

Esthetic impact of gingival plastic surgery from the dentistry students' perspective

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ABSTRACT

Objective: The aim of the this study was to evaluate the perception of smile esthetics and alterations in cases of gingival plastic surgery for correction of a gummy smile, by means of alterations in smile photograph among dentistry degree students. **Materials and Methods:** A frontal smile photograph of a 40-year-old woman having normal occlusion was used with diverse compositions of gingival exposure level and crown length of maxillary teeth. The eight photographs were evaluated by 216 dentistry students in five class groups (1st, 2nd, 3rd, 4th and 5th classes). **Results:** The results revealed that almost all of the class' students perceived differences between images, additionally, the highest percentage of students that answered "no difference" was 12% at 1st class' students. 1st and 2nd class' students most liked photograph which is 2.5 mm gingival display and 3rd class students liked two different photographs which are 2.5 mm gingival display and 2 mm gingival display whereas 4th class students preferred two different photographs which are 1.5 mm gingival display and 1 mm gingival display, 5th class students preferred photograph which is 1.5 mm gingival display as the most. **Conclusion:** Esthetic perception of smile improve as a student passes to higher study classes in terms of gingival exposure. The harmonious display of gingiva exhibits an important effect in the smile esthetics rather than reduced or excessive display.

Key words: Clinical crown of maxillary anterior teeth, esthetics, perception, periodontal surgery, photography

INTRODUCTION

Facial beauty attached to some factors, personal opinion, cultural factors and media influence are a few of them.^[1] The harmonious smile has been considered as the indicator of facial attractiveness and beauty since the beginning of humanity. This smile effects social interaction, interpersonal success, person's self-confidence and also business performance.^[2]

For these reasons, one of the most crucial goals of orthodontic therapy is analysis and design of the smile.^[3]

The concept of ideal smile is related with the position, color and shape of anterior teeth and a good harmony between lip and gingiva.

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How to cite this article: Ayyildiz E, Tan E, Keklik H, Demirtag Z, Celebi AA, Python MM. Esthetic impact of gingival plastic surgery from the dentistry students' perspective. Eur J Dent 2016;10:397-402.

DOI: 10.4103/1305-7456.184164

Access this article online	
Quick Response Code: 	Website: www.eurjdent.com

The normal smile is characterized with 1–3 mm exposure of gingiva including interdental and marginal tissue.^[4] If the gingival display is more than 3 mm, it is defined as gummy or gingival smile which is unesthetic.^[5,6]

Depending on true diagnosis, excessive gingival display can be stemmed from vertical maxillary skeletal excess, short upper lip, gingival hypertrophy and short clinical crowns of anterior teeth. All these problems should be evaluated with interdisciplinary approach including orthodontic, periodontal and prosthetic treatments.^[7]

When there is no skeletal vertical maxillary excess, the correction of gummy smile can be made with altering of the natural relationship between the clinical crowns and gingival tissue. If there is a gingival hypertrophy and/or short clinical crowns, gingival plastic surgery is performed.

There are many studies evaluating esthetic perception degree of laypersons, professionals, and dental students, but there is no study regarding the perception of dental students among the grades about altered level of gingival smile with crown lengthening.^[8-11]

The aim of the current study was to evaluate the perception of smile esthetics and alterations in dentistry degree students determining whether there are educational differences among classes (from 1st to 5th) about gingival plastic surgery, by means of alterations in smile photograph.

MATERIALS AND METHODS

To perform current study, 40 years old woman's frontal smile photograph with normal occlusion, was used with the courtesy of Pithon *et al.*^[10] This photograph was obtained with a digital photograph machine (Canon Rebel XTI, 10 megapixels) and cropped as an image including the lips, gingiva and teeth. The images used by Pithon were created that the various lengths of gingiva were removed from the maxillary teeth to simulate the feasible outcome of gingival plastic surgery with crown lengthening. The eight photographs were composed of removing 0.5, 1, 1.5, 2, 2.5, 3 and 3.5 mm of maxillary gingival height and the original one [Figure 1]. No changes were done on these images by us.

The photographs were evaluated by 216 dentistry students of whom 47.7% male ($n = 103$) and 52.3%

female ($n = 113$) in five class groups (1st, 2nd, 3rd, 4th and 5th classes) studying at Kirikkale University, Faculty of Dentistry, Kirikkale [Table 1]. None of the students had received orthodontic treatment. The images were prepared as a questionnaire and asked to students. On the first sheet, the series of miniature images (4.6 cm × 4.8 cm – 1–8) was printed and chosen by students as the most and the least pleasing images [Figure 1a]. The process was repeated on a second sheet with the altered distribution of the same images of Figure 1a to evaluate the reliability of the students' answers [Figure 1b]. Finally, students evaluated the larger size of each photograph (20 cm × 19 cm) of Figure 1a randomly and individually using a scale of attractiveness: 10, the most attractive; 5, attractive and 0, the least attractive. The students were not allowed to make comparisons among images. The image evaluation time for each image was limited to 10 s and placed at a distance of 30 cm from the students' eyes.

The Chi-square test was performed to determine the frequencies of replies by the students in each dental class group. When the expected frequency was <5, the Fisher exact test was used. To compare the given values to each photograph, the Kruskal–Wallis test was used and to compare pairs the Mann–Whitney test also. The level of significance adopted was 5% ($P < 0.05$). The data sets were analyzed with statistical software (IBM SPSS Version 20, IBM Germany).

RESULTS

Tables 2 and 3 show the perceptions of students with respect to the differences and preferences regarding Figure 1a and b, respectively. The results revealed that almost all of the class' students perceived differences between images additionally the highest percentage of students that answered "no difference" was 12% at 1st class' students. There was no significant difference in the frequency of replies among the classes for both images ($P = 0.32$ and $P = 0.31$, respectively).

Tables 2 and 3 show the perceptions of students with respect to the differences and preferences regarding Figure 1a and b, respectively.

Table 2 shows that 1st and 2nd class students liked Photograph 4 the most and 3rd class students liked Photograph 4 and 5 the most with the percentage of 31.8%, 31.1%, and 26.2% whereas 4th class students preferred Photograph 6 and 7, 5th class students preferred Photograph 6 as the most with the percentage



Figure 1: (a) (1) Smile without any alteration, with 4.0, (2) 3.5, (3) 3.0, (4) 2.5, (5) 2.0, (6) 1.5, (7) 1.0, (8) and 0.5 mm of gum exposure. (b) (1) Smile with 3.5 mm of gum exposure (2) 1.0 mm, (3) Smile without any alteration, and smile with 4.0, (4) 2.5, (5) 0.5, (6) 3.0, (7) 1.5, and (8) 2.0 mm of gum exposure

Table 1. Demographic data of dental students participants

Sex	Class n=216					Sum n=216
	1 n=50	2 n=46	3 n=44	4 n=38	5 n=38	
Male	25 (50.0%)	22 (47.8%)	18 (40.9%)	20 (52.6%)	18 (47.4%)	103 (47.7%)
Female	25 (50.0%)	24 (52.2%)	26 (59.1%)	18 (47.4%)	20 (52.6%)	113 (52.3%)

of 24.3% and 38.9%, respectively. Photograph 8 was selected by the 1st and 2nd class (52.3% and 60.0%) whereas Photograph 1 was selected by the other classes as the least preferred ones (71.4%, 75.7% and 69.4%).

For Figure 1b, Table 3 reveals that 1st and 3rd class students preferred Photograph 4 (29.5% and 30.2%), 2nd class student Photograph 6 (28.5%) and 4th and 5th class students preferred Photograph 7 (29.7% and 36.1%) as the most liked. Photograph 5 was selected by the 1st and 2nd class students (36.4% and 47.7%), Photograph 3 was selected by the 3rd class students (34.9%) and Photograph 1 was selected by the 4th and 5th class students (45.9% and 41.7%) as the least preferred ones.

The mean scores awarded to each photograph are presented in Table 4. In this Table 4, Photograph 5 was scored by the 1st and 2nd classes, Photograph 4 was scored by the 3rd class, Photograph 6 was scored by the 4th and 5th classes as the most attractive while Photograph 8 was scored by 1st and 2nd classes and Photograph 1 was scored by 3rd, 4th, and 5th classes as the least attractive. The scores awarded to Photograph 1, 6, 7, and 8 presented significant differences among the classes. Comparisons between class groups showed that 2nd, 4th, and 5th class students attributed better scores to these four photographs when compared with other class students.

Table 2. Participants' perceptions with respect to differences and their preferences for Image 1

Answer	Class					P value
	1	2	3	4	5	
Perceive Differences						
Yes	44 (88.0%)	45 (97.8%)	42 (95.5%)	37 (97.4%)	36 (94.7%)	0.32 [‡]
No	6 (12.0%)	1 (2.2%)	2 (4.5%)	1 (2.6%)	2 (5.3%)	
Image 1 like most						
1	3 (6.8%)	3 (6.7%)	0	0	0	<0.001 [†]
2	7 (15.9%)	6 (13.3%)	2 (4.8%)	0	0	
3	4 (9.1%)	10 (22.2%)	4 (9.5%)	1 (2.7%)	1 (2.8%)	
4	14 (31.8%)	14 (31.1%)	11 (26.2%)	7 (18.9%)	5 (13.9%)	
5	7 (15.9%)	6 (13.3%)	11 (26.2%)	8 (21.6%)	8 (22.2%)	
6	1 (2.3%)	2 (4.4%)	5 (11.9%)	9 (24.3%)	14 (38.9%)	
7	6 (13.6%)	0	7 (16.7%)	9 (24.3%)	4 (11.1%)	
8	2 (4.5%)	4 (8.9%)	2 (4.8%)	3 (8.1%)	4 (11.1%)	
Image 1 like least						
1	13 (29.5%)	12 (26.7%)	30 (71.4%)	28 (75.7%)	25 (69.4%)	<0.001 [†]
2	4 (9.1%)	1 (2.2%)	0	1 (2.7%)	1 (2.8%)	
3	2 (4.5%)	0	0	0	0	
4	1 (2.3%)	0	0	0	0	
5	0	1 (2.2%)	1 (2.4%)	0	0	
6	0	0	0	0	0	
7	1 (2.3%)	4 (8.9%)	0	0	3 (8.3%)	
8	23 (52.3%)	27 (60.0%)	11 (26.2%)	8 (21.6%)	7 (19.5%)	

*Answered only by those who perceived differences between the images; [†]Chi-square test; [‡]Fisher exact test

Table 3. Participants' perceptions with respect to differences and their preferences for Image 2

Answer	Class					P Value
	1	2	3	4	5	
Perceive Differences						
Yes	44 (88.0%)	42 (91.3%)	43 (97.7%)	37 (97.4%)	36 (94.7%)	0.316 [‡]
No	6 (12.0%)	4 (8.7%)	1 (2.3%)	1 (2.6%)	2 (5.3%)	
Image 2 like most						
1	6 (13.6%)	5 (11.9%)	1 (2.3%)	0	0	<0.001 [†]
2	3 (6.8%)	0	8 (18.6%)	0	3 (8.3%)	
3	4 (9.1%)	0	3 (7.0%)	1 (2.7%)	0	
4	13 (29.5%)	9 (21.4%)	13 (30.2%)	8 (21.6%)	9 (25.0%)	
5	2 (4.5%)	4 (9.6%)	0	8 (21.6%)	5 (13.9%)	
6	7 (15.9%)	12 (28.5%)	2 (4.7%)	1 (2.7%)	2 (5.6%)	
7	3 (6.8%)	2 (4.8%)	6 (14.0%)	11 (29.7%)	13 (36.1%)	
8	6 (13.6%)	10 (23.8%)	10 (23.3%)	8 (21.6%)	4 (11.1%)	
Image 2 like least						
1	7 (15.9%)	5 (12.0%)	10 (23.3%)	17 (45.9%)	15 (41.7%)	0.007 [†]
2	7 (15.9%)	6 (14.2%)	3 (7.0%)	4 (10.8%)	1 (2.8%)	
3	9 (20.5%)	7 (16.7%)	15 (34.9%)	8 (21.6%)	13 (36.1%)	
4	1 (2.3%)	0	0	0	1 (2.8%)	
5	16 (36.4%)	20 (47.7%)	12 (27.9%)	5 (13.5%)	5 (13.9%)	
6	1 (2.3%)	0	1 (2.3%)	2 (5.4%)	0	
7	0	2 (4.7%)	1 (2.3%)	1 (2.7%)	1 (2.8%)	
8	3 (6.8%)	2 (4.7%)	1 (2.3%)	0	0	

*Answered only by those who perceived differences between the images; [†]Chi-square test; [‡]Fisher exact test

DISCUSSION

The smile attractiveness is the most important component of the facial esthetics. When designing

the true smile, these should be considered effectively; gingival exposure, smile line, height and harmony of the marginal gingiva, size and proportion of the maxillary teeth.^[12]

Table 4. Mean scores (SD) of photographs awarded by the students participants by class

Photograph	Class					P value
	1	2	3	4	5	
Image 1	2.64 (1.89) ^a	3.28 (2.21) ^a	2.41 (1.46) ^a	2.34 (2.32) ^b	1.95 (1.69) ^b	0.023
Image 2	3.50 (2.07)	3.41 (2.38)	3.16 (1.87)	3.03 (1.95)	3.00 (1.69)	NS
Image 3	4.80 (2.38)	4.54 (2.20)	4.39 (1.60)	3.92 (2.05)	3.66 (1.89)	NS
Image 4	4.80 (2.12)	4.04 (1.88)	5.20 (1.77)	4.66 (1.90)	4.63 (1.44)	NS
Image 5	4.88 (1.93)	4.67 (2.23)	5.09 (1.44)	4.79 (1.84)	4.92 (1.76)	NS
Image 6	3.26 (2.17) ^a	2.87 (2.21) ^a	4.41 (2.29) ^b	4.82 (2.57) ^b	5.42 (2.37) ^b	<0.001
Image 7	3.16 (2.16) ^a	2.30 (2.40) ^b	3.75 (2.30) ^a	4.63 (2.62) ^c	5.08 (2.21) ^c	<0.001
Image 8	1.74 (1.99) ^a	1.78 (2.59) ^a	3.50 (2.80) ^b	4.05 (2.42) ^b	3.97 (3.08) ^b	<0.001

The scores were compared with Kruskal-Wallis test. Values with different superscript letters are significantly different (Mann-Whitney test).

One to 3 mm gingival display is defined as normal esthetically.^[4] Excessive gingival display meaning gummy smile (>3 mm) is usually accepted unesthetic.^[6,13,14] Vertical skeletal maxillary excess which is one of the most crucial etiology of gummy smile is reduced with a Le Fort I impaction but if there is a contraindication of orthognathic surgery or unwillingness of the patient for surgery, this type of treatment is impractical. In this case, effective treatment of gummy smile can be performed with crown lengthening via gingival plastic surgery. While performing this procedure, the harmony between the clinical crown size and gingival display when smiling is a critical role in esthetics and has clinical relevance in orthodontics, periodontics and prosthodontics.

When planning the orthodontic treatment, it is important to know the patient's opinion about esthetics as well as to know the esthetic perception of orthodontists whom make the treatment. The esthetic perception of dentists is strongly correlated with educational backgrounds. In the first 2 years of dental education, basic medical sciences are predominated and professional courses are included limitedly in education curriculum. Whereas after the 2nd class, professional lessons are predominated and clinical practices are started. Especially, the photography lesson is learned in this class and the orthodontic internship and case discussions are started also by the lecturer of department of orthodontics and these can be contributed to development of students' esthetic perception. The studies analyzing the perception of smile esthetics in the literature were generally about dental professionals, laypersons, or dental students.^[8-10] However, there is only one study comparing the perception of smile esthetics and alterations in dentistry degree students.^[15] Therefore, the results of the current study presented original outcomes.

There are lots of studies in the literature using modified smile photographs as current study which is evaluated by different age groups, occupational and social

groups also.^[10,16-19] Our findings indicated that there were statistical significant differences among different study years for both Figure 1a and b. In Figure 1a, the 1st and 2nd class students most liked Photograph 4 and 3rd class students liked Photograph 4 and 5 whereas 4th class students preferred Photograph 6 and 7, 5th class students preferred Photograph 6 as the most. As for the least ones; 1st and 2nd class disliked Photograph 8 but the other classes disliked Photograph 1 (original) [Table 2]. The results demonstrated that esthetic perception of smile improve as a student passes to higher study classes in terms of gingival exposure. Our results were incompatible with that of España *et al.*^[15] They suggested that there were statistically significant differences among different study years, but this condition didn't show a linear improvement from 1st to 5th dental degree classes.

As for Figure 1b, the 1st and 3rd class students most liked Photograph 4 and 2nd class students liked Photograph 6 whereas 4th and 5th class students preferred Photograph 7. As for the least ones; 1st and 2nd class disliked Photograph 5, 3rd class disliked Photograph 3 (original) but the other classes disliked Photograph 1 [Table 3]. For Figure 1a and b, our findings were similar with the results of Pithon *et al.*^[10] and contrast to that of Malkinson *et al.*^[17] Additionally, the preferences of 3rd, 4th and 5th classes were also similar with some other study results.^[10,20-22]

Ioi *et al.*^[11] demonstrated that the dental students selected the smile with 2 mm of lip coverage of the upper central incisors as the most attractive. Whereas in our study, 1st and 2nd class students disliked images which visible only crowns of teeth when smiling.

CONCLUSION

- There were significant differences among dental degree classes when judging the gingival smile on facial esthetics

- This perceptual difference might be resulted from different educational program at each class such as photography lesson, orthodontic internship, case discussions and the preclinical period including prosthetic courses
- The harmonious display of gingiva exhibits an important effect in the smile esthetics rather than reduced or excessive display. Up to 3 mm gingival display is defined as acceptable so it should be considered in the evaluation of smile esthetics by orthodontists, periodontologists and prosthodontists.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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