ORIGINAL ARTICLE

PERCEPTION OF FEMALE DENTAL STUDENTS TO SOME GINGIVAL DEFECTS

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ABSTRACT

The main objective of this study was to assess the perception of smile attractiveness towards four periodontal defects; namely: gingival recession (GR), gingival pigmentation (GP), black triangle (BT) and gummy smile (GS) among female dental students (n=100) in five academic levels at College of Dentistry, King Saud University, Saudi Arabia. Fifteen standardized altered smile images, representing the four defects at varying severities, were displayed to the students in a power point. A questionnaire with visual analog scale (VAS) was used to estimate the perception to each defect at each severity (1500 responses). The perception score was based on a scale of 0-100, where 0= the defect is strongly unattractive, and 100= the defect is relatively attractive. Results showed that PG defect was the relatively most ($p \leq 0.05$) attractive defect, whereas GR was the most unacceptable defect. Generally, perception scores decreased significantly ($p \leq 0.05$) as the severity of each defect was increased. Education level of students had a strong effect; students at higher academic levels were more accurate and have more critical eyes than students in lower level.

Key Words: *Black triangle; Dental education; Gingival pigmentation; Gingival recession; Gummy smiles; Perception; Saudi students.*

INTRODUCTION

Undoubtedly, aesthetic demands have been greatly increasing in this century. Several factors, such as mass media and internet, have played major role in the perception of beauty in modern cultures.[1] The perception of dental aesthetics varies greatly from person to person. This perception is influenced by different factors, such as personal experience, culture, time and dental education.[2-7] For example, Musskopf et al. (2013) compared the perception of smile aesthetic among some patients, dental students and dentists.[7] They found that patients were less critical in their perceptions than the professionals (dentists and dental students). It has been found that age also has an impact on the perception of smile esthetics in a study which evaluated the differences in smile esthetic perception between a younger and older age group of laypeople.[8]

Dental profession plays a major role in building the aesthetic standards. It is very interesting to see how the future dental professionals evaluate the various aesthetic situations, and how can dental education alter their perception of smile esthetics. A thorough knowledge of the perception of smile components may guide professionals to prepare appropriate treatment plans and to recognize what is most likely to be understood as good appearance. Several studies to evaluate aesthetic perception of the components that comprise the smile (the teeth, the lip and the framework of the gingival scaffold)[9] have been conducted.[10-15] Information available in literature about the perception of dental students to altered smile are few and scattered. Perception of dental students towards some parameters of altered smile and the effect of abnormal deviations of these parameters was studied by Nabil et al. (2016). They found that senior students were more critical in their evaluation than junior students.[16] Another study was conducted by Rocha et al. (2011)[17] to assess perception of dental students towards changes in some features of smile.[17] These researchers found that uneven gingiva had the worst perception in periodontal aesthetic, however, the perception of localized and generalized gingival recession did not differ significantly.

Most studies to evaluate the perception of altered smile features have been conducted on orthodontic variables. There is scarcity of information on evaluating the perception of altered smile on periodontal variables. Therefore, the present study was conducted: 1) to assess the perception towards four classic periodontal defects at different severities among female dental students at College of Dentistry, King Saud University in Riyadh, Saudi Arabia and 2) to determine the effect of the students' academic level (five academic years) on their

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perception towards the selected periodontal defects.

METHODOLOGY

The present study was approved by the College of Dentistry Research Center (CDRC) at King Saud University, Riyadh, Saudi Arabia. Each participant in the study signed an informed consent.

Participant:

A total of one hundred female students at the College of Dentistry, King Saud University participated in this study. Twenty female students from each of the five academic levels were randomly selected using Research Randomizer Program (copy right © 1997-2018 by Geoffrey C. Urbaniak and Scott Plous).

Variables

Three female students and one female patient were first chosen for their smiles. The smiles had little gingival exposure to give a space for altered gingival defects that will be manipulated later. Informed consent forms were obtained from them to digitally manipulate their smiles and to use them in this study. A colored smile photograph was obtained from each of the four smiles using a digital camera (KODAK easy share p712 camera - dental flash & close-up lens- Eastman Kodak Company Rochester NY 14650-made in Korea) in the frontal pose by the same photographer (Figure 1). Each original smile photograph was obtained by positioning the subject 5 feet. from the camera with the head in the natural position.[18] The original photographs were then manipulated using image processing software (Adobe Systems, Photoshop version CS2, San Jose, California, USA) to produce a series of images with the nose and chin removed from the images to reduce the number of confounders.

Study design

This study was a cross sectional study to verify the students' perception towards four gingival defects; namely: gingival recession (GR), black triangle (BT), gingival pigmentation (GP) and the gummy smile (GS). The defects GR, GP and GS were at four severities (classes), whereas the defect BT was at three severities. The original smile photographs (Fig. 1) were altered based on the following classifications;

1. The first original photo (Fig. 1A) was manipulated to a series of four images (Fig. 2) to create GR according to Miller classification for gingival recession.[19]
2. The second original photo (Fig. 1B) was manipulated to a series of four images (Fig. 3) to create GP following the Melanin Index.[20]
3. The third original photo (Fig. 1C) was manipulated to a series of three images (Fig. 4) to create BT according to Nordland and Tarnow classification system for loss of papillary height.[21]
4. The fourth original photo (Fig. 1D) was manipulated to a series of four images (Fig. 5) to create GS based on gummy smile scale proposed by Kurpis.[22] This scale measures the amount of gingival tissue displayed as a percentage of tooth height which classify it into: a) Mild: where the amount of gingival tissue shown during smiling is 1-25% of tooth length, b) Moderate: where the amount of gingival tissue shown during smiling is 25-50% of tooth length, c) Advanced: where the amount of gingival tissue shown during smiling is 50-100% of tooth length, and d) Severe: where the amount of gingival tissue shown during smiling is more than 100% of tooth length.

All alterations were selected after consultation with clinically experienced periodontist.

Questionnaire

A questionnaire was developed and distributed to the selected female students. Students were asked to score the attractiveness / unattractiveness of each smile image separately, using a visual analog scale (VAS). This scale was graded from 0 to 100; where 0 was strongly unattractive and 100 was considered to be relatively attractive. The questionnaire consisted of two parts: 1) introduction of the students and their academic level and 2) visual analog scales (VAS). A 10-cm VAS was used for ratings. It has a graded scale, each 1 cm represents 10 reading (10, 20, 30...100). Each student was asked to mark along the VAS according to her perception of the smile aesthetics.

Settings

The questionnaire was distributed to the selected students in a lecture room, each academic level alone. An introduction was first given to the students, and then they were asked to fill their demographic data. Then, the fifteen smile pictures were displayed with a power point presentation on a smart board, one picture at a time. These fifteen pictures were randomly displayed, each for 30 seconds.

Statistical analysis

SPSS, version 22.0 (IBM Corp, 2013) was used. Analysis of variance (ANOVA) was utilized to determine the significant differences. When F values were significant ($p \leq 0.05$), Duncan's multiple-range test was used to separate means. Linear correlation analysis was performed to determine the relationship between the academic level of the participant female students and their perception scores.

RESULTS

A total of 100 female dental students, from the five

different academic levels, were randomly selected in this study. Twenty students were selected from each academic level. Their age ranged from 19 to 24 years. The students were asked to give their perception towards four main clinical gingival defects at varying severities. The four gingival defects were displayed in different situations according to their severities. A total of 15 smile photos were displayed, and a total of 1500 responses were obtained.

Perception to the different defects and severities

The overall perception to the four gingival defects, at all severities (classes), is shown in Table 1. The gingival pigmentation (GP) was the relatively most ($p \leq 0.05$) attractive defect among all participated female students, whereas the gingival recession (GR) was the most unattractive defect. The other two defects (BT, GS) were in the middle, with no significant ($p \leq 0.05$) differences between these two defects (Table 1). Table 2 represents the effects of the defect severities on perception. In general, perception scores decreased ($p \leq 0.05$) (i.e. least attractive) as the severity of each defect was increased (Table 2).

Effect of students' education on perception

The level of students' education showed a strong effect on their perception towards the four gingival defects (Table 3) and at different severities (Figs.6, 7, 8, 9). Female students in higher academic levels (i.e. third, fourth and fifth) showed greater ($p \leq 0.05$) accuracy and have more critical eyes than students in lower academic levels (i.e. first and second levels) (Table 3). This is also true with regard to increasing severities of the four defects (Figs. 6, 7, 8, 9).

TABLE 1: PERCEPTION TO THE FOUR GINGIVAL DEFECTS AMONG FEMALE STUDENTS IN COLLEGE OF DENTISTRY, KING SAUD UNIVERSITY

Gingival defect	n	Perception (0.0 – 100)	SD
GP	400	43.26 a	± 22.50
BT	300	35.51 b	±19.10
GS	400	33.95 b	±23.80
GR	400	17.54 c	±17.51

- Means within a column followed by the same letter are not significantly ($p \leq 0.05$) different, according to Duncan's multiple range test.

- Perception score was based on a scale of 0.0-100, where: 0.0=defect is strongly unattractive, and 100=defect is relatively attractive.

- Gingival defects: GP= gingival pigmentation, BT= black triangle, GS=gummy smile and GR= gingival recession.

TABLE 2: PERCEPTION TO THE FOUR GINGIVAL DEFECTS AT DIFFERENT SEVERITY CLASSES AMONG FEMALE STUDENTS IN COLLEGE OF DENTISTRY/ KING SAUD UNIVERSITY

Severity Levels	Perception (0.0-100)			
	GR	GP	GS	BT
Class I	32.22 a (±15.61)	56.85 a (±21.01)	47.30 a (±21.36)	37.30 a (±17.63)
Class II	18.70 b (±15.61)	45.15 b (±20.14)	41.10 b (±21.83)	42.15 a (±19.60)
Class III	12.70 c (±15.47)	39.90 b (±19.70)	22.90 c (±21.89)	27.07 b (±16.92)
Class IV	6.53 d (±11.99)	31.15 c (±21.31)	24.50 c (±20.53)	_

- Values are means of 100 responses. Means in the same column with the same letter are not significantly ($p \leq 0.05$) different, according to Duncan's multiple range test.

- Gingival defects: GP= gingival pigmentation, BT= black triangle, GS=gummy smile and GR= gingival recession.

- Perception was based on a scale of 0.0-100, where 0.0= strongly unattractive and 100=relatively attractive.

TABLE 3: PERCEPTION TO THE FOUR GINGIVAL DEFECTS AMONG FEMALE STUDENTS IN EACH OF THE FIVE ACADEMIC LEVELS

Academic level	Perception (0.0-100)				
	GR (n = 80)	GP (n = 80)	GS (n = 80)	BT (n = 60)	All defects (n=300)
First	20.69 a (±15.87)	51.13 ab (± 18.62)	40.75 ab (± 17.49)	43.33 a (± 17.34)	38.68 a (± 20.78)
Second	21.88 a (±19.037)	52.19 a (± 25.04)	45.75 a (± 24.89)	43.58 a (± 21.45)	40.67 a (± 25.59)
Third	19.63 ab (±21.71)	44.94 b (± 24.12)	34.44 ab (± 26.78)	35.37 b (± 18.58)	33.47 b (± 24.97)
Fourth	14.63 bc (±14.92)	37.00 c (± 18.05)	29.75 c (± 22.33)	30.17 bc (± 14.90)	27.73 c (± 19.79)
Fifth	10.88 c (±12.42)	31.06 c (± 18.40)	19.06 d (± 16.86)	25.08 c (± 15.88)	21.28 d (± 17.72)

- Means in the same column with the same letter are not significantly ($p \leq 0.05$) different, according to Duncan's multiple range test.

- Gingival defects: GP= gingival pigmentation, BT= black triangle, GS=gummy smile and GR= gingival recession.

- Perception was based on a scale of 0.0-100, where 0.0= strongly unattractive and 100= relatively attractive.

Fig 1: The original smile photos. A) This photo was used to manipulate to GR. B) This photo was used to manipulate to GP. C) This photo used to manipulate to BT. D) This photo was used to manipulate to GS

Fig 2: Classes (severities) of gingival recession (GR). A) Class I. B) Class II. C) Class III and D) Class IV

Fig 3: Classes (severities) of gingival Pigmentation (GP). A) Class I. B) Class II. C) Class III and D) Class IV

DISCUSSION

Although many studies have been conducted to evaluate different dentofacial aspects that affect smile attractiveness, the perception of different gingival defects is not yet discussed in the periodontal literature. The present study was conducted to evaluate the perception towards four classic clinical defects at varying severities. Female dental students (n = 100), in five academic levels, were asked to evaluate fifteen

Fig 4: Classes (severities) of black Triangle (BT). A) Class I. B) Class II and C) Class III

Fig 5: Classes (severities) of gummy Smile (GS). A) Mild. B) Moderate. C) Severe and D) Advanced

altered smile images, using the visual analogue scale (VAS). VAS has been used successfully and widely for the purpose of evaluating subjective feelings and has showed good levels of reproducibility and validity.[7,17,23]

Results of this present study indicated that, among the four gingival defects, the gingival recession (GR) was the most unattractive defect, whereas the gingival pigmentation (GP) was the relatively most attractive. As defect severities were increased, the perception scores decreased, as expected. GR is a common clinical feature in poor and high populated regions of the world.[24,25] It has been reported that patients are often unaware of buccal gingival recessions due to the fact that most of these defects are asymptomatic [26], and only 28% of the clinically-identified recession sites were perceived by patients. Laypersons (unlike professionals and dental students) cannot recognize gingival recession (GR) of less than 2mm.[7] This study of Musskopf and his co-workers (2013)[7], is in contrast to the present study, that examined GR as a result of soft tissue inflammation and periodontal disease that comprise bone destruction. All recessions here were symmetrical. This fact assist professionals to understand the reason behind the lowest perception, by raters, for GR.

Gingival pigmentation (GP), in contrast to GR, was found in this study as the relatively most attractive

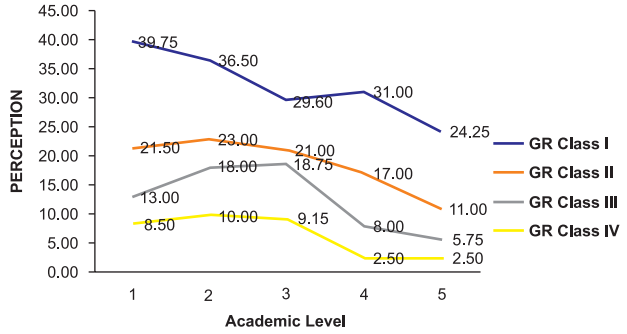

Fig 6: Relationship between academic levels and perception toward gingival recession (GR) at different classes (severities). Coefficient correlation (CF) for Class I=-0.95*, (CF) for Class II= -0.88*, (CF) for Class III = -0.66 and (CF) for Class IV = -0.83

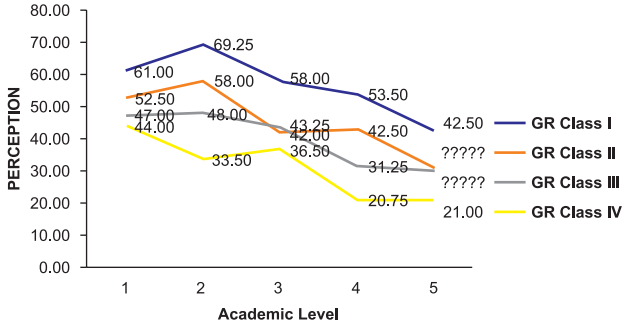

Fig 7: Relationship between academic levels and perception toward gingival pigmentation (GP) at different classes (severities). Coefficient correlation (CF) for Class I= -0.85, (CF) for Class II= -0.89*, (CF) for Class III = -0.93* and (CF) for Class IV = -0.92*

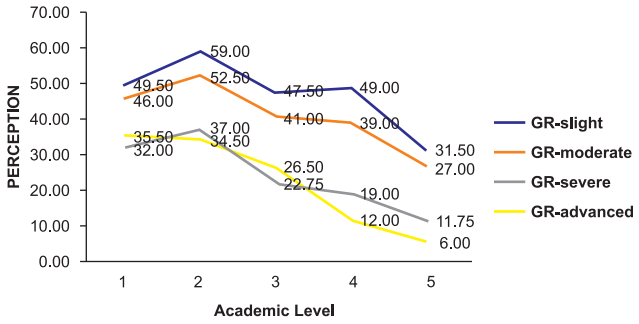

Fig 8: Relationship between academic levels and perception toward gummy smile (GS) at different severities. Coefficient correlation (CF) for slight GS= -0.73, (CF) for moderate GS= -0.86, (CF) for severe GS= -0.97* and (CF) for advanced GS = -0.92*

defect. GP is well-known to affect the colour of the gingiva; it will turn the colour to darker instead of normal pale pink. However, change in colour does not affect any function or causes physiological impairment. In the Middle East, especially in the Gulf countries (GCC), most of the people have darker skin, and subsequently have darker gingival colour than Caucasian people. The fact that ethnic and social differences make people more familiar with darker gingiva, GP images

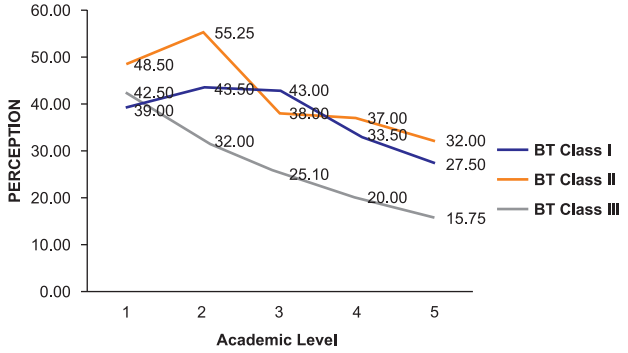

Fig 9: Relationship between academic levels and perception toward black triangle (BT) at different classes (severities). Coefficient correlation (CF) for Class I= -0.77, (CF) for Class II= -0.86, and (CF) for Class III = -0.98*.

are more acceptable, as was found in this study. The present study also found that severity of PG increased the perception scores decreased. The used severity level for GP was based on Melanin Index by Hedin (1977) which categorize the smoker's melanosis. To my knowledge this index is the only classification found for GP in the periodontal literature.

The perception scores towards the other two defects of gummy smile (GS) and black triangle (BT) were in the middle (33.9 and 35.5) respectively. Gummy smile (GS) represent a condition considered anti-aesthetic.[9, 27] Normally, the individual exposes 1-3 mm of gum at smiling. When she/he exposes a large extension of gum more than 3mm, this individual has a condition of gummy smile. Using a series of extraoral front-view-photographs of a gingival smile before and after surgical corrections of gummy smile, Pithon et al. (2014) found that photos which showed 2.5mm of gingiva when smiling scored as the most attractive by the dental professional and students, whereas the image that showed 3mm of gingiva when smiling was most attractive to the laypersons.[28]

The present study shows that as the severity of GS increased, the perception of attractiveness decreased (Table 2, Fig. 8). The severity of gingival exposure depends on distance between the upper lip and the gingival margins of central incisors. Perceptions of gingival display and gingival design or height are reported in several articles and reviewed by Parrini et al. (2016).[29] In their review article, Parrini and his Colleagues looked for thresholds of acceptance for gingival exposure and reported many measurements. They indicated that perception scores decreased with increased gingival display, as confirmed by the current study.[29] Some researchers[10] have stated the gingival display is often aesthetically appealing because it corresponds with a more youthful appearance.

Black triangle (BT) was found in the present study

to affect the smile attractiveness. BT is a result of loss of interdental papilla height, resulting in embrasure not being filled with soft tissue and bone. This small space occurs in more than one third (1/3) of adults. In present study, the perception toward BT scored intermediate (35.5). Unlike the other studies, BT, in our study was applied between all upper anterior teeth and it was symmetrical. Generally, perception decreased as BT severity was increased. However, no difference ($p \leq 0.05$) was found between the classes I and II, and this might be due to the small differences detected in black spaces which happened due to minor loss of soft tissues and bone. In contrary, in class III, the papilla loss (BT) has more bone loss which negatively affect the aesthetic smile. Pithon and his colleagues (2013) evaluated the aesthetic perception of the smile by laypersons at three age groups (15-19, 35-44, and 65-74 years) with regard to black spaces between the maxillary central incisors.[30] They found that younger people are more likely, than older people, to perceive black spaces in maxillary incisors, and also found that the larger the black spaces, the less attractive the persons rate the smile. Our results about BT confirm the findings by Sriphadungporn and Chamnannidiadha (2017) that the presence of a black triangle between maxillary central incisors was more attractive by older people than younger ones.[8] Based on their assumption, a 0.05mm black triangle represented the threshold of acceptability in younger group, whereas in the older group, 1.5mm was the limit of acceptability.

The other factor that play very important role in the perception to the aesthetic smile is the level of dental education. Our results show that as the academic level of the female dental students increased, these students became more aware and have much critical eye in their perception to the smile, especially in the third, fourth and fifth academic years. There was a linear improvement from the first academic year to the fifth academic year. Our results confirm those by Ayyıldız and his colleagues (2017) who found increased aesthetic awareness among students after the second year.[31] However, a study by España and others (2014) failed to find linear improvement from year 1 to year 5 or any significant between genders.[32] They, however, evaluated aesthetic perception toward altered: midline diastema, upper and lower midlines, crown length of the maxillary right central incisor, occlusal cant and gummy smile.

In College of Dentistry at King Saud University dental students start periodontics courses and clinics from third year. This may explain why students in the third, fourth and fifth academic years found the altered smile features photos less attractive compared to students in the first and second years who showed no significant differences in perception toward the four gingival defects (GR, GP,GS and BT).

Females are known to have more critical eye and vision when it comes to aesthetic evaluation. Therefore, it would be interesting to compare the relative perception between male and female dental students. It is desirable to expand study sample and include more categories such as periodontists and laypeople to identify levels of acceptance, attractiveness and unattractiveness and treatment needs for each defect. Such useful information is needed to help periodontists to direct proper treatment and to develop more strategic procedures to increase the beauty of smiles.

CONCLUSION

Gingival recession (GR) affect greatly the smile attractiveness compared to the other gingival defects (GP, GS and BT). Gingival pigmentation (GP) show the highest perception, among the others, in altered smile images. As the severity of periodontal defects increases, the perception of attractive smile decreases. Dental education plays an important role in the development of aesthetic perception of dental students.

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