

Perception of dentists, dental students, and patients on dentogingival aesthetics

Percepção de dentistas, estudantes de odontologia e pacientes sobre a estética dentogingival

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Resumo

Introdução: A procura dos pacientes pela estética dentogingival tem aumentado significativamente nos últimos anos, sendo um conceito complexo devido aos inúmeros fatores envolvidos para a obtenção da satisfação paciente/profissional. Algumas características dentogingivais podem alterar a harmonia do sorriso como por exemplo o excesso de exposição gengival. **Objetivo:** Avaliar se a presença da exposição gengival tem uma influência negativa na percepção da estética dentogingival. **Material e método:** 180 indivíduos (60 dentistas, 60 acadêmicos de odontologia e 60 pacientes) avaliaram imagens de sorrisos de voluntários. Essas imagens foram alteradas digitalmente pelo software Adobe Photoshop™, criando diferentes situações de exposições gengivais (4 mm, 2 mm, 0 mm, -2 mm, -4 mm), e classificados pelos avaliadores através dos escores: (01) sorriso muito agradável, (02) agradável e (03) desagradável. Os escores atribuídos foram analisados por meio da ANOVA ($\alpha=0,05$). **Resultado:** Exposições gengivais entre 0 e 2 mm foram consideradas esteticamente agradáveis. Alterações de -4 e +4 mm foram definidas como as mais desarmônicas. O sorriso de 0 mm no sexo feminino foi considerado mais harmônico para os dentistas (1,51) e estudantes de odontologia (1,77), pelo teste *t* de Student ($p<0,05$). Na opinião dos pacientes o sorriso de +2 mm foi considerado o mais estético. Na avaliação das imagens do sexo masculino, o sorriso de 0 mm foi considerado o mais estético ($p<0,05$), para dentistas (1,85) e estudantes de odontologia (1,62). Os pacientes consideraram +2 mm de exposição gengival como o sorriso mais harmônico. **Conclusão:** A percepção estética de estudantes de odontologia e cirurgiões dentistas foram diferentes quando comparado ao grupo dos pacientes.

Descritores: Estética; sorriso; gengiva.

Abstract

Introduction: Patients' demand for dentogingival aesthetics has increased significantly in recent years, and this is a complex concept due to numerous factors involved in obtaining patient/professional satisfaction. Some dentogingival features may alter smile harmony, such as excessive gingival display. **Objective:** To evaluate whether the presence of gingival display has a negative influence on the perception of dentogingival aesthetics. **Material and method:** 180 individuals (60 dentists, 60 dental students, and 60 patients) evaluated images of volunteer smiles. These images were digitally altered by the Adobe Photoshop™ software, creating different situations of gingival display (4 mm, 2 mm, 0 mm, -2 mm, -4 mm), and graded by the evaluators with the following scores: (01) very pleasant smile, (02) pleasant smile, and (03) unpleasant smile. The scores assigned were analyzed using ANOVA ($\alpha=0.05$). **Result:** Gingival displays between 0 and 2 mm were considered aesthetically pleasing. Changes of -4 and +4 mm were defined as the most disharmonious smiles. The 0-mm female smile was considered the most harmonious for dentists (1.51) and dental students (1.77), by Student's *t* test ($p<0.05$). In the opinion of patients, the smile of +2 mm was considered the most aesthetic. In the image evaluations of men, the 0-mm smile was considered the most aesthetic ($p<0.05$) for dentists (1.85) and dental students (1.62). The patients considered +2 mm of gingival display the most harmonious smile. **Conclusion:** The aesthetic perception of dental students and dentists was different when compared to the group of patients.

Descriptors: Aesthetics; smile; gingiva.



INTRODUCTION

The constant and increasing demand for excellence in aesthetics along with a harmonious smile became a requirement in social and cultural relations, interfering with psychological factors and mostly with the self-esteem of human beings¹. Regarding human relations, the concern with appearance is no longer mentioned as vanity, but as a necessity. A healthy mouth may promote good looks, expression, and interpersonal communication; it is also a major factor for preserving self-esteem and critical for formulating our judgement².

Smile harmony may be altered by some dentogingival characteristics such as gingival excess, that is, the overexposure of gingiva when smiling, which negatively affects smile aesthetics^{3,4}. This condition affects approximately 10% of the population aged 20 through 30 years, and it recedes with aging. A smile is considered harmonious when the position of the upper lip is leveled to the gingival margin of the upper central incisors, but a display of up to 3 mm is acceptable within aesthetic standards⁵. The main causes of gummy smile include excessive vertical facial growth, passive eruption, excess of attached gingiva, more active elevator muscles of the upper lip, and maxillary projection. However, both aesthetic medicine and dentistry offer correction treatments^{6,7}.

There are three types of smiles. The low smile is defined by the exposure of 75% or less of crown height of the anterior teeth in the upper arch (canines, lateral incisors, and bilateral central incisors), which is considered unpleasant in dentogingival aesthetics⁸. The medium smile occurs when the tooth is fully visible, meaning there is at least 75% of exposure of the clinical crown and interdental papillae, considering the most aesthetically standard acceptable for gingival display is from 0 mm to 2 mm^{9,10}. Lastly, the high smile has more than 3 mm of the gingiva exposed above the gingival zenith, meaning that the entire cervical and incisal aspects of the tooth are exposed, which is considered anti-aesthetic^{11,12}.

Thus, this study aimed to evaluate the perception of dentists, patients, and dental students on the determinants of smile aesthetics in relation to the gummy smile. The hypothesis tested is that dentists are more critical in evaluating dental aesthetics than dental students, who in turn are more critical than patients.

MATERIAL AND METHOD

It is a cross-sectional observational study defined as a survey, which sample consisted of three groups. The first group included dentists with at least 3 years of clinical experience, selected according to the specialty fields of orthodontics, periodontics, dentistry, and general practitioners. A second group consisted of patients from private clinics, basic health units, and popular clinics, who were assisted at the School of Dentistry of the University of Passo Fundo (FOUPF) - RS, Brazil. The third group included dental students of the 1st and 2nd terms of the FOUPF who had not attended classes related to aesthetics (periodontics, dentistry, orthodontics, and occlusion), as well as students of the final terms (9th and 10th) of the same Dentistry course. The subjects signed and agreed with the Informed Consent Form and the study was approved by the Research Ethics Committee (CEP) under protocol CAAE: 42462414.8.0000.5342.

This study featured a 32-year-old female model (M.D.) with gingival display of +2 mm and a 25-year-old male model (F.M.) with gingival display of +4 mm. Frontal photographs of the models were taken with a professional digital camera (Nikon D 3200 with macro lens). The original photographs were digitally altered using the Adobe Photoshop CC 2015™ image editing software, resulting in the following gingival measurements: upper lip covering the upper incisors (-4 mm), upper lip covering the upper incisors (-2 mm), upper lip leveled to the cervical margin of the upper incisors (0 mm), gingival display of +2 mm, and gingival display of +4 mm, as shown in Figure 1.



Figure 1. Photographs of individuals of the female gender (1) and male gender (2), and gingival alterations. (A) -2 mm; (B) +4 mm; (C) 0 mm; (D) -4 mm; (E) +2 mm.

The photographs included the faces of the models, simulating their actual size. Then, the images were printed in 20 × 25 cm (5 photographs of each gender) and arranged randomly for each research group to evaluate.

Prior to the execution of the project, a pilot study was conducted with 15 subjects (5 dentists, 5 dental students, and 5 patients). This pilot study allowed verifying the need for excluding two variables from the Visual Analogue Scale (VAS) (a little pleasant smile and a completely pleasant smile) to reduce the ambiguity of answers.

Structured questionnaires were applied to each group with questions about gender, age, income, and level of education. An additional structured questionnaire was applied to the participants regarding other dentogingival characteristics that might influence smile aesthetics, such as gingival excess, tooth alignment, tooth color, gingival recession, tooth size, median line, among others. The questionnaire included sociodemographic questions (age, gender, level of education, etc.) as well as the following ones: “How would you rank what you consider most important in a smile?”, and “What would you change about your own smile?” Only the single most important option should be selected for the latter.

The answers were given according to individual perceptions after the analysis of different alterations in the photographs (randomly distributed), which were evaluated by scores 1 (one) a very pleasant smile, 2 (two) a pleasant smile, and 3 (three) an unpleasant smile. Each evaluator received a record form containing the Visual Analogue Scale and a photo album with ten (10) photographs of 5 women and 5 men, analyzed separately. In order to produce an evaluation mean among participants, the following score variation was used: 0-0.9 (very pleasant), 1-1.9 (pleasant), and 2.0-3.0 (unpleasant).

Statistical analysis was performed using the SPSS 18.0, which quantitative data were presented as mean and standard deviation (ANOVA with Tukey's post-hoc test), and qualitative data were described with absolute and relative frequencies (Student's t test). Both tests were considered significant at $p < 0.05$, with test power of 0.81.

RESULT

The final population of the survey included 180 participants with average age of 31.51 years (17 to 75 years old), wherein 62.7% were women (113 participants) and 37.3% were men (67 participants). According to Table 1 - Sociodemographic characterization of the study population -, the mean values and standard deviations for dentists were 36.6 ± 12.2 , followed by patients with 34.8 ± 12.8 , and dental students with 20.9 ± 2.9 , which showed a significant difference among the groups ($p = 0.001$).

According to Table 2, the measure for the most aesthetic female smile was 0 mm of gingival display ($p < 0.05$), as analyzed by dentists (1.51) and dental students (1.77). Patients considered +2 mm of gingival display (1.61) the most aesthetic smile. The measure for the most aesthetic male smile was 0 mm of gingival display ($p < 0.05$), as evaluated by dentists (1.85) and dental students (1.62). Patients considered +2 mm of gingival display (1.54) the most aesthetic smile. The most unpleasant smile measure for all groups was -4 mm of gingival display, followed by +4 mm, for both male and female

Table 1. Sociodemographic characterization of the study population

Group	Dentists (n=60)	Patients (n=60)	D. Students (n=60)	Total (n=180)
Mean age	38.6±12.2	34.8±12.8	20.9±2.9	31.51±12.8
Female	33(29.2%)	36(31.9%)	44(38.9%)	113(62.8%)
Male	27(40.3%)	24(35.8%)	16(23.9%)	67(37.2%)

smiles. The ANOVA with Tukey's post-hoc test ($p < 0.05$) showed significant differences for almost every comparison of the 0-mm smile with the other situations ($p < 0.05$). Only for patients and dental students, the smile with +2 mm of gingival display did not show significant differences when compared to 0 mm ($p > 0.05$).

Most participants (40.5%) consider that tooth alignment is the most important characteristic in dentogingival aesthetics, followed by the number of teeth present in the dental arch (32.2%). On the other hand, tooth color ranked in third place with a rate of 11.8%. Tooth size (5.5%), gingival contour (3.9%), median line (3.3%), and gingival color (2.8%) presented lower rates when evaluated by participants. For patients, tooth alignment is the most important factor (40.0%), followed by the number of teeth (25.0%), tooth color (21.7%), tooth size (5.0%), gingival contour (5.0%), gingival color (1.7%), and median line (1.7%). For dental students of the School of Dentistry of the University of Passo Fundo (FOUPF), tooth alignment is the most important factor in dental and gingival aesthetics (40.0%), followed by the number of teeth (30.0%), tooth color (8.3%), median line (8.3%), tooth size (6.6%), gingival contour (3.3%), and gingival color (3.3%). Table 3 shows the most important characteristics in each group.

According to Table 4, most of the respondents would change tooth color (40.1%) in their smile. On the other hand, 24.4% would change tooth alignment, and 9.4% of participants would change nothing about their smile, showing total satisfaction with it. Tooth size was mentioned as a potential alteration by 8.3% of respondents. A rate of 7.2% of participants would change other dentogingival characteristics such as tooth re-anatomization, incisor inclination, and tooth shape. Other characteristics respondents would like to change were gingival recessions (5.6%), median line (3.9%), and gingival excess (1.1%).

DISCUSSION

This cross-sectional observational study with 180 individuals assessed the perception of dentists, patients, and dental students on photographs of the face and smile of female and male patients; the smile and dentogingival aesthetics were altered in a computer software (Adobe Photoshop CC 2015™). The gingival display of the smile was analyzed regarding its influence on dentogingival aesthetics, which allowed confirming the hypothesis of this study.

The smile line is classified in low, medium, and high. However, the most aesthetic beauty standard is the medium smile line, with gingival display from 2 mm to 3 mm^{13,14}.

Table 2. Mean and standard deviation for each sample group. Statistical significance by ANOVA (Tukey's test)

Group	Images	-4 mm	-2 mm	0 mm	+2 mm +4 mm
Dentists	Male	2.67±0.55 ^{ab}	2.33±0.48 ^{ab}	1.85±0.60 ^{ab}	2.00±0.48 ^{ab} 2.70±0.54 ^{ab}
	Female	2.82±0.39 ^{ab}	2.45±0.50 ^{ab}	1.51±0.57 ^{ab}	1.94±0.75 ^{ab} 2.82±0.39 ^{ab}
Patients	Male	2.42±0.58 ^{ab}	2.08±0.41 ^{ab}	1.62±0.58 ^{ab}	1.54±0.66 ^c 2.82±0.39 ^{ab}
	Female	2.53±0.56 ^{ab}	2.17±0.51 ^{ab}	1.64±0.64 ^{ab}	1.61±0.55 ^c 2.28±0.74 ^{ab}
Dental students	Male	2.44±0.63 ^{ab}	1.94±0.25 ^{ab}	1.62±0.50 ^{ab}	1.69±0.63 ^c 2.44±0.63 ^{ab}
	Female	2.72±0.45 ^{ab}	2.14±0.41 ^{ab}	1.77±0.56 ^{ab}	1.88±0.58 ^c 2.44±0.63 ^{ab}

Letters^{ab}: There were statistical differences by the Tukey's test; Letters^c: There was no statistical difference by the Tukey's test.

Table 3. Characteristics participants consider most important in a smile

Characteristics	Group			
	Dentists n(%)	Patients n(%)	D. Students n(%)	Total n(%)
Tooth color	3(5.0)	13(21.6)	5(8.3)	21(11.7)
Gingival contour	2(3.3)	3(5.0)	2(3.3)	7(3.9)
Tooth alignment	25(41.7)	24(40.0)	24(40.0)	73(40.5)
Median line	0(0.0)	1(1.7)	5(8.3)	6(3.3)
Tooth size	3(5.0)	3(5.0)	4(6.8)	10(5.6)
Gingival color	2(3.3)	1(1.7)	2(3.3)	5(2.8)
Number of teeth	25(41.7)	15(25.0)	18(30.0)	58(32.2)

Table 4. Frequency and rate of characteristics participants would change in their smile

Characteristics	Group			
	Dentists n(%)	Patients n(%)	D. Students n(%)	Total n(%)
Nothing	10 (16.7)	2 (3.3)	5 (8.3)	17(9.4)
Gingival excess	0 (0.0)	2 (3.3)	0 (0.0)	2(1.1)
Tooth alignment	10 (16.7)	22 (36.7)	12 (20.0)	44(24.4)
Tooth color	23 (38.3)	22 (36.7)	24 (40.0)	72(40.1)
Gingival recession	4 (6.7)	2 (3.3)	4 (6.7)	10(5.6)
Tooth size	4 (6.7)	2 (3.3)	9 (15.0)	15(8.3)
Median line	1 (1.7)	4 (6.7)	2 (3.3)	7(3.9)
Other	8 (13.2)	4 (6.7)	4 (6.7)	13(7.2)

An attractive smile does not only depend on factors such as tooth size, shape, color, and position, but also on the amount of gingival display¹⁵. An accentuated gingival display compromises the entire dentogingival aesthetics, interfering negatively. In a study with Japanese orthodontist and dental students, the orthodontists considered the smile with 0 mm of gingival display the most attractive,

while the 2-mm smile was the most attractive for dental students¹⁵. In the present study, orthodontists and dental students considered the 0-mm smile the most pleasant. The most disharmonious smile was the one exceeding +2 mm of gingival display for both Japanese students and orthodontists, which agrees with the data from our study. In the present study, the groups considered the 0-mm female smile the most aesthetic, with no statistical difference (p=0.671).

Both male and female smiles with +4 mm and -4 mm of gingival display were considered the most disharmonious and anti-aesthetic. The study by Kokich et al.¹⁶ showed that orthodontists perceived smile disharmony in alterations over 2 mm of gingival display; however, laypeople perceived it over 3 mm. This indicates that in both studies the perception of gingival excess interferes negatively with smile aesthetics.

As shown in our study, only small gingival displays from 0 mm to 2 mm in the female smile were considered pleasant aesthetic standards. For the male gender, in turn, 0 mm of gingival display was considered the most pleasant aesthetic standard, followed by +2 mm, which agrees with the studies herein mentioned and a study¹⁷ that considered disharmonious the smile with gingival display over 3 mm. There were no statistical differences among the groups assessed, but minimal gingival display made the smile more harmonious¹⁸. This result agrees with the research by Işıkşal et al.¹⁹, which showed that evaluators considered pleasant the gingival displays of 0 mm to +2 mm. Other authors reported that regarding aesthetic parameters, the presence of gingiva is important for the smile²⁰.

A study by Suzuki et al.²¹ concluded that dentists, laypeople, and orthodontists considered either 0 mm or 1 mm of gingival display the most pleasant smiles. Orthodontists consider aesthetic up to 2 mm of gingival display, agreeing with the present study. Laypeople attributed high scores for all levels of gingival display (0 mm to +7 mm), disagreeing with our data in which laypeople considered anti-aesthetic the smiles with over +4 mm of gingival display²¹. General physicians accept an aesthetic smile of up to 4 mm of gingival display, disagreeing with our study, which shows that dentists consider aesthetic the smiles with up to 2 mm of gingival display and unpleasant the smiles with a 4 mm of gingival display.

Our study showed that measures from 0 mm to +2 mm of gingival display were the most harmonious smiles. A study described that a range from 2 mm to 3 mm of gingival display was considered the most aesthetic smile²². According to smile analysis, Geron, Atalia²³

considered that the most attractive smiles had 0 mm to 2 mm of the margin covered, and the most aesthetic smile had 0 mm. Thus, the most aesthetically harmonious gingival display was up to +1 mm²³.

Gingival overexposure is considered anti-aesthetic, corroborating our results in which a display over +2 mm was considered disharmonious²². Agreeing with our study, authors²³ comparing the low smile line found that the most anti-aesthetic smile covered -5 mm of the dental crown and had over +2 mm of gingival display. In our study, the most anti-aesthetic smiles presented alterations of +4 mm and -4 mm.

The results found in the present study showed that dentists (16.6-37.1), patients (26.6-36.7%), and dental students (21.6-45.0%) would change their own dental alignment and tooth color at the respective rates indicated. Our results agree with the study performed by Tin-Oo et al.¹, in which tooth color is mentioned as the most important factor for individual satisfaction, considering that 52.8% of participants were not satisfied with tooth color and 32.3% with alignment. This shows the importance of the smile for individual self-esteem¹.

Dental alignment was mentioned as the main factor in smile aesthetics, agreeing with the observations of our study, which showed dental alignment (40.5%) and the number of teeth (32.2%)

as the main factors in dentogingival aesthetics²⁴. However, it also disagrees with the same study, which reports gingival contour as the second most important factor for the group of dentists, while our study showed that dentists considered the number of teeth and gingival alignment the most important factors, both with 41.7%.

CONCLUSION

Regarding gender, the participants considered the most aesthetic and harmonious smiles, both male and female, the ones with 0 mm of gingival display, followed by +2 mm for the female gender. The measures of +4 mm and -4 mm were considered the most disharmonious smiles for both genders.

Dentists were more critical in the perception of dentogingival aesthetics, followed by dental students, and patients.

The teeth have high or total influence on the physical and general appearance of an individual. The number of teeth and their alignment are factors considered most important in smile aesthetics. Tooth color and alignment are dental characteristics that participants would seek to change in order to improve smile aesthetics.

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CONFLICTS OF INTERESTS

The authors declare no conflicts of interest.

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Received: September 30, 2017

Accepted: April 10, 2018