Perception of Smile Aesthetics and Attractiveness among Saudi Females

Nozha Sawan[a], Mamata Hebbal[a], Abeer Alshami[a], Afnan Ben Gassem[b], Yara Alromaih[c], Nora Alsuwidan[c], Eman Alsagob[a*]

[a]Preventive Dental Sciences Department, College of Dentistry, Princess Nourah bint Abdulrahman University, Riyadh 11564, Saudi Arabia

[b]Department of Orthodontics, College of Dentistry, Taibah University, Madinah 42353, Saudi Arabia

[c]College of Dentistry, Princess Nourah bint Abdulrahman University, Riyadh 11564, Saudi Arabia

*Corresponding author: eialsagob@pnu.edu.sa

ABSTRACT

Smile aesthetic, known as the static and dynamic relationship of the dentition and supporting structures to the facial soft tissues, is one of the most important elements of facial attractiveness. The objective of the study was to assess the perception of smile aesthetics and attractiveness through digital image manipulation of aesthetic variables and to compare those perceptions according to diverse sociodemographic data among female Saudi laypeople attending the dental clinic. A cross-sectional study of 193 female Saudi participants were randomly selected and consented to answer the study questionnaire. Nine smile photograph images were created to compare different smile aesthetic perceptions. Two groups were recruited: 120 participants in the first group (under 30 years old) and 73 participants in the second group (30 years old or above). All participants in both groups were asked to choose the attractiveness of each smile image using multiple-choice options. A statistically significant finding showed that normal buccal corridors were chosen as the most attractive smile by 42.5% of the participants in the younger group and by a significantly higher ratio of the participants with a bachelor's degree or higher level of education at 49% ($p < 0.05$). Laypeople's preferences regarding smile attractiveness vary, but a normal appearance was the ideal choice for the majority. Orthodontic treatment should consider the general sociocultural understanding of smile perception.

Keywords: Dental aesthetics; orthodontics; perception; Saudi Arabia; smile

INTRODUCTION

Smile aesthetic, known as the static and dynamic relationship of the dentition and supporting structures to the facial soft tissues, is one of the most important elements of facial attractiveness (Talic *et al.*, 2013). A smile's attractiveness is a matter of subjective opinion and is influenced by diverse factors, such as culture, social status and education level. In modern society, mass media such as television, social media, advertising, the internet and movie play a crucial role in the perception of attractiveness. These factors make smile aesthetics and the perception of beauty

complex are difficult to be judged by the orthodontists (Frush & Fisher, 1958; Hulsey, 1970; Shaw, 1981; Espeland *et al.*, 1991; McNamara, 2000; Sarver & Ackerman, 2003; Moore *et al.*, 2005; Parekh *et al.*, 2007; Pinho *et al.*, 2007; Ker *et al.*, 2008; Heravi *et al.*, 2011), who must make a diagnosis and treatment plan based on scientific evidence from studies measuring smile aesthetics (Pinho *et al.*, 2007).

One challenge facing orthodontists is that, after orthodontic treatment, the clinical results are judged differently from a patient's perspective than from the orthodontist's, making the satisfaction criteria difficult and complicated to specify (Shaw, 1981; Espeland *et al.*, 1991). A number of variables affect smile aesthetics and attractiveness, including the smile arc, overbite, diastema, buccal corridors, maxillary to the mandibular midline, maxillary midline to the face, maxillary gingival display, and maxillary central and lateral incisors gingival height discrepancy (Ker *et al.*, 2008). The results of previous studies suggest that smile arc, a diastema, missing teeth, midline deviation, buccal corridors and a gummy smile were the variables of beauty (Johnson & Smith, 1995; Mokhtar *et al.*, 2015); however, due to changing habits, behaviours, and conflicting opinions, and expectations of smile aesthetics vary across age ranges (Heravi *et al.*, 2011).

Recently, three variables have received great attention: buccal corridors, the smile arc and maxillary gingival display (Parekh *et al.*, 2007). Frush & Fisher (1958) were among the first to address the concept of smile arc, which is the curvature of the upper border of the lower lip and the arc of the incisal edges of the upper anterior teeth. Additionally, the negative space found between the cheek's inner wall and the buccal surfaces of the posterior teeth is known as buccal corridor space (Frush & Fisher, 1958). Orthodontic therapies flatten the smile line and maxillary widening in the absence of cross bites was recommended in order to eliminate the buccal corridor space (McNamara, 2000).

The aim of orthodontic expansion is to increase the beauty of the smile (Sarver & Ackerman, 2003). More importantly, Moore *et al.* (2005) revealed that smiles without buccal corridors are more appealing. Multiple studies suggested that buccal corridors have no effect on smile attractiveness. They have utilised inter-canine width to determine buccal corridor size (Hulsey, 1970; Kim & Gianelly, 2003; Roden-Johnson *et al.*, 2005). Additionally, buccal corridor spaces did not add considerably to smile aesthetics (Hulsey, 1970).

The maxillary gingival display is defined as the distance between the upper lip and the gingival margin of the maxillary incisors. Usually, females tend to show 1–2 mm more gingival tissue than males. An excessive gingival display is known as a gummy smile, resulting in an unpleasant smile (Zawawi *et al.*, 2013). Based on previous studies, the perception of smile attractiveness variables changes continually among laypeople over the decades. Therefore, it is important to understand smile attractiveness from the perspective of female Saudi laypeople as their judgement determines whether or not orthodontic treatment is successful. The present study evaluated three smile aesthetic variables smile arc, buccal corridors and maxillary gingival display as judged by female laypeople at our dental clinics and compared their preferences according to their sociodemographic data.

MATERIALS AND METHODS

Study Design

A cross-sectional study was conducted among randomly selected female Saudi participants attending our dental clinics. The STROBE guidelines for cross-sectional studies were followed (von Elm *et al.*, 2008).

Setting and Participants

The population included female Saudi participants aged 18 years old and above who visited the dental clinics. The study was conducted over a period of three months from March to May 2019. A list of female patients aged 18 years old and above and have an appointment for a given day was obtained. Patients were selected using the alternate-person method. When the patient arrived at the clinic at the scheduled time, the purpose of the study was explained, she was invited to participate, and she was included in the study after providing informed consent. The patient was assured that she was free to withdraw from the study and that doing so would not affect her treatment.

Sample Size

The previous year's outpatient records were retrieved, including 175 records, and it was observed that approximately five new patients within the required age range visited the dental clinic. Based on these criteria, the sample size was estimated to be 180.

Questionnaire Design

A self-designed questionnaire in the Arabic language was validated for content by subject experts, and a pilot study was conducted among 28 randomly selected females to check the clarity. The questionnaire had six questions. The first part was for demographic data, including age, education level and whether or not the participant had undergone orthodontic treatment. Three questions with three images each were posed about the most attractive smile based on buccal corridors (narrow, wide and normal), smile arc (flat, reverse and normal), and maxillary gingival display (no gingival display, gummy smile and normal gingival display). The digital images were processed using the Adobe Photoshop CS6 Version 13.0.1. Data collection was done on a digital tablet using the QuickTapSurvey application to maintain the high resolution of the images as follows:

1. Buccal corridors: The photograph was modified between the maxillary teeth buccal surfaces and the mouth's corners (Fig. 1).

2. Smile arc: The curvature of anterior teeth was reversed and flattened in relation to the lower lip's curvature (Fig. 2).

3. Maxillary gingival display: Modifications were based on the upper lip relationship with the gingival margin of the maxillary incisors (Fig. 3).

Fig. 1 Photographs shows the modified buccal corridors, (A) narrow buccal corridors (broad smile), (B) Normal buccal corridors, (C) Wide buccal corridors (narrow smile).

Fig. 2 Photographs shows alterations in the smile arc. (A) Reverse smile arc, (B) Normal smile arc that follows the curvature of the lower lip, (C) Flat smile arc.

Fig. 3 Photographs illustrated different maxillary gingival display. (A) Excessive gingival display (gummy smile), (B) Normal gingival display, (C) No gingival display.

Statistical Methods

The data were collected, entered and analysed using Statistical Package for Social Science software, version 25.0 (SPSS Inc., IBM, Armonk, NY, USA). Descriptive analysis was done to calculate frequencies and percentages for age, education level and history of orthodontic treatment. A Chi-square test was used to find the relationships between demographic variables and aesthetic perceptions. A p-value of < 0.05 was considered as statistically significant.

Ethical Considerations

This research was reviewed and approved by the Institutional Review Board (IRB log number 18-0351). All measures followed were in accordance with the ethical standards. Informed consent was obtained from all the participants.

RESULTS

One hundred ninety-three female participants visiting the dental clinics completed the survey questionnaire, of whom 62.2% were younger than 30 years old and 37.8% were 30 years old or older. Regarding education level, 66.3% had a bachelor's degree or higher, and 33.7% had less than a bachelor's degree, and 34.2% of the participants had a history of previous orthodontic treatment, while 65.8% had none (Table 1).

Our findings showed that most participants, regardless of age and education level, chose image A in all the figures as the normal, ideal and most attractive appearance of each variable. The responses regarding the buccal corridor included those of many participants with a history of orthodontic treatment; 50% of them chose the normal buccal corridor variable. By contrast, only 35% of the participants without a history of orthodontic treatment chose it (Table 2).

Table 1 Demographic data of study participants

Demographic data		n	%
Age (years old)	Younger than 30	120	62.2
	Older than 30	73	37.8
Educational level	Bachelor's degree or higher	128	66.3
	Less than a bachelor's degree	65	33.7
History of orthodontic treatment	Yes	66	34.2
	No	127	65.8

Note: Data are presented as frequency and percentage

Table 2 Distribution of study participants according to the perception of the buccal corridor variable

Parameters		Buccal corridor variable						p-value
		Normal		Wide buccal corridor		Narrow buccal corridor		
		n	%	n	%	n	%	
Age (years old)	Younger than 30	51	42.5	26	21.7	43	35.8	0.30
	Older than 30	26	35.6	23	31.5	24	32.9	
Educational level	Bachelor's degree or higher	62	49.0	28	22.0	37	29.0	**0.002***
	Less than bachelor's degree	15	23.0	21	32.0	30	45.0	
History of orthodontic treatment	Yes	33	50.0	13	20.0	20	30.0	0.11
	No	44	35.0	36	28.0	47	37.0	

Notes: *Significant p-value; Data are presented as frequency and percentage

There was no statistically significant difference between the two age groups when comparing the three smile variables as the normal appearance was the preferred choice of both. In contrast, normal buccal corridors were chosen as the most attractive smile by 49% of the participants with a bachelor's degree or higher, whereas 45% of the participants with less than a bachelor's degree chose narrow buccal corridors meaning they preferred broad smiles. This difference was statistically significant ($p < 0.002$) (Table 2).

Among participants with a history of orthodontic treatment, 50.8% rated the normal smile arc as more attractive than the flat and reverse smile arc, but no statistically significant difference was noted between the educational levels of the participant groups in regard to the smile arc variable (Table 3).

The normal maxillary gingival display was perceived as the most attractive smile for both groups who had previous orthodontic treatment (80%) or did not (66%). Similarly, most participants preferred normal maxillary gingival display to excessive gingival display (gummy smile) or no maxillary gingival display (Table 4). Fig. 4 shows the descriptive data of selected smiles aesthetic variables by study participants.

DISCUSSION

Understanding what smile features are considered attractive by society is important for successful orthodontic treatment. Saudi females' perceptions of smile aesthetic characteristics may be influenced by age, education level, general background, and ethnicity, and various races have unique aesthetic preferences for their smiles

**Table 3** Distribution of study participants according to the perception of smile arc variable

Parameters		Smile arc variable						p-value
		Normal		Flat		Reverse		
		n	%	n	%	n	%	
Age (years old)	Younger than 30	61	50.8	38	31.7	21	17.5	0.1
	Older than 30	27	37.0	25	20.8	21	28.8	
Educational level	Bachelor's degree or higher	63	50.0	39	31.0	25	20.0	0.3
	Less than bachelor's degree	25	38.0	24	36.0	17	26.0	
History of orthodontic treatment	Yes	36	55.0	19	29.0	11	17.0	0.2
	No	52	41.0	44	35.0	31	24.0	

Note: Data are presented as frequency and percentage

Table 4 Distribution of study participants according to the perception of maxillary gingival display variable

Parameters		Maxillary gingival display variable						p-value
		Normal		Excessive		No display		
		n	%	n	%	n	%	
Age (years old)	Younger than 30	85	70.8	16	13.3	19	15.8	0.9
	Older than 30	52	71.2	11	15.1	10	13.7	
Educational level	Bachelor's degree or higher	62	49.0	28	22.0	37	29.0	0.6
	Less than bachelor's degree	15	23.0	21	32.0	30	45.0	
History of orthodontic treatment	Yes	53	80.0	7	11.0	6	9.0	0.11
	No	84	66.0	20	16.0	23	18.0	

Note: Data are presented as frequency and percentage
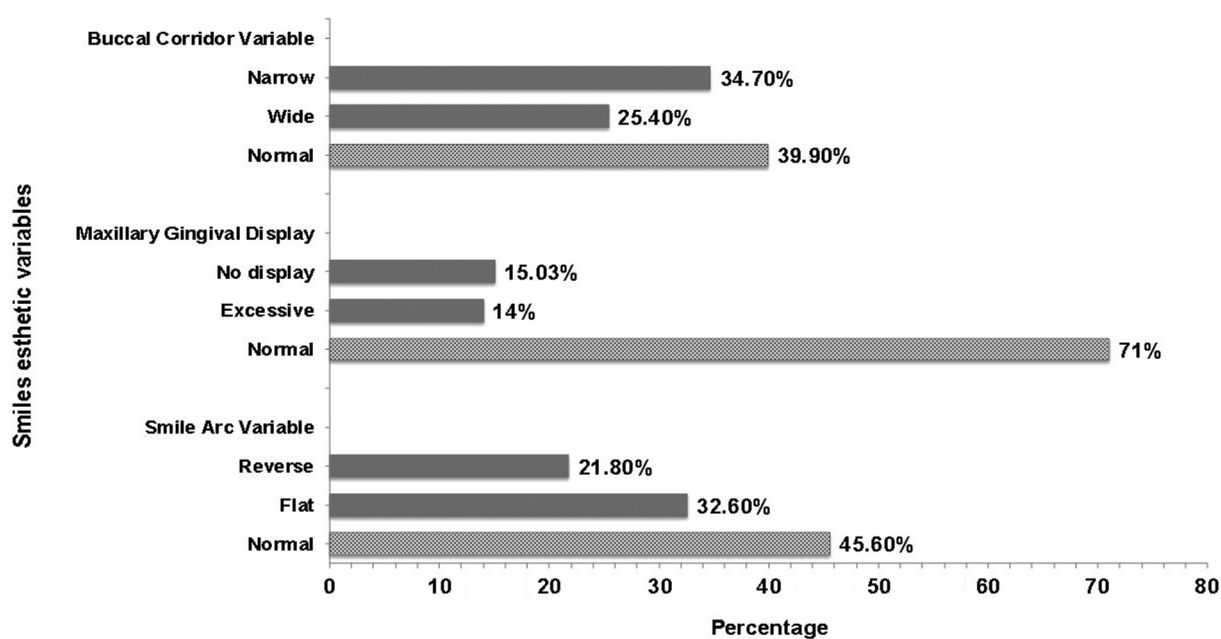
Fig. 4 Descriptive data of selected smiles esthetic variables by study participants.

(Almanea *et al*., 2019). Another study demonstrated that Indians and American Indians, the Americans with ancestry from India, favoured a buccal corridor space and a minimal smile arc over US Caucasia (Sharma *et al*., 2012). They had also highlighted a significant difference in the perceptions of the gingival display, buccal corridor and occlusal cant between the US and Canadian populations (Sharma *et al*., 2012). Furthermore, Al Taki *et al*. (2016) reported that the perceptions of smile variables significantly differ among the German, Russian and Turkish populations. Therefore, further regional studies on smile aesthetics evaluation are necessary.

Many factors contribute to smile aesthetics and attractiveness. Some previous studies have found that tooth colour is an important factor in smile attractiveness (Al Taki *et al*., 2016). Hulsey (1970) observed that the buccal corridors were not linked to smile attractiveness and Schabel *et al*. (2008) concluded that only the smile arc and gingival display were substantially related to smile aesthetics out of the 11 elements that they had tested. In the present study, three variables affecting smile aesthetics, including smile arc, buccal corridors and gingival display, were evaluated by female laypeople with diverse ages, education levels and orthodontic treatment history who visited the dental clinics. Previous studies have found that age influences the perception of smile attractiveness and judgements of smile aesthetics were stronger among younger participants. In other studies, however, the perception of smile attractiveness was not influenced by age (Kau *et al*., 2020).

Earlier studies have shown that the perfect smile arc enhances smile attractiveness while the reverse smile arc greatly decreases smile attractiveness (Hulsey, 1970; Zachrisson, 1998; Gracco *et al*., 2006; Zawawi *et al*., 2013; Mokhtar *et al*., 2015; Sriphadungporn & Chamnannidiadha, 2017), and only a few studies have shown that the smile arc has little impact on the aesthetic benefit of a smile (McNamara *et al*., 2008; Rai *et al*.,

2013). Among laypeople in Dubai, there was no significant difference in the evaluation of the reverse smile arc's effect on smile attractiveness between diverse age groups (Rai *et al*., 2013). In a 2019 study evaluating the smile arc among Saudi laypeople, 43% of the participants reported that a consonant smile arc, determined by the upper incisal line and the internal surface of the lower lip, was the most attractive. However, around 27% of those Saudi laypeople perceived a reversed smile to be attractive, which implies that the smile arc is not critical in the perception of smile attractiveness (Almanea *et al*., 2019). Despite the larger sample of Almanea *et al*. (2019), only 99/244 are laypeople, and the majority were specialist dentists 145/244. In addition, the present study added the association between the participants' perceptions and their sociodemographic data, giving more details regarding the predictors of these perceptions.

In the present study, most participants preferred a normal smile arc and age, education level, and history of orthodontic treatment did not influence the evaluation of smile aesthetics regarding normal, flat or reverse smile arcs. The participants' evaluations could be influenced by their regular visits to the dental clinics as their dentist or orthodontist may have explained the effect of the smile arc on the smile's attractiveness. In addition, social media may have influenced the layperson's perspective on the most attractive smile aesthetic.

McNamara *et al*. (2008) showed that there is no significant association between the length of the buccal corridors and the smile aesthetics. Our significant finding shows that the perception of smile attractiveness related to the buccal corridors was higher in the younger group of participants with a bachelor's degree or higher, which preferred the normal buccal corridor. In contrast, participants with less than a bachelor's degree preferred a narrow buccal corridor. By contrast, a 2019 study on the effect of buccal corridors on smile attractiveness among orthodontists, dentists and laypeople

found that a wider buccal corridor was more attractive (Almanea *et al.*, 2019), and a 2007 study on the impact of buccal corridors on smile attractiveness found that age did not influence the perception of the buccal corridors' size (Martin *et al.*, 2007).

The smile aesthetics was reported to be also affected by the extent of gingival display (Kokich *et al.*, 2006). The maxillary incisor crowns should be fully visible with 1–2 mm of gingival display in a youthful smile (Sarver, 2004). Excessive gingival display, also known as a gummy smile, can make a smile seem unattractive, but Saudi laypeople have found gingival displays of up to 1 mm to be appealing (Sarver, 2004). Another survey of Saudi laypeople showed that even with a length of 5.0 mm in comparison to the patient's philtrum, many laypeople did not consider an exaggerated upper gingival showing to be unattractive (Moore *et al.*, 2005). Yet another study found that 66% of Saudi lay participants agreed that a 1–2 mm gingival display constituted the most attractive smile, and 18% of laypeople thought that a 0 mm display was attractive (Almanea *et al.*, 2019). Furthermore, male participants, more often than female participants, considered gummy smiles to be unattractive (Almanea *et al.*, 2019). In this study, Saudi female laypeople considered a normal gingival display to be more attractive than an excessive gingival display or no gingival display. This perception of the normal gingival display was not affected by age group, education level, or history of orthodontic treatment.

This study has limitations as it included only the perceptions of female Saudi participants visiting the dental clinics. It did not consider the participant's socioeconomic status, affecting the perception of an attractive smile. It is recommended that further studies include and compare the perceptions of more participants, male and female, from all Riyadh city regions as well as other Saudi Arabian cities. Future studies should also include participants from diverse cultures and ethnicities to evaluate intercultural differences in smile attractiveness perception.

Regarding data analysis, age was categorised into two groups, younger than 30 years old and 30 years old or older. This categorisation was done during the methodology development because the most common age of the dental clinic visitors was unknown. The number in the 18–29 years old category was greater than that in the 30 years old and above category, so more age categories should have been included as doing so may have revealed a statistical difference in the smile aesthetic variables. Similarly, the participants' education level was associated with a large difference in the numbers between the two categories. Therefore, more categorisations should have been done to avoid data loss and ensure greater accuracy. In addition, increasing the sample number would have affected the ratio of participants with or without a history of orthodontic treatment.

CONCLUSION

Diverse smile aesthetic variables can influence the perception of smile attractiveness. The buccal corridor influences smile attractiveness among Saudi females of various ages and education levels. Participants in the younger group and those with a bachelor's degree or higher preferred a normal buccal corridor, whereas participants with less than a bachelor's degree found a narrow buccal corridor more attractive. Smile arc and gingival display did not influence the perception of smile aesthetics between age groups, education levels and the history of orthodontic treatment. Understanding what smile features are considered attractive by society is crucial to successful orthodontic treatment and patient satisfaction.

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