

Perceptions of Jordanian laypersons and dental professionals to altered smile aesthetics

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SUMMARY The purposes of this study were to rate the attractiveness of different smile variables, to compare the perception of Jordanian laypeople, general practitioners, and orthodontists to altered smile aesthetics, and to identify the threshold where different variables begin to impair smile aesthetics. A smiling photograph of a female dental student was selected and digitally manipulated to create changes in buccal corridor space (BCS), the amount of gingival display, and the midline diastema. These altered images were rated by three groups of Jordanians: 200 laypeople (100 females and 100 males), 200 general practitioners (100 females and 100 males), and 160 orthodontists (40 females and 120 males). Smile aesthetics scores were calculated and comparisons between groups were performed using the univariate general linear model.

The results showed that profession and gender affected BCS and midline diastema attractiveness ratings ($P < 0.001$). Wide BCSs, a gingival display of more than 2 mm, and the presence of a midline diastema of any size were rated as unattractive by all groups.

Introduction

The re-emergence of the soft tissue paradigm in clinical orthodontics has made smile analysis a key element in diagnosis and treatment planning (Ackerman and Ackerman, 2002). As an attractive well-balanced smile is a paramount treatment objective of modern orthodontic therapy, extensive studies on facial features have resulted in the establishment of norms that orthodontists use as guidelines to evaluate facial forms to direct therapy. Smile analysis includes evaluating the smile arc, tooth and gingival display, presence of buccal corridor space (BCS), midline coincidence, tooth proportionality, gingival aesthetics, shade of teeth, and the cant of occlusal plane.

The aesthetics of a smile is influenced by features such as the presence of BCSs, the amount of gingival display, and the presence of a midline diastema. The influence of the buccal corridors on smile aesthetics has been noted by some investigators to be of no aesthetic consequence (Roden-Johnson *et al.*, 2005), whereas others believe that it is unattractive (Moore *et al.*, 2005; Martin *et al.*, 2007; Ioi *et al.*, 2009).

A smile demonstrating minimal gingival display has been deemed more aesthetic than one with excessive gingival display. Geron and Atalia (2005) reported that upper gingival exposure of up to 1 mm was regarded as attractive. Kokich *et al.* (2006) reported that the lay and orthodontic groups rated a 3 mm distance as unattractive.

The presence of a midline diastema produces an unattractive smile. Rodrigues *et al.* (2009) reported that

large midline diastema negatively influenced smile aesthetics, while a midline diastema of up to 1.5 mm was regarded as attractive (Kokich *et al.*, 2006).

The perception of aesthetics varies from person to person and is influenced by personal experiences and social environment (Flores-Mir *et al.*, 2004). For the same reasons, there can be differences of opinion regarding aesthetics between laypeople and professionals (Albino *et al.*, 1984). Whereas Roden-Johnson *et al.* (2005) and Pinho *et al.* (2007) reported that general practitioners, orthodontists, and laypersons evaluated smiles differently Ioi *et al.* (2009) found that orthodontists and dental students rated the attractiveness of smiling photographs similarly. However, other researchers reported that smile attractiveness did not differ between dental professionals and laypeople (Ritter *et al.*, 2006; Martin *et al.*, 2007).

Many factors can influence the formation of aesthetic beauty standards including culture (Oumeish, 2001). Although many studies have been published on smile aesthetics, this was the first regarding the perception of aesthetic smiles among Jordanians. The aims of this study were to rate the attractiveness of different smile variables (amount of gingival display, BCSs, and midline diastema) among Jordanians, to compare the perception of laypeople, general practitioners, and orthodontists to the presence of altered smile aesthetics, and to identify the threshold where different variables begin to impair smile aesthetics. The conduct of this study was based on the assumption that aesthetic values of Jordanians might differ from those from other countries.

Subjects and methods

The present research project was approved by the Institutional Research Board committee at Jordan University of Science and Technology.

The raters comprised 560 Jordanian participants (240 females and 320 males) from different cities in Jordan (Amman, Irbid, and Al Zarkah). The participants were divided into three groups: group 1 (laypeople) consisted of 200 subjects (100 females and 100 males, average age 26.5 ± 6.4 years) selected randomly from different places (offices, university students, and hostels). Group 2 (general dental practitioners) consisted of 200 subjects (100 females and 100 males, average age 28.5 ± 3.2 years) selected randomly from different private dental clinics located in different cities in Jordan, and group 3 (orthodontists) consisted of 160 subjects (40 females and 120 males, average age 30 ± 2.5 years) from private clinics, Royal Medical Service Clinics, government hospitals, and university clinics.

A female individual was chosen who had a smile with characteristics close to standard norms (Rufenacht, 1990). Informed consent form was obtained from the candidate to digitally manipulate her smile and to use it in this study. A coloured smile photograph was obtained of the female smile using a digital camera (Nikon Coolpix 5000; Melville, New York, USA) in the frontal pose (Figure 1). The ideal smile photograph was obtained using a standardized procedure by positioning the subject 5 ft from the camera with the head in



Figure 1 Ideal smile.

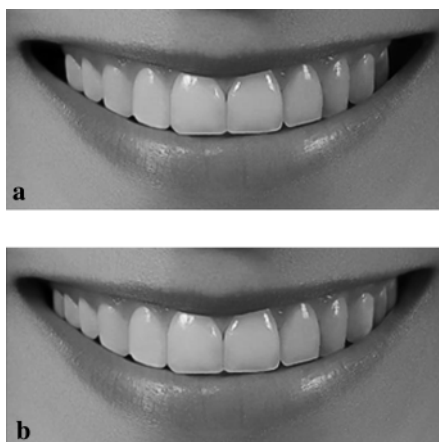


Figure 2 Narrow (a) and wide (b) buccal corridor spaces.

the natural position (Turkkahraman and Gökalp, 2004). The original photograph (ideal smile) was then manipulated using image processing software (Adobe Systems, 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. Each aesthetic characteristic was altered to varying degrees (Kokich *et al.*, 2006).

The ideal smile photograph was altered based on the following variables:

1. BCS (Figure 2a and 2b): the size of the BCS was altered bilaterally by increasing (narrow) or reducing (wide) the number of teeth showing posteriorly.
2. Amount of gingival display (Figure 3a–3d): smiles with different degrees of gingival display (1–4 mm) were produced. This was done by raising the upper lip.
3. Midline diastema (Figure 4a–4d): this was done digitally by adding spaces with different widths (1–4 mm) between the maxillary central incisors.

Questionnaire

The questionnaire comprised three printed pages with a catalogue that included the sets of the coloured smile photographs. The questionnaire included information regarding age, gender, and the profession of the rater. The importance of an attractive smile for the rater, the satisfaction of the rater regarding his/her own smile, the desire for changing the rater's smile, the impact of the smile in social life, and the importance of different smile variables were evaluated using the Likert scale (very high = 1, high = 2, medium = 3, low = 4, and very low = 5).

The photographs of the different manipulated smiles were presented in a catalogue and evaluated by the subjects using the rating (very attractive = 1, attractive = 2, accepted = 3, unattractive = 4, and very unattractive = 5). The catalogue contained 11 pages, each page having one smile photograph to reduce confounders.

Method error

The reliability of the questionnaire was carried out using Cronbach's alpha. Cronbach's alpha ranged from 0.88 to 0.94 indicating good internal consistency. Ten subjects completed the questionnaire again after a 2 week interval. Reliability was carried out for all questions using correlation coefficient test. The correlation coefficients were high and ranged from 0.84 to 0.95.

Statistical analysis

Data analysis was undertaken using the Statistical Package for Social Science (version 15.0; SPSS Inc., Chicago, Illinois, USA). The mean and standard deviation (SD) of each group were calculated. Comparison between the groups was performed using the univariate general linear

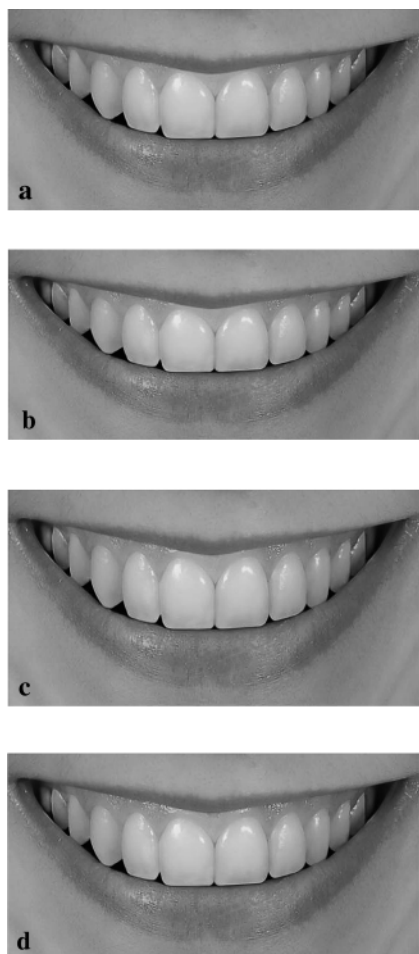


Figure 3 Gingival display of 1 (a), 2 (b), 3 (c), and 4 mm (d).

model, which was selected to test the effect of independent factors on smile attractiveness as well as the interactions between these factors.

Results

The means and SDs for questions related to the impact of the smile on the subjects are shown in Table 1. Higher scores indicate less impact.

Importance of attractive smile

Orthodontists considered an attractive smile more important than general practitioners and laypeople ($P < 0.001$). There were statistically significant differences between laypeople and general practitioners ($P < 0.001$).

Satisfaction with own smile

Laypeople were the most satisfied with their own smile. There were statistically significant differences between

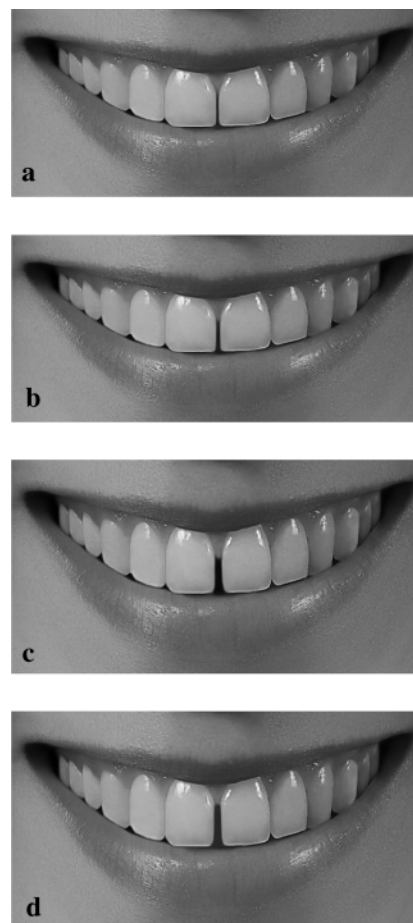


Figure 4 Midline diastema of 1 (a), 2 (b), 3 (c), and 4 mm (d).

laypeople and general practitioners ($P < 0.01$) and between laypeople and orthodontists ($P < 0.001$).

The impact of an attractive smile on social acceptance

There were significant differences between laypeople and general practitioners ($P < 0.001$), between laypeople and orthodontists ($P < 0.001$), and between general practitioners and orthodontists ($P < 0.05$).

The impact of the presence of anterior spacing on smile attractiveness

There were only statistically significant differences between laypeople and general practitioners ($P < 0.001$) and between laypeople and orthodontists ($P < 0.01$).

Subjects' rating of the altered smile photographs

The means and SDs for attractiveness of different smiles as rated by the study population are shown in Table 2. Higher attractiveness scores indicate a less attractive smile.

Table 1 Means and standard deviations (SDs) for the impact of smile attractiveness as perceived by the study population.

Question	Laypeople, mean \pm SD ($n = 200$)	General practitioners, mean \pm SD ($n = 200$)	Orthodontists, mean \pm SD ($n = 160$)
The importance of an attractive smile for you	1.59 \pm 0.86	1.23 \pm 0.50	1.09 \pm 0.35
Are you satisfied with your smile	2.55 \pm 1.50	2.18 \pm 0.92	1.89 \pm 0.83
The impact of an attractive smile on social acceptance	2.40 \pm 1.42	1.87 \pm 1.16	1.55 \pm 0.95
The impact of the presence of spacing between teeth on smile attractiveness	1.68 \pm 0.90	1.39 \pm 0.65	1.39 \pm 0.68

Table 2 Means and standard deviations (SDs) for attractiveness scores of the different smile variables as rated by the study population.

Variables	Profession			Gender	
	Laypeople, mean \pm SD ($n = 200$)	General practitioners, mean \pm SD ($n = 200$)	Orthodontists, mean \pm SD ($n = 160$)	Females, mean \pm SD ($n = 240$)	Males, mean \pm SD ($n = 320$)
Ideal	2.22 \pm 0.94	1.98 \pm 0.83	2.18 \pm 0.81	2.48 \pm 0.80	2.46 \pm 0.93
Buccal corridor spaces					
Narrow	1.66 \pm 0.72	1.30 \pm 0.57	1.59 \pm 0.65	1.51 \pm 0.71	1.57 \pm 0.77
Wide	2.37 \pm 0.92	2.22 \pm 0.75	2.36 \pm 0.67	1.87 \pm 0.77	1.87 \pm 0.86
Amount of gingival display (mm)					
1	1.80 \pm 0.82	1.81 \pm 0.75	1.94 \pm 0.75	2.17 \pm 0.90	2.13 \pm 0.92
2	2.13 \pm 0.92	2.14 \pm 0.74	2.37 \pm 0.83	2.47 \pm 0.83	2.37 \pm 0.88
3	2.48 \pm 0.93	2.38 \pm 0.77	2.31 \pm 0.82	2.83 \pm 0.89	2.76 \pm 0.89
4	2.36 \pm 0.96	2.63 \pm 0.78	2.49 \pm 0.86	3.65 \pm 0.62	3.39 \pm 0.85
Midline diastema (mm)					
1	2.58 \pm 0.96	2.27 \pm 0.78	2.50 \pm 0.73	2.25 \pm 0.93	2.21 \pm 0.84
2	2.93 \pm 0.90	2.93 \pm 0.66	2.90 \pm 0.70	2.27 \pm 0.90	2.32 \pm 0.85
3	3.53 \pm 0.78	3.58 \pm 0.67	3.40 \pm 0.91	3.13 \pm 0.76	2.86 \pm 0.81
4	3.40 \pm 0.91	3.50 \pm 0.69	3.56 \pm 0.62	3.85 \pm 0.54	3.80 \pm 0.65

Ideal smile

The mean scores were 2.22 ± 0.94 , 1.98 ± 0.83 , and 2.18 ± 0.81 for laypeople, general practitioners, and orthodontists, respectively. There were only statistically significant differences between laypeople and general practitioners ($P < 0.05$). Mean attractiveness scores as rated by females and males subjects were 2.48 ± 0.80 and 2.46 ± 0.93 , respectively ($P = 0.748$).

Effect of BCS on smile attractiveness

There were significant differences in attractiveness scores of narrow BCS between laypeople and general practitioners ($P < 0.001$) and between general practitioners and orthodontists ($P < 0.001$). However, no significant differences were detected between the three groups regarding the attractiveness of wide BCSs. No gender differences were detected.

Effect of the amount of gingival display on smile attractiveness

Gingival displays of 1, 2, and 3 mm. No significant differences were observed between laypeople, general

practitioners, and orthodontists. No gender differences were detected.

Gingival display of 4 mm. Laypeople were the least sensitive to the presence of a 'gummy' smile. Significant differences were only detected between laypeople and general practitioners ($P < 0.01$). Females were more sensitive to the presence of a gingival display than males ($P < 0.001$).

Effect of midline diastema on smile attractiveness

1 mm. There were statistically significant differences between laypeople and general practitioners ($P < 0.001$) and between general practitioners and orthodontists ($P < 0.05$). No gender differences were found.

2 mm. No significant differences were detected between laypeople, general practitioners, and orthodontists or between genders.

3 mm. No significant differences were observed between laypeople, general practitioners, and orthodontists. Females were more sensitive to the presence of a 3 mm midline diastema than males ($P < 0.001$).

4 mm. No significant differences were found between laypeople, general practitioners, and orthodontists. No gender differences were detected.

Effect of profession, gender, and age of subjects on attractiveness scores

The effects of profession, age, and gender on the perception of smile attractiveness are shown in Table 3. Age did not affect smile attractiveness rating. However, profession and gender of the rater affected smile attractiveness rating of BCS and midline diastema (both $P < 0.001$).

Overall smile attractiveness scores

Means, standard errors (SEs), and 95 per cent confidence intervals of different smiles are shown in Table 4.

Ideal smile. The mean attractiveness score was 2.12 ± 0.04 . This was set as the cut off score for what was considered attractive. Smiles rated less than this score

were regarded as attractive and those rated higher as unattractive.

BCS. The mean attractiveness score was 1.54 ± 0.74 for a narrow buccal corridor, while for a wide buccal corridor, the mean attractiveness score was 2.36 ± 0.86 . Accordingly, a wide buccal corridor was considered as less attractive than a narrow buccal corridor.

Amount of gingival display. The raters were less sensitive to the changes in the amount of gingival display when it was 1 mm (mean attractiveness score 1.84 ± 0.03). A gingival display of 2 mm or more was considered unattractive with a mean score of 2.21 ± 0.04 .

Midline diastema. The mean attractiveness scores for the 1, 2, 3, and 4 mm midline diastemas were 2.44 ± 0.037 , 2.97 ± 0.034 , 3.53 ± 0.03 , and 3.51 ± 0.03 , respectively. All midline diastemas were rated as unattractive.

Discussion

This research focused on three aspects of smile aesthetics: the amount of gingival display, BCS, and midline diastema. In this study, the raters were selected from different professions and of different gender and age to investigate the effect of these variables on smile attractiveness rating. One strength of this study is its large sample size as previous investigations on smile attractiveness were carried out using a smaller number of raters.

The photographs used in this study were limited to the mouth to reduce the effect of confounders (Kokich *et al.*, 2006; Martin *et al.*, 2007; Ioi *et al.*, 2009). Moore *et al.* (2005) reported that the size of the BCS influences smile attractiveness when the full face is taken in context.

In this study, photographs of the different smiles were evaluated using different rating scores (very attractive, attractive, acceptable, unattractive, and very unattractive). Other researchers (Roden-Johnson *et al.*, 2005; Parekh *et al.*, 2006; Krishnan *et al.*, 2008; Ioi *et al.*, 2009) used a visual analogue scale (VAS) to judge smile attractiveness. Using the former method in rating aesthetics produces simple, rapid, and reproducible results, whereas a VAS may mean different things to different raters (Aitken, 1969) and raters will use certain portions of the scale and ignore others (Phillips *et al.*, 1992).

Attractiveness is suggested to influence social interaction. In this study, the impact of an attractive smile on social acceptance was rated high by all groups. This was in agreement with Van der Geld *et al.* (2007) who emphasized the importance of an attractive smile on social acceptance.

In this study, age did not affect the rating of smile attractiveness, whereas the profession and gender of the raters had an effect. This is in agreement with the findings of Gracco *et al.* (2006) and Martin *et al.* (2007) who reported

Table 3 *F* and *P* values for the effect of profession, gender, and age on smile attractiveness scores.

Variables	Profession		Gender		Age	
	<i>F</i>	<i>P</i>	<i>F</i>	<i>P</i>	<i>F</i>	<i>P</i>
Buccal corridor space	7.67	***	1.47	0.230	1.05	0.381
Amount of gingival display	0.71	0.494	0.83	0.363	0.35	0.555
Midline diastema	1.93	0.147	13.21	***	0.67	0.414

*** $P < 0.001$.

Table 4 Means, standard errors (SEs), and 95 per cent confidence intervals (95% CIs) of different smiles.

Variables	Mean \pm SE	95% CI
Smile		
Ideal	2.12 ± 0.04	2.05 ± 2.20
Buccal corridor spaces		
Narrow	1.54 ± 0.74	1.78 ± 1.90
Wide	2.36 ± 0.86	2.32 ± 2.46
Amount of gingival display (mm)		
1	1.84 ± 0.03	1.78 ± 1.91
2	2.21 ± 0.04	2.14 ± 2.28
3	2.39 ± 0.04	2.32 ± 2.46
4	2.48 ± 0.04	2.41 ± 2.56
Midline diastema (mm)		
1	2.44 ± 0.04	2.37 ± 2.51
2	2.97 ± 0.03	2.90 ± 3.03
3	3.53 ± 0.03	3.47 ± 3.60
4	3.51 ± 0.03	3.44 ± 3.57

that the age of the rater did not affect attractiveness rating of BCS but is contrary to the results of Moore *et al.* (2005) and Ioi *et al.* (2009) who suggested that males and females rated smile attractiveness similarly. However, the fact that the evaluators in this study were all adults may explain the lack of age influence.

The rating of attractiveness of BCS was not affected by age or gender. This is in agreement with other studies (Moore *et al.*, 2005; Gracco *et al.*, 2006; Martin *et al.*, 2007; Ioi *et al.*, 2009). However, the profession of the rater affected smile attractiveness scores in the presence of BCS. This is contrary to the findings of Krishnan *et al.* (2008) and Ioi *et al.* (2009) who reported that orthodontists and dental students had similar tendencies in scoring the preferences of BCS.

Wide buccal corridors were considered unattractive in the present research, in agreement with the findings of Martin *et al.* (2007) and Parekh *et al.* (2006) who reported that both orthodontists and laypeople preferred minimal BCS. However, it has been suggested that BCS was not a significant variable for smile aesthetic evaluation (Rodén-Johnson *et al.*, 2005; Ritter *et al.*, 2006).

All raters (laypeople, general practitioners, and orthodontists) in this study were less sensitive to a change of 1 mm in the amount of gingival display of 1 mm. A gingival display of 2 mm or more was considered unattractive by all groups. This is in agreement with Hunt *et al.* (2002) who reported that a gingival display of more than 2 mm was considered less attractive. However, although previous studies agreed that as the amount of gingival display increased, the smile attractiveness reduced the threshold, which was regarded as unattractive varied. Geron and Atalia (2005) found that a gingival display of more than 1 mm was considered unattractive, whereas Kokich *et al.* (2006) reported that gingival display during smiling was not noticeable by general practitioners or laypeople until it was at least 4 mm.

A midline diastema was rated as unattractive by all groups. This is in agreement with Kokich *et al.* (2006) who suggested that orthodontists rated the smile as unattractive when the midline diastema width was 1–1.5 mm or more, while general practitioners and laypeople considered the smile as unattractive when the midline diastema width was 2 mm or more. Rodrigues *et al.* (2009) reported that a large diastema may have a negative influence on the aesthetic evaluation of the smile. This was in agreement with the findings of Kerosuo *et al.* (1995) who investigated the attractiveness of a midline diastema among European adults and found that patients with a large midline diastema were perceived as being less socially successful and of lower intelligence.

The lack of information regarding racial backgrounds of subjects involved in previous smile attractiveness studies makes racial comparison difficult. However, the results of this study showed that Jordanians were similar to Europeans

(Kerosuo *et al.*, 1995; Hunt *et al.*, 2002), Americans (Kokich *et al.*, 2006; Parekh *et al.*, 2006; Rodrigues *et al.*, 2009), and Japanese (Ioi *et al.*, 2009) in their perception of an attractive smile.

The findings of this study showed that laypeople accept a wider range of deviation compared with dentists and orthodontists. Therefore, when aesthetic treatment to obtain a harmonious smile is performed, clinicians must be careful about imposing his/her own beauty norms upon patients. The type and degree of deviation from the norm and the opinion of the patient need to be taken into consideration.

The limitations of this study include the use of a female smile as the only model image as it has been shown that the gender of the model smile image affects smile attractiveness (Geron and Atalia, 2005). BCSs were also presented to raters as narrow or wide which masked the size of the BCS that may be acceptable to Jordanians. Another limitation is that the socio-economic status of the laypeople was not taken into account, which may have affected the results.

Conclusions

1. The profession and gender of the raters affected smile attractiveness scores.
2. A wide buccal corridor, a gingival display of 2 mm or more, and the presence of a midline diastema of any size were considered as unattractive by Jordanians.

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