of the upper and lower lips (thick, medium and thin) to determine the influence of this parameter on the perception of malocclusion and normal occlusion. They also evaluated the effects midline deviation, short lateral incisors, absence of canines, diastema on midline, crowding and central incisor loss. The results showed that orthodontists and general dentists were more critical in evaluating these factors than were plastic surgeons and laypersons.

Hunt et al. (3) and Geron et al. (12) used manipulated images with variations in the amount of gingival exposure when smiling to evaluate the aesthetic perception of the gingival smile. These authors only evaluated the perception of laypeople and did not make comparisons with other groups of examiners. According to Hunt et al. (3), smiles with more than 2 mm of gingival exposure were considered to be unaesthetic, and the ideal was no gingival exposure. Literature also suggests that women are more tolerant of variations in this characteristic than men (12). General dentists learn the concept of ideal aesthetic standards and are trained to achieve them in their patients. However, aesthetic concepts may differ according to the expectations and desires of the patients, which must be taken into consideration when treatments are planned (6-13). Therefore, in order to obtain a clinically satisfactory outcome, one must understand that what is beautiful and attractive to the orthodontist and general dentists might not be what the patient really considers to be aesthetic (10-13).

Scientific studies investigating the aesthetic standards of the smile in laypersons are therefore of paramount importance. The aim of this paper is to compare the aesthetic perception of five levels of gingival exposure (0, 1, 3, 5 and 7 mm) between orthodontists, maxillofacial surgeons and laypersons.

## Methods

One photograph was taken for each of four subjects displaying a closed smile: two African-Brazilian subjects (a man and a woman) and two Caucasian subjects (a man and a woman) between 20 and 30 years old.

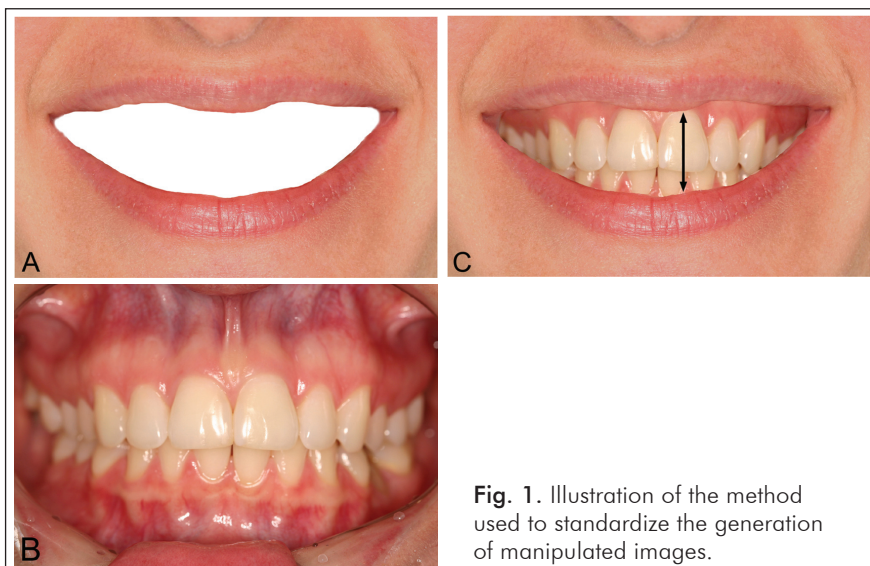
The images were manipulated in the computer to delete the teeth and gingiva (illustrated in Fig. 1A). Then, an image from a previously taken frontal intrabuccal photograph was inserted and manipulated upwards or downwards to generate images showing different levels of gingival exposures (Fig. 1B and 1C). The images were created via an adaptation of the method described by Peck et al. (4), illustrated in Figure 2.

Initially, two points were created: the subnasal point, corresponding to the upper limit of the labial filter at the median sagittal plane, and the upper labial point, corresponding to the lower limit of the labial filter just above the vermilion of the lip. These served as reference points for a vertical line drawn to correspond to the median sagittal plane. Then, two horizontal lines were drawn, one tangent to the uppermost gingival margin of the central incisors and the other tangent to the most inferior contour of the upper lip, both perpendicular to the vertical line. Finally, as illustrated in Figure 1C, the central image was moved upwards or downwards and the distances between the horizontal lines (millimeters) were recorded. Images were presented at actual size (that is, 1 mm in the image was equivalent to 1 mm in the patient).

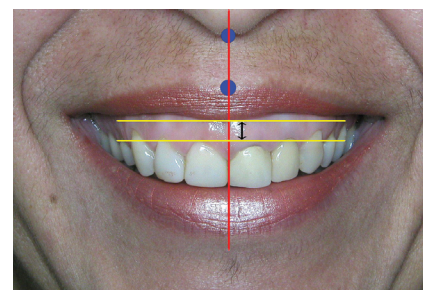
At the end of the process, five images had been generated:

- 0 mm of gingival exposure – upper lip positioned on the gingival margin of the upper central incisors;
- 1 mm of gingival exposure – upper lip positioned 1 mm above the gingival margin of the upper central incisors;
- 3 mm of gingival exposure – upper lip positioned 3 mm above the gingival margin of the upper central incisors;
- 5 mm of gingival exposure – upper lip positioned 5 mm above the gingival margin of the upper central incisors;
- 7 mm of gingival exposure – upper lip positioned 7 mm above the gingival margin of the upper central incisors.

The final images were digital files with 300 dpi resolution in JPEG format with a size of 25 cm × 38 cm. The images were processed in a specialized digital laboratory and printed with professional equipment (Noritsu 2901; Noritsu do Brasil S/A, Manaus, AM, Brazil) on standard A3 format (29.7 cm × 42 cm) Kodak Edge Generations paper (Kodak do Brasil, Manaus, AM, Brazil). Then, a photo album containing four pages with randomly assigned images was assembled (Fig. 3).



**Fig. 1.** Illustration of the method used to standardize the generation of manipulated images.



**Fig. 2.** Illustration of the method used to create images with different levels of gingival display.



**Fig. 3.** Example of the allocation of the manipulated closed smile images in a photo album.

The album was given to 60 subjects, equally divided among orthodontists, maxillofacial surgeons and laypersons, who were asked to evaluate the attractiveness of the images. Along with the album, each evaluator received a form with a printed image of a ruler (analogical visual scale) for each photograph (5 rulers per page, 20 in total) on which they were asked to mark an "X" indicating the level of attractiveness of each image (14-15). At the end of the evaluation process, 20 images had been examined by each evaluator. The data were submitted to statistical analyses. Central tendency and dispersion were calculated and the normal distribution was tested (k-s test).

## Results

Table 1 shows the averages, standard deviations and confidence intervals related to the scores given to images with each degree of gingival exposure by the different groups. The average scores of smiles with 0, 1, 3, 5 and 7 mm of exposed gingiva were 6.6, 6.4, 5.2, 3.4 and 2.9, respectively. In general, laypersons gave higher scores to all levels of gingival exposure and were less critical when evaluating the smiles, compared to the surgeons and orthodontists.

There was no statistical difference between groups in the evaluation of the smiles with gingival exposure of 0 mm and 1 mm, showing that the aesthetic perception of this level of exposure was similar in all individuals ( $P < 0.05$ ).

However, the exposures of 3 mm, 5 mm and 7 mm were evaluated differently by the different groups. In all of these situations, the surgeon group was statistically similar to the orthodontist group. The laypersons group statistically differed from the orthodontists group on all those levels of

exposure. The laypersons also differed from the surgeons in evaluating the 3 mm and 7 mm exposures but not the 5 mm exposure ( $P < 0.05$ ).

## Discussion

All examiners gave higher scores to images displaying no (0 mm) or little (1 mm) gingival exposure, with averages of 6.6 and 6.4, respectively. This is consistent with the results of Peck and Peck (4), who stated that a variation up to 1 mm of gingival exposure is considered aesthetically pleasing. This result also suggests that, in the ideal smile, there is no gingival exposure and the upper lip rests near the gingival margin of the upper central incisors (1,3,12). On the other hand, Kokich et al. (9) found that laypeople and general dentists consider gingival exposure up to 4 mm to be acceptable, while orthodontists consider gingival exposure of more than 2 mm to be unaesthetic, contrary to the results presented in this paper.

Interestingly, laypersons gave the highest scores overall and the orthodontists gave the lowest scores. An exception was seen for the gingival exposure of 1 mm, which was scored lowest by the surgeons. These findings suggest that orthodontists are more critical than laypersons when evaluating the smile, consistent with some studies in the literature. However, it is notable that statistical differences were only found for gingival exposures over 3 mm, showing that there are some similarities in aesthetic preferences among these groups of evaluators. In the study conducted by Kokich et al. (9), laypersons and general dentists appeared to have similar opinions. In this study, although the general dentist group was replaced by a group of maxillofacial surgeons, the

**Table 1.** Average and standard deviation of scores for each smile.

Gingival Display	Examiners	Average Score	SD	Comparison
0 mm	1 – MF Surgeons	6.544	1.821	(1 = 2 = 3)
	2 – Laypersons	7.077	2.370	
	3 – Orthodontists	6.298	2.063	
	GENERAL	6.64	2.113	
1 mm	1 – MF Surgeons	6.059	2.072	(1 = 2 = 3)
	2 – Laypersons	6.829	1.984	
	3 – Orthodontists	6.188	1.978	
	GENERAL	6.359	2.032	
3 mm	1 – MF Surgeons	5.085	2.118	(1 = 3), (1 = 2) (2 ≠ 3)
	2 – Laypersons	5.748	2.174	
	3 – Orthodontists	4.737	1.732	
	GENERAL	5.190	2.053	
5 mm	1 – MF Surgeons	3.131	1.831	(1 = 3), (1 ≠ 2) (2 ≠ 3)
	2 – Laypersons	4.118	2.425	
	3 – Orthodontists	2.908	1.650	
	GENERAL	3.386	2.057	
7 mm	1 – MF Surgeons	2.868	2.016	(1 = 3), (1 = 2) (2 ≠ 3)
	2 – Laypersons	3.408	2.313	
	3 – Orthodontists	2.388	1.993	
	GENERAL	2.888	2.145	

scores given by this group were also similar to those given by the laypersons for almost all levels of gingival exposure. Therefore, it can be stated that orthodontists are more critical than all other groups.

The results found in this study differ from those of some authors, probably due to the different methods used and dento-facial parameters investigated. For instance, Kokich et al. (9) conducted a similar study, but also changed the thickness and shape of the upper lip in their images, thus complicating the analysis of the effect of gingival display. Furthermore, the concept of beauty is not absolute but subjective, despite some predetermined parameters. Thus, the aesthetic perception of the smile is something very personal and varies according to the sensibility of each subject (7). Dental professionals, especially orthodontists and periodontists, have recently demonstrated an outstanding tendency to treat patients with the aim of improving the aesthetic of the smile (5). However, although the literature reports some clinical opinions regarding the ideal or acceptable gingival exposure level, most of them have no scientific basis. Therefore, the aesthetic perception of laypersons, particularly in comparison with that of orthodontists, must also be taken into consideration when planning orthodontic treatments.

Although few studies have assessed and compared these perceptions, the results presented here suggest that gingival display in the range of 0 mm to 1 mm is aesthetically pleasing to all examiners. Conversely, when gingival exposure is equal to or greater than 3 mm, laypersons and orthodontists have different opinions. All groups of examiners perceived

that more gingival display was less attractive, although orthodontists were much more critical than laypersons. Importantly, although orthodontists will always strive for the ideal aesthetic standard in their patients, less-than-ideal results obtained due to difficulties and limitations can meet the aesthetic expectations of the patients.

Although it was not one of the primary aims of this study, the possibility of gender- and ethnicity-related influences on the perceptions of different levels of gingival display was introduced. As only a small number of subjects (four) were used, intrinsic variables biased the analysis of absolute scores. Therefore, more studies with larger sample sizes and more ethnic groups will be required to explore this topic, particularly in Brazil, due to the great racial diversity observed in this country.

## Conclusions

Gingival displays of 0 mm and 1 mm received the highest aesthetic scores. Laypersons gave the highest overall scores and the orthodontists the lowest. However, there was no statistically significant difference in the perception of gingival exposures of 0 mm and 1 mm between groups, showing that this level of exposure is attractive to all groups.

Gingival displays of 3 mm, 5 mm and 7 mm were perceived differently by different groups. Maxillofacial surgeons and orthodontists gave similar scores while laypersons were statistically more accepting of these levels than the orthodontists. Laypersons also gave higher scores than the surgeons for the 3 mm and 7 mm images.

## References

- Hulseycm. An esthetics evaluation of lip-teeth relationships present in the smile. *Am J Orthod Dentofacial Orthop* 1970;57:132-44.
- Ahmad I. Geometric consideration in anterior dental aesthetics: restorative principles. *Pract Periodontic Aesthetic Dent* 1998;10: 813-22.
- Hunt O, Johnston C, Hepper P, Burden D, Stevenson, M. The influence of maxillary gingival exposure on dental attractiveness ratings. *Euro J Orthod* 2002;24:199-204.
- Peck S, Peck L, Kataja M. The gingival smile line. *Angle Orthod* 1992;62:91-100.
- Sarver DM. Principles of cosmetic dentistry in orthodontics: Part 1. Shape proportionality of anterior teeth. *Am J Orthod Dentofacial Orthop* 2004;126:749-53.
- Peck H, Peck S. A concept of facial esthetics. *Angle Orthod* 1970;40:284-99.
- Reis SA, Abrão J, Capezolla LF, Claro CA. Análise facial subjetiva. *Rev Dental Press de Ortodon Ortop Facial* 2006;11:1-21.
- Johnston DR, Gallerano R, English J. The effects of buccal corridor spaces and arch form on smile esthetics. *Am J Orthod Dentofacial Orthop* 2005;127:343-50.
- Kokich JR, Kiyak HA, Shapiro PA. Comparing the perception of dentists and lay people to altered dental esthetics. *J Esthet Dent* 1999;11:311-24.
- Pinho S, Ciriaco C, Faber J, Lenza MA. Impact of dental asymmetries on the perception of smile esthetics. *Am J Orthod Dentofacial Orthop* 2007;132:748-53.
- Scott RC, Goonewardene SM, Murray K. Influence of lips on the perception of malocclusion. *Am J Orthod Dentofacial Orthop* 2006;130:152-62.
- 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.
- Arnett WG, Bergman RT. Facial Keys to orthodontic diagnosis and treatment planning part II. *Am J Orthod Dentofacial Orthop* 1993;103:395-411.
- Maple JR, Vig KW, Beck FM, Larsen PE, Shanker SA. A comparison of providers' and consumer's perceptions of facial-profile attractiveness. *Am J Orthod Dentofacial Orthop* 2005;128:690-6.
- Montini RW, McGorray SP, Wheeler TT, Dolce C. Perceptions of orthognathic surgery patient's change in profile. *Angle Orthod* 2007;77:5-11.