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# Perception of general dentists and laypersons towards altered smile aesthetics

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## Abstract:

**OBJECTIVES:** This study aimed to evaluate how dental practitioners and laypersons differ in their perception of altered smile aesthetics based on viewing images of a digitally manipulated smile.

**MATERIALS AND METHODS:** A photograph with close to ideal smile characteristics was selected and digitally manipulated to create changes in buccal corridor space (BCS), midline diastema, gingival display, and midline shift. These altered images were rated by two groups: dental practitioners and lay persons using a visual analogue scale. The mean  $\pm$  standard deviation (SD) of both groups were calculated and the Student's *t*-test was used to identify any statistically significant differences between the groups. Data analysis was done using the Statistical Package for Social Science (version 23.0; SPSS Inc., Chicago, Illinois, USA).

**RESULTS:** The dentists were more sensitive to changes in the midline shift than laypeople and provided lower scores. There were no significant differences between the two groups when the gingival display alteration was  $\leq 3$  mm. However, for gingival display of 4 mm and 5 mm, there was significant difference between the two groups, with dentist rating them poorer as compared with the laypeople ( $P < 0.001$ ). Dentists were more sensitive than the laypeople for midline diastema of 2 mm and 3 mm ( $P < 0.001$  and  $P = 0.005$  respectively). Changes in the BCS had minimal impact on the overall esthetic score for both the groups.

**CONCLUSIONS:** Perception of smile esthetics differed between dentists and laypersons.

## Keywords:

Dentist perception, lay people, smile esthetics, visual analog scale

## Introduction

Smile is considered to be an integral component of nonverbal communication, and contributes much to the self-esteem of individuals.<sup>[1]</sup> Providing patients with an attractive well-balanced smile is a challenge faced by most practicing dentists. Several guidelines have been proposed to aid dentists to achieve optimal aesthetic results in their patients. However, the concept of an 'attractive smile' is very subjective and it

may vary greatly between populations and also between individuals.

Dental professionals bear a significant role in determining the threshold level of acceptable deviations in different aesthetic variables responsible for making a smile pleasing and attractive.<sup>[2-6]</sup> The search for treatment modalities to improve the appearance of the smile has been increasing; with that, patients' esthetic demands have also increased. A dentists' smile assessment would be based on objective components like the buccal corridor spaces (BCS), position of midline, presence of a midline

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diastema, correlation between the shape and colors of teeth and ratio between the lips and gingiva.<sup>[7,8]</sup> On the other hand, subjective assessments of smile would be influenced by several factors such as culture, income, age and opinions of others.<sup>[9,10]</sup>

For these reasons, it is important for dental professionals to understand the patient's perception of smile aesthetics in order to provide the most satisfying dental aesthetic treatment.<sup>[11-13]</sup> Numerous studies have compared the preferences of smile aesthetics between dentists and the laypersons<sup>[6,14-16]</sup> Kokich *et al.*<sup>[16]</sup> assessed the perception of asymmetric, and symmetric alterations of the teeth, and tissues among orthodontist, dentists and layperson in the United States. Similar studies, were undertaken in various countries in the Middle-East like Dubai,<sup>[15]</sup> Jordan<sup>[14]</sup> and Saudi Arabia.<sup>[6]</sup> However, several gaps exist in the literature especially on the amount of variation between patients and providers, role of BCS and the impact of social environment on the esthetic perception.

This study aimed to evaluate how dental practitioners and the general population in a sub-population from Riyadh, Saudi Arabia differ in their perception of altered smile aesthetics based on viewing images of a digitally manipulated smile.

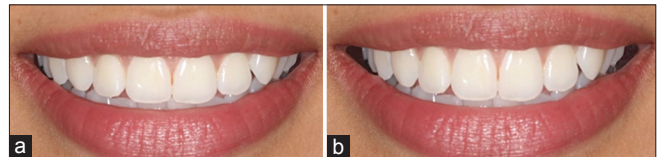
## Materials and Methods

The present study was approved by the Institutional Review Board at King Abdullah International Medical Research Center (IRBC/482/17). A female individual with smile characteristics close to standard norms<sup>[17]</sup> was selected for this study. An informed consent was obtained from the individual to digitally manipulate her smile and use it in this study. A colored smile photograph was obtained using a digital camera (Nikon D500; New York, USA) in the frontal pose. The subject was positioned 5 ft. from the camera with the head in natural position.<sup>[18]</sup> The nose and chin were cropped from the photograph to reduce distractions. This ideal smile photograph was then intentionally manipulated using image processing software (Adobe Systems, San Jose, California, USA) to produce a series of 15 images. Each esthetic characteristic was altered to varying degrees based on Kokich's approach.<sup>[16]</sup> All the alterations were selected after consultation with clinically experienced general dentists. The features of the smile photograph were altered in millimeter (mm) increments:

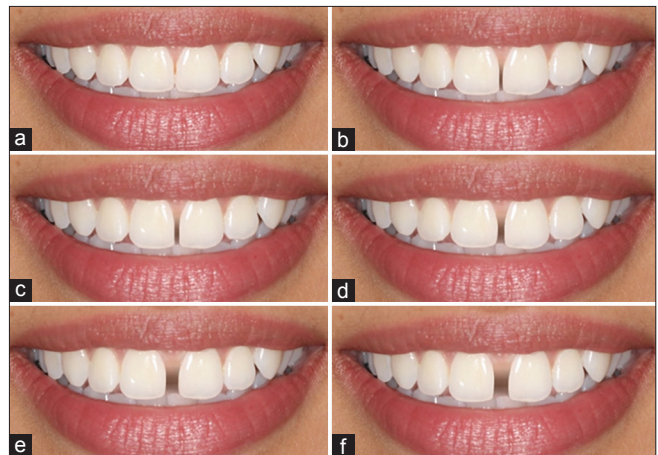
1. BCS: the size of the BCS was altered bilaterally by increasing or reducing the space visible [Figure 1a and b]
2. Midline diastema: this was achieved digitally by adding space between the maxillary central incisors [Figure 2a-f]

3. Midline shift: the upper midline was moved to the left [Figure 3a-f]
4. Gingival display: the amount of gingiva display was increased [Figure 4a-f].

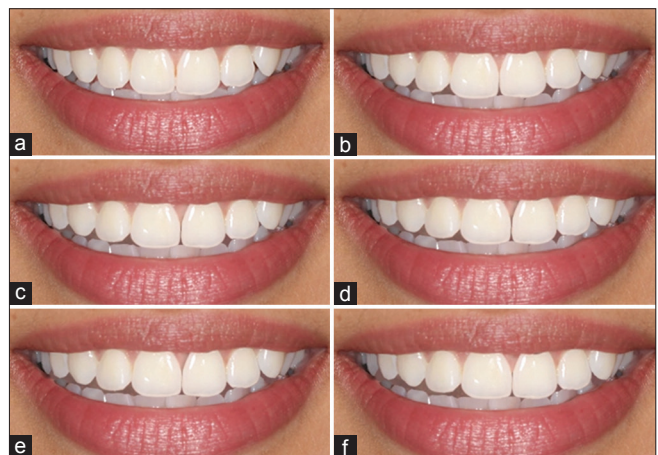
Based on a previous study,<sup>[4]</sup> for an expected effect size of 1.5 mm vertical overlap, with a standard deviation of 3.5, it was estimated that 87 patients would be required to obtain a power of 86% with a 95% confidence interval (95% CI). This was further rounded off to 100 per group.



**Figure 1:** Photographs showing alteration to the buccal corridor space. (a) represents narrow buccal corridor space; (b) represents wide buccal corridor space



**Figure 2:** Photographs showing alteration of a midline diastema. The alterations were done by an increment of 1 mm. (a) No alteration; (b) 1 mm midline diastema; (c) 2 mm diastema; (d) 3 mm diastema; (e) 4 mm diastema and (f) 5 mm diastema



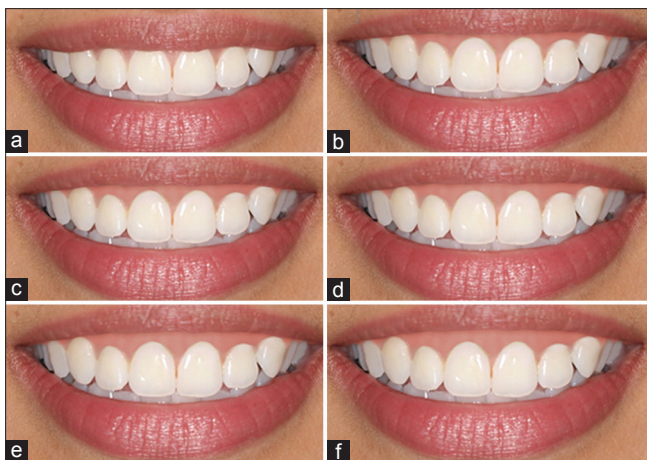
**Figure 3:** Photographs showing alterations to midline shift. The alterations were done with 1 mm increment. (a) No alteration; (b) 1 mm midline deviation to the left; (c) 2 mm deviation; (d) 3 mm deviation, (e) 4 mm deviation, and (f) 5 mm deviation

The altered images were examined by 100 general dentists and 100 lay persons. The dentists were all Saudi nationals practicing in Riyadh. About 100 dentists were randomly selected by means of a draw from the list obtained from the Saudi Dental Society. If the selected individual refused to participate, the next person from the list was considered. This procedure was followed until the required sample size was achieved. The lay group were selected from amongst bystanders accompanying patients to the King Abdulaziz Medical City, Riyadh, using a convenient sampling technique. This group consisted of people with different backgrounds with no formal dental training.

Anyone who is under the age of 18, mentally challenged, or visually impaired were excluded from the study. A written consent form was signed by all participants. A questionnaire along with the smile photographs were given to the participants. The questionnaire included information regarding age, gender, education, and the profession of the rater. The importance of an attractive smile for the rater, the satisfaction of the rater regarding their own smile, the impact of the smile on social life and the impact of the smile on quality of life were evaluated using the 5-point Likert scale (very high = 1, high = 2, medium = 3, low = 4, and very low = 5).

A 10-point visual analogue scale (VAS) was used under each photograph to rate the attractiveness of the smile. The left end of the scale was labelled as "very unattractive" and was represented by the number zero. The right end of the scale was labelled "very attractive" and was represented by the number 10.

Data analysis was done using the Statistical Package for Social Science (version 23.0; SPSS Inc., Chicago, Illinois, USA). The mean and standard deviation (SD)



**Figure 4:** Photographs showing alteration of the gingival show. Alterations were based on the relation of the upper lip with the gingival margin of the maxillary incisors. (a) No alteration; (b) 1 mm increase in gingival show; (c) 2 mm; (d) 3 mm; (e) 4 mm and (f) 5 mm

of both groups were calculated. The data were normally distributed and parametric tests were used for the bivariate analysis. Student's t-test to identify any statistically significant differences in the perception of dentists and lay people to altered smile aesthetics. The confidence level was set at  $P < 0.05$ .

## Results

The response rate was higher among the dentists (88%) compared with the laypersons (72%). The age range of the dentists was 25-58 years and that of the lay people was 18-61 years with a mean age of 37 and 42 years respectively. Table 1 shows the distribution of the socio-demographic variables between the two groups. The laypeople had different backgrounds and most of them had Baccalaureate degree or higher (66%).

Both, dentists as well and laypeople considered having a beautiful smile as important and were similarly satisfied with their own smiles. However, the laypeople valued the importance of smile for social acceptance lower than the dentists ( $P = 0.03$ ). Dentists as well as laypeople considered smile to have significant positive impact on the individuals' quality of life [Table 2].

Table 3 shows that rating of dentist and laypeople to the different smile variables. The mean score for ideal smile for dentists was  $6.90 \pm 2.25$  and for lay persons was  $8.23 \pm 1.93$  which was statistically significant ( $P < 0.001$ ). There was statistically significant difference in the Midline shift at 1 mm, 3 mm, 4 mm and 5 mm. The dentists were more sensitive to changes in the midline shift than laypeople and provided lower scores. There were no

**Table 1: Frequency distributions of the socio-demographic variables**

Variables	Dental practitioners (%)	General population (%)
Gender		
Male	53	50
Female	47	50
Occupation		
Teacher	-	19
Housewife	-	17
Government employee	-	21
Military	-	40
Student	-	3
Education		
High School or less	-	34
Bachelors and above	100	66
Income		
<10,000 SAR*	2	9
10,000-20,000 SAR	15	25
20,000-30,000 SAR	34	42
More than 30,000SAR	49	24

\*SAR – Saudi Arabian Riyals

**Table 2: Means and standard deviations (SDs) for the impact of smile attractiveness as perceived by the study population**

Variables	Mean±SD		P
	Dental practitioners	General population	
The importance of an attractive smile for you	1.52±0.64	1.52±0.69	1.00
Are you satisfied with your smile	2.19±0.89	2.41±1.07	0.13
The impact of an attractive smile on social acceptance	1.67±0.59	1.91±0.90	0.03
The impact of an attractive smile on quality of life	1.52±0.50	1.26±0.44	0.10

**Table 3: Means and standard deviations of the rating by dentists and the general population to the different smile variables**

Variable	Dentists (Mean±SD)	General population (Mean±SD)	P
Ideal	6.90±2.25	8.23±1.93	<0.001*
Midline shift discrepancy			
1 mm midline shift	6.92±2.74	8.08±3.57	0.01*
2 mm midline shift	7.50±2.76	8.14±3.47	0.15
3 mm midline shift	5.53±2.11	8.16±3.32	<0.001*
4 mm midline shift	5.62±2.17	7.56±3.57	<0.001*
5 mm midline shift	5.62±2.22	4.65±2.95	0.009*
Gingival display discrepancy			
1 mm gingival display	7.43±2.63	7.20±2.32	0.51
2 mm gingival display	6.67±2.14	7.23±3.55	0.18
3 mm gingival display	6.50±2.16	6.85±3.03	0.35
4 mm gingival display	5.27±2.35	7.62±2.41	<0.001*
5 mm gingival display	4.87±2.98	7.21±2.69	<0.001*
Diastema discrepancy			
1 mm diastema	6.66±2.14	6.58±3.55	0.84
2 mm diastema	6.20±2.07	4.36±3.13	<0.001*
3 mm diastema	5.34±2.60	4.12±3.41	0.005*
4 mm diastema	4.34±2.38	4.24±3.35	0.81
5 mm diastema	3.70±2.51	4.08±3.47	0.42
BCS discrepancy			
Narrow BCS	7.13±2.29	7.95±3.23	0.04*
Wide BCS	7.43±1.84	7.72±2.98	0.41

\*The mean difference is significant at the 0.05 level; BCS - Buccal corridor space

significant differences between the two groups when the gingival display alteration was  $\leq 3$  mm. However, for gingival display of 4 mm and 5 mm, there was significant difference between the two groups, with dentist rating them poorer as compared with the laypeople ( $P < 0.001$ ). Dentists were more sensitive than the laypeople for midline diastema of 2 mm and 3 mm ( $P < 0.001$  and  $P = 0.005$  respectively). The perceptions of dentists and the general population to buccal corridor space show were not significantly different for wide BCS. However, dentists were more sensitive to narrow BCS and rated it poorer than the laypeople.

## Discussion

This study focused on four aspects of smile aesthetics: BCS, gingival display, midline diastema, and midline shift. The raters were selected from different backgrounds

and socioeconomic status to investigate the effect of these variables on smile attractiveness rating. There was significant difference between the dentist and layperson in their evaluation of different aspects of the altered smile.

The raters scored the attractiveness of the altered images on a 10-point visual analogue scale (VAS), which has been proven to produce simple, rapid, and reproducible results.<sup>[19]</sup> Higher scores indicating better esthetics. An attractive smile is an integral component of self-confidence and thereby influences social interaction.<sup>[10]</sup> In this study, the layperson rated the impact of an attractive smile on social acceptance higher than dentists. This clearly demonstrates the importance placed on smile esthetics by the general population.

Both groups of raters in this study were less sensitive to a changes up to 3 mm in the amount of gingival display. Dentists were more critical than layperson when the gingival display was 4 mm or more. This is in agreement with Kokich *et al.*,<sup>[16]</sup> who reported that gingival display during smiling was not noticeable by general practitioners or the general population until it was at least 4 mm. Hunt *et al.*<sup>[20]</sup> reported that a gingival display of more than 3 mm was considered less attractive. It has been observed that as the amount of gingival display increased, the smile attractiveness reduced, although the threshold value varied.

The dentists in this study were more sensitive to midline deviations than the general population even at 1 mm discrepancy. This is in agreement with Kokich *et al.*,<sup>[21]</sup> who reported that  $>1$  mm as the threshold for dentists to notice midline deviation. In this study, midline shifts upto 4 mm was not perceived by the general population, which is similar to the findings of Pinho *et al.*<sup>[22]</sup> In contrast, Beyer *et al.*<sup>[23]</sup> and Johnston *et al.*<sup>[24]</sup> reported that the threshold of midline deviation for the general population is 2 mm. This could be due to the difference in the population studied and also the difference in the socio-demographic background between the two populations. Changes in the symmetry between upper arch and lower arch might appear unattractive to dental professionals, but lay persons often do not recognize them.

In this study, midline diastema was considered unattractive by both the groups. This is in agreement with Rodrigues *et al.*<sup>[25]</sup> who reported that a large diastema may negatively impact the smile aesthetics. In this study, the general population were more critical than the dentists in their evaluation of the smile esthetics, when there was midline diastema of 2-3 mm. Both the groups rated similarly when the diastema was more than 4 mm. This is different from an earlier report where the threshold of dentist and general population was reported to be 2 mm.<sup>[16]</sup>

Moore *et al.*<sup>[26]</sup> reported that the size of the BCS influences smile attractiveness when the full face is taken in context. Therefore, the photograph used in this study focused only on the mouth. There have been conflicting reports on the role of BCS on smile aesthetics. Some authors found it to be of no aesthetic value,<sup>[19]</sup> while others believe that it is unattractive.<sup>[27,28]</sup> In the current study, dentists were more sensitive to the impact of narrow BCS on the smile esthetics than the lay persons. Changes in the BCS had minimal impact on the overall esthetic score for both the groups.

In this study, the smile was altered using computer software to mimic various dental anomalies. By focusing on selected dental anomalies and modifying them in increments, it was possible to accurately determine the rater's threshold to the discrepancies. The results of this study should be interpreted with caution, as the values presented are subjective and based on the rater's opinions. However, the findings of this study demonstrates the difference between dentists and laypersons in their perception of smile esthetics. Dentists should be careful in ensuring that they do not impose their esthetic norms upon their patients.

## Conclusions

The lay person accepted a wider range of deviation compared with dentists across most of the discrepancies. Dentists were more sensitive to changes in the midline shift

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## Conflicts of interest

There are no conflicts of interest.

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