ORIGINAL ARTICLE
PERCEPTION OF DIFFERENT SMILE ARC TYPES IN ORTHODONTIC PATIENTS VISITING DENTAL SECTION AYUB MEDICAL COLLEGE

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Background: The smile arc is one of the imperative components of an attractive smile. The objective of this study was to investigate the frequency of perception of orthodontic patients regarding various smile arc types and to assess awareness of their own smile arc. **Methods:** It was a single-center, cross-sectional study conducted at the Department of Orthodontics, Ayub Medical College, Abbottabad from December 2023 to January 2024. A sample of 126 participants was included through non-random consecutive sampling. Participants were asked to fill out a validated questionnaire to evaluate their perception regarding the smile arc. **Results:** In a study of 126 participants, majority were males and most belonged to age group 13–15 years. Among them 52.3% rated picture A as beautiful, while pictures B and C were rated as average by 58.7% and 40.5%, respectively. Age and occupation significantly influenced smile arc preferences (p<0.05). Overall, 62% correctly identified their smile arc, with no significant difference (p=0.80) between males (63%) and females (61%). Identification rates varied by age group and profession, though none were statistically significant (p=0.39 and p=0.13 respectively). **Conclusion:** The study revealed that the patients consistently rated consonant smile arcs as the most beautiful, while flat and reverse smile arcs were perceived as average. The study also highlighted the fact that patients visiting for orthodontic consultation are predominantly aware of their smile arc. These findings underscore the significance of dental harmony in shaping perceptions of facial attractiveness.

Keywords: Smile arc; Perception; Esthetics; Orthodontics

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INTRODUCTION

Facial and smile attractiveness are closely linked together as during social interaction one's attention is primarily focused on the mouth and eyes.[1] Smile is crucial for facial expression and appearance, and studies[2, 3] have shown that individuals with pleasant smiles are often associated with higher intellectual and social abilities and are considered more attractive than those with less pleasant smiles. However, a smile is highly subjective and is influenced by religion, culture, demographics, education level as well as the social circle of the individual. Orthodontics aims to improve dental aesthetics and function, with a primary focus on achieving an attractive smile.

There are five important parameters of a smile: smile arc, gingival visibility, facial and dental midline, gingival zenith, and buccal corridors. Smile arc, which refers to the curvature of the incisal edges of the maxillary anterior teeth with the curvature of the lower lip, plays a crucial role in smile aesthetics.[4] There are three types of smile arcs: consonant, flat, and reverse.[5] Smile arc is consonant when the curvature of the upper incisal line is parallel to the curvature formed by the lower lip when smiling. A consonant smile arc is considered the most pleasant and esthetic. Smile arc is flat when the upper incisal line is flat about the curvature of the lower lip and is reverse/inverse when the upper incisal line forms an opposite curvature to that formed by the lower lip, during a smile. An inverse smile gives a more aged appearance.[5]

Various studies have been conducted on assessing the parameters of smiles including smile arc. In one of the studies on the prevalence of smile arc types in dental students,[6] it was found that consonant smile arc was present in 45.2% of dental students, flat smile arc in 37.6%, and reverse smile arc in 7% of dental students. In another study,[7] it was found that female dental students are more able to identify consonant smile arcs than male students. This study[7] also showed that dental students were more critical in rating their smile as compared to medical and IT students. In a study by Jabbar *et al.*,[8] 126 patients undergoing orthodontic treatment were asked about different parameters of smile, almost 51% (n=64) of them preferred consonant smile arc as the most attractive.

There is limited research on the perception of different smile arc types among orthodontic patients. This cross-sectional study aims to investigate the frequency of perception of orthodontic patients regarding various smile arc types and to assess awareness of their smile arc.

Understanding the perception and preferences of orthodontic patients regarding different smile arc types can provide valuable insights for orthodontic treatment planning. This research will contribute to the existing knowledge base, helping orthodontists tailor treatment strategies to meet patients' aesthetic expectations.

MATERIAL AND METHODS

It was a cross-sectional study. The sampling technique used was non-probability consecutive sampling. The study was conducted at the Department of Orthodontics, Dental section, Ayub Medical College from 27th December 2023 to 30th January 2024. The sample size was calculated to be 126 using OpenEpi with a frequency percentage of 91%,[9] confidence limit of 5%, population size of 1 million, design effect equal to 1, and confidence level of 95%. Patients from both genders before starting their orthodontic treatment and above 14 years of age were included. Patients with a previous history of orthodontic treatment or already under orthodontic treatment, patients with a previous history of prosthodontic treatment, or patients having missing or severely restored maxillary anterior teeth were excluded from the study.

After obtaining approval (RC-EA-2023/200) from the institutional ethical review board committee, informed written consent was taken from the participants. The participants were then given a questionnaire form (annexure I, modified from a study[7]) on which they were shown digital images of smile arc variations, including a consonant smile arc, a flat smile arc, and a reverse smile arc. They were asked to rate the attractiveness of each image on a 1–4 scale (1=beautiful, 2=good, 3=average, and 4=poor) to indicate their preference for a specific smile arc type. Then they were asked about their smile arc type. Demographic data, including age, gender, and cultural background, were also collected. After filling out their questionnaire, a close-up image of their smile was taken with a Nikon D3500 SLR camera with an 18-55 mm kits lens on settings of f/8 aperture size, 1/200 shutter speed, 100 ISO, and magnification of 1:10.[10] Last part of the questionnaire was filled by the primary investigator. The primary investigator compared the patient's answer with their photograph and decided whether the patient had correctly identified their smile arc type or not.

Statistical analysis was performed on SPSS version 29. Descriptive statistics were used to summarize the data, including mean attractiveness ratings for each smile arc type. Categorical variables like gender and occupation were described as frequencies and percentages. Quantitative variables like age were described as mean±SD. Chi-square tests were conducted to identify associations between smile arc perception and demographic factors. All these were taken at a 5% level of significance and *p*-value less than 0.05.

RESULTS

Out of 126 participants, 70 (56%) were males and 56 (44%) were females with a mean age of 18.27±3.67 years. Patients were divided into five groups based on their age range: 13–15 years, 16–18 years, 19–21 years, 22–24 years, and 25–27 years. Most of them were in the 13–15 years and 19–21 years age range group. Figure-1 shows the age range distribution.

Among the participants 89% were students, 5% were dentists, 4 % were doctors, and 2% were housewives. The participants rated pictures A, B, and C as beautiful, good, average, and poor (Table-1). They rated picture A as beautiful (53.2%), and pictures B and C as average (58.7% and 40.5% respectively) Based on gender picture A was rated beautiful by both males and females (Figure-2). Picture B was rated average by both genders (see Figure-2). Picture C was rated poor by males and average by females (Figure-2). On the Pearson Chi-square test *p*-value was calculated to be 0.05 for picture A and 0.55 for picture B which was statistically insignificant while the *p*-value for picture C was <0.00 which was statistically significant.

Picture A was rated beautiful by 66.7% of the dentists, 80% of the doctors, and 52.7% of the students, while 100% of the housewives rated it as good with a *p*-value of 0.00 which is statistically significant. Picture B was rated good by 66.7% of the dentists, 80% of the doctors, and 100% of the housewives while it was rated as average by 63.4% of the students with a *p*-value of 0.01 which is statistically significant. Picture C was rated as poor by 66.7% of dentists and 80% of doctors while students (40.2%) and housewives (100%) rated it as average with a *p*-value of 0.04 which is statistically significant. Figure 3 shows the rating of pictures A, B, and C based on the age range of the participants. On the Pearson chi-square test, the *p*-value was calculated to be 0.01 for picture A, 0.00 for picture B, and <0.00 for picture C which were statistically significant. Out of 126 participants, 78 (62%) correctly identified the picture representing their smile arc. Table 2 shows the details of the participants correctly identifying their smile arc based on gender, age, and occupation along with their *p* values.

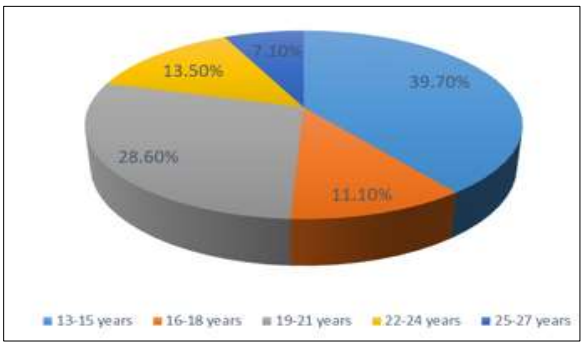

Figure-1: Age range of the participants

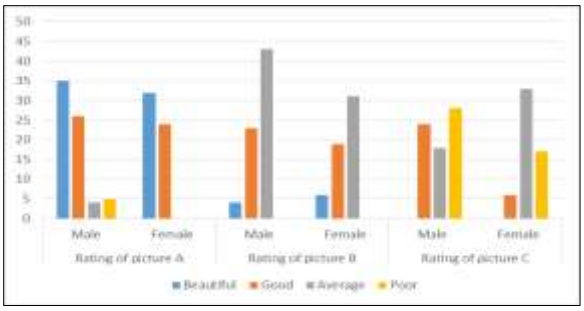

Figure-2: Ratings of pictures A, B, and C based on gender

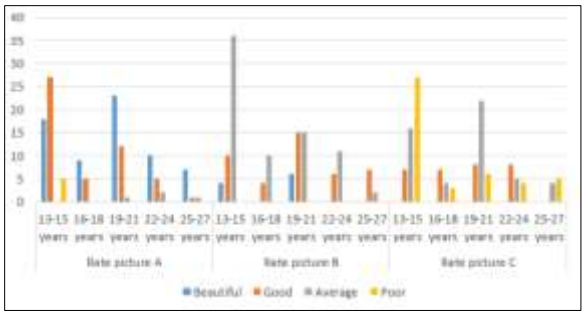

Figure-3: Ratings of pictures A, B, and C based on the age range

Table-1: Ratings of pictures A, B, and C.

Picture	Beautiful		Good		Average		Poor	
	Frequency	Percentages	Frequency	Percentages	Frequency	Percentages	Frequency	Percentages
A	67	53.2	50	39.7	4	3.2	5	4
B	10	7.9	42	33.3	74	58.7	0	0
C	0	0	30	23.8	51	40.5	45	35.7

Table-2: Participants correctly identify the picture representing their smile arc based on gender and age.

		Frequency	Percentage	*p*-value
Gender	Male	44	63	0.80
	Female	34	61	
Age	13-15 yrs.	34	68	0.39
	16-18 yrs.	8	57	
	19-21 yrs.	18	50	
	22-24 yrs.	11	65	
	25-27 yrs.	7	78	
Occupation	Student	70	62.5	0.13
	Dentist	4	66.7	
	Doctor	4	80	
	Housewife	0	0	

DISCUSSION

In this study, the preference for smile arc among orthodontic patients was investigated to understand its importance in treatment planning and overall patient satisfaction. The results revealed that a majority of patients exhibited a preference for a consonant smile arc, emphasizing the importance of achieving harmony between facial features and dental aesthetics.

Among the participants, 53.2% rated picture A (consonant smile arc) as beautiful while picture B (flat smile arc) and C (inverse smile arc) were rated as average by 58.7% and 40.5% of participants respectively. These results are similar to the study by Parekh *et al*.,[11] where consonant smile arc was rated acceptable by 84–95% of the participants while flat smile arcs were rated as acceptable by only 50–60%. In a similar study,[12] consonant smile arc was selected as the most attractive smile while inverse smile was selected as the least attractive smile. This preference could be attributed to the correlation of smile arc with youthfulness and vitality.

Gender did not affect the rating of pictures representing three different smile arcs except for the inverted smile arc. Both males and females rated consonant smile arc as beautiful, and flat smile arc as average while inverted smile was rated poor by males and average by females. In a similar study,[13] both genders (34.3%) considered consonant smile arc as fairly good, flat smile arc was considered bad by males (25.7%) and average by females (40%), reverse smile arc was rated bad by both males and females (31.7% and 45.7% respectively). In a dissimilar study, a [14] consonant smile arc was preferred in female subjects while a flat smile arc was preferred in male subjects. Our current study showed that age significantly affected the ratings of three pictures and this is by a similar study[15] with younger people being more aware of the attractiveness of smile as compared to older groups who are more tolerant in regards to smile attractiveness. In the current study, dentists and doctors were more aware of the smile attractiveness than the housewives and students, they identified consonant smile arcs as more beautiful while inverse smile arcs as poor. These results are from a study by Alshahrani *et al*.,[7] while they are in contradiction to another study[11] where occupation did not affect the rating of smile attractiveness.

Most of the participants (62%) in this study were able to correctly identify their smile arc with gender, age, and occupation having no significant impact. This could be due to the reason that the age group was between 13-27 years and this age group belonged to the era of selfies and

video callings. With the popularity of selfies,[16] people concentrate more on the lower third of their face specifically their smile so they are more aware of their smile and when asked they can easily identify their smile arc type. Increased use of Zoom calling during the COVID-19 pandemic not only brought individuals to visual scrutiny by others but they could also see themselves from an observer's perspective leading to increased self-awareness.[17] Thus irrespective of gender, age, and occupation people nowadays are more self-aware regarding their smile. So keeping these things in mind, the orthodontist should consider patients' smile arc preference while planning treatment to increase patients' satisfaction with the results. To enhance patient satisfaction with treatment, orthodontists should inquire about their patient's smiles and what changes they desire for their smiles and then proceed accordingly.

The strengths of the study was the large sample size. Limitations of the study were that the sampling technique was non-random sampling and the study was conducted at one center only so generalization to a larger population is not possible.

CONCLUSION

It was concluded that orthodontic patients consider consonant smile arcs as the most beautiful smile, and flat and inverted smile arcs as average. Age and occupation had a significant role in smile arc preference. Most of the patients were able to correctly identify their own smile arc and gender, age, and occupation did not affect this. So, by incorporating patient preferences, including smile arc preferences, into treatment planning, orthodontists can enhance patient satisfaction and improve treatment outcomes. Further research could be carried out in multiple centers and using more variables like lip morphology, tooth size buccal corridor, etc.

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AUTHORS' CONTRIBUTION

EN: Conceived, designed, did data collection, statistical analysis, manuscript writing, final approval of manuscript and is responsible for integrity of research. WI: Designed, statistical analysis, editing and review of manuscript, is responsible for integrity of research. NI: Statistical analysis and review of manuscript. FNA: Data collection. MJ: Statistical analysis. SS: Data collection

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