

## Perception of Smile Esthetics –A Questionnaire Based Study

B. Nivethigaa, Aravind Kumar Subramanian\* and Remmiya Mary Varghese

Department of Orthodontics, Saveetha Dental College, Saveetha  
University, SIMATS, Chennai 600077, India

### ABSTRACT

Smile is the most indicating feature of a individual's physical and social well-being. Most of the cosmetic treatment are aimed at achieving an ideal smile through improving various features of the smile. The predominant notable characteristic of the smile includes the dental hard and soft tissues which are at fault for many and subsequent orthodontic opinion are sought. From an orthodontist point of view, successful orthodontic treatment concerns about finishing the case according to the certain guidelines which in general includes dental relationships like dentition in occlusion, functional occlusion and parallel roots on panoramic radiograph with an esthetic soft tissue profile. But on the contrary, the patient views only the esthetic soft tissue profile and few visible dental features upon smiling. This study aimed at evaluating the perception of various features of smile esthetic by patients visiting orthodontic fraternity. The samples for the study were chosen among patients who visited Saveetha dental college for their orthodontic consultation. From among the orthodontic outpatients, 60 respondents (30 male and 30 females) between the age group of 15-30 years were randomly chosen.

Patient's consent to participate in the study was initially obtained. Few esthetically appealing posed smiles photographs with almost ideal occlusion were chosen. Using a photo modifying software, the photographs were then altered and arranged in a cluttered sequence where each set represented variations in particular dental and smile feature. Visual Analog scale was used to score these photographs. This consisted of a scale of values from 1 to 100 with labelling of least attractive towards the left which was coded as zero to right extreme at 100 mm which was labelled as very attractive. Data was tabulated and descriptive and inferential (independent t test) statistics were calculated. No Gingival show more than 1-2 mm, increase of 1 mm above the average crown exposure, presence of midline diastema was considered to be less esthetic Difference in the perception between the male and female population( $p>0.05$ ) was noted to be very minimal in the present study indicating an equally increasing awareness in both the genders. With increasing awareness among the laypersons, the decision regarding the treatment can be made a combined decision between the orthodontist and the layperson.

**KEY WORDS:** SMILE ESTHETICS, PATIENT PERSPECTIVE, PHOTOGRAPHIC SMILE ASSESSMENT, DENTAL ESTHETICS, VISUAL ANALOG SCALE.

### ARTICLE INFORMATION

\*Corresponding Author: [aravindkumar@saveetha.com](mailto:aravindkumar@saveetha.com)  
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## INTRODUCTION

Smile is the most indicating feature of an individual's physical and social well-being. It exhibits attractiveness to a patient appearance and also improves the self-confidence of an individual in the society. Most of the cosmetic treatment are aimed at achieving an ideal smile through improving various features of the smile. The predominant notable characteristic of the smile includes the dental hard and soft tissues, which are at fault for many for which subsequent orthodontic opinion are sought. Majority of the patients seek orthodontic treatment with a concern to improve smile esthetics (Shaw et al., 1985). Soft tissue drape either exhibits the problem of the underlying teeth and bone or it masks the problem by compensation. Achieving an esthetic smile is based on our understanding about various components of the smile and the balance that exists between hard and soft tissues.

Every coin has two sides, as with the saying, any orthodontic treatment need raised by the patient has two perspectives. Successful orthodontic treatment, in the orthodontist point of view, it concerns about finishing the case according to the certain guidelines which in general includes dental relationships like dentition in occlusion, functional occlusion and parallel roots on panoramic radiograph with an esthetic soft tissue profile. But on the contrary, the patient views only the esthetic soft tissue profile and few visible dental features upon smiling. Studies have shown a poor correlation between the patient perception and dentist consideration of these guidelines (Almanea et al., 2019). Difference in opinion exists even among the specialist pertaining various dental specialties. The orthodontist, periodontist usually be the critical reviewers followed by the endodontist and the prosthodontist compared to any other dental speciality. Hence apart from obtaining a good occlusion, consideration of the soft tissue in treatment planning holds utmost importance for an esthetic outcome (Khalil, 2019, Pinzan-Vercelino et al., 2020).

Hence soft tissue components should also be considered in these to improve the attractiveness of the smile (Schabel et al., 2008). The esthetic consideration of smile varies among people from different national and cultural background. Deviation from normal value can be acceptable in different population while achieving esthetic smile for a patient orthodontically (Jayachandar and Dinesh, 2016; Kamath and Arun, 2017; McLeod et al., 2011; Sridharan and Samantha, 2016). Several parameters of the facial features are considered to rate the attractiveness of the smile and these parameters vary among both the genders (Godinho et al., 2020).

Smile esthetics seems to be affected by a variety of dental features, each with a varied degree of threshold including the lateral negative space, arch with, shape, teeth shape, any other dental asymmetries and also the age of the population examined. Among the various factors, the presence of anomalies in the shape of the

teeth seemed mostly to affect smile esthetics (Kau et al., 2020). Standard orthodontic records include the photographs, radiographs and dental cast. They serve as an ideal replica of the hard and soft tissues. Photograph gives us a wide knowledge about the patient's smile and the soft tissue facial features (Havens et al., 2010; Howells and Shaw, 1985; Schabel et al., 2010).

Extraoral facial photographs depict the patient features at rest and during smile. Of the various possible smile, posed smile is one where voluntary smile is elicited and it is not driven by any emotions. It is usually a learned greeting and can be sustained and is reproducible. This is used in evaluation for orthodontic purposes (Ackerman et al., 1998). The smile features like the amount of lateral negative space visible, smile arc, smile line and symmetry of the smile are among the most importantly considered factors by many orthodontist and these factors altogether can be diagnosed from a frontal and oblique view photographs which hence form a essential modality for diagnosing orthodontic cases (Kadhim et al., 2020).

Variation in type of extraction plan has no effect on the smile esthetics. But rather it depends on the way in which the treatment plan is executed. Hence proper planning of various stages of treatment is more essential for success of orthodontic treatment (Janson et al., 2011). But in a study by Kim et al this concept has been disproved since no difference in change in arch width is noted among the two treatment options (Kim and Gianelly, 2003). Also type of the fixed appliance used doesn't have any difference in the smile esthetics, only the mechanics plays a role (Negreiros et al., 2020). Whereas another study had concluded that different modalities of the treatment have varied effect on the smile features when concerned like in patients treated with fixed appliance therapy, the amount of lateral negative space was reduced with increased dental show when compared to the patients treated with functional appliance therapy (Shoukat et al., 2020).

Previous literature evidences rule out the void between the patient desires and an orthodontist opinion on ideal occlusion. With a shift towards soft tissue paradigm, it is essential to consider the patient opinion regarding the final outcome of the treatment when deciding the treatment plan and the mechanics with which it would be achieved. This study aimed at evaluating the perception of various features of smile esthetics by the patients (non-dentist) visiting orthodontic fraternity (Shoukat et al., 2020).

**Objectives:** The objectives of the study were to evaluate patient perspective in visualizing the various features in a posed smile, especially, Level of Visibility of Gingival Margin, Crown Height of Central Incisors, Lateral Negative Space, Midline Diastema- Upper Central Incisors, Midline Deviation- Lower, Crown Angulation of Central Incisor

## MATERIAL AND METHODS

**Study Sample:** This was a cross sectional study done among patients who visited Saveetha dental college for their orthodontic consultation. From among these patients, 30 male and 30 female participants were randomly chosen. All these participants were in the age group of 15-30 years and had internal motivation for need for orthodontic treatment. Followed by explanation of the purpose of the study, with the respondent's consent, questionnaire was distributed.

**Questionnaire:** This consisted of 7 different smile photographs each one was used to depict a particular dental feature. Only ideal smile component was chosen and using a digital photo modifying software, each photograph was then altered (Adobe Systems Inc.) with few variations in each of the dental features specified. The alterations in these photos were made such that they quantify an increasing order of the particular discrepancy.

Seven sections of the photographs were included and under each of these the photograph depicting a particular parameter was jumbled and arranged such that they do not follow a constantly increasing pattern.

Several methods are available to measure individual perceptions of a particular feature (Phillips et al., 1992). Few of which includes the Q sort analysis and use of grading scales. Grading scales provide us a knowledge about exacting responses in comparison. Each of these methods has advantages and limitations (Schabel et al., 2009). Grading Scales are used for a variety of purpose including the perception of pain (Almoammar et al., 2020), effect of certain medicaments, anxiety (Gazal et al., 2016), assessment of esthetics (Cosyn et al., 2017). The major advantage with the use of such calibration was the continuum scale in which the number of features can be rated and the arithmetic mean and standard deviation would provide needed details regarding the discrete features (Fowler et al., 2019).

Table 1. Smile Parameters Mentioned in survey

Parameter	Increments of change
Level of visibility of gingival margin	Increased in an increment of 0.5 mm from 0.5mm to 2.5 mm (Figure 1)
Crown Height of Central incisors	Increased in an increment of 0.5 mm from less than 0.5mm to 2.5mm (Figure 2)
Lateral negative space	Increased in an increment of 1 mm from 0-5 mm. (Figure 3)
Midline diastema- Upper central incisors	Increased in an increment of 0.5 mm from 0mm- 2.5 mm (Figure 4)
Midline deviation- Upper	Increased in an increment of 0.5 mm from 0mm- 2 mm (Figure 5)
Midline deviation- Lower	Increased in an increment of 1 mm from 1-5 mm. (Figure 6)
Crown angulation of central incisor	Increased in increment of 5 degrees. from 0-15 degrees. (Figure 7)

Figure 1: Level of visibility of gingival margin- Increased in an increment of 0.5 mm from 0.5mm to 2.5 mm



Figure 2: Crown Height of Central incisors- Increased in an increment of 0.5 mm from less than 0.5mm to 2.5mm



In the present study, VAS (Visual analog scale ) was used to rate these photographs. This consisted of a scale of values from 1 to 100 with labelling of least attractive toward the left corner which was coded as zero to right corner at 100 mm which was labelled as very attractive.

Hence the participants after visualizing the set of pictures under each subheading, marked a score of 1-100 for each of the photograph. Pre testing of the questionnaire was initially done by the examiners among few out patients and the ability to process the details in



the photographs were analysed. After modifications, questionnaire consisting of seven dental features where shown to the patient ratings were graded based on the patient evaluation.

**Statistical Analysis:** Scores for each of the modified photograph along with the original photograph were

then entered in an excel sheet and the results were summarized. Data were then transferred to a SPSS (version 26.0) software and statistical analysis were performed. Independent samples t test was done between the male and the female population regarding their opinion about the individual smile parameters.

Figure 3: Lateral negative space - Increased in an increment of 1 mm from 0-5 mm.



Figure 4: Midline diastema- Upper central incisors- Increased in an increment of 0.5 mm from 0mm- 2.5 mm



Figure 5: Midline deviation- upper- Increased in an increment of 0.5 mm from 0mm- 2 mm



Figure 6: Midline deviation- Lower- Increased in an increment of 1 mm from 1-5 mm



Figure 7: Crown angulation of central incisor- Increased in increment of 5 degrees from 0-15 degrees.



## RESULTS AND DISCUSSION

The purpose of this study was to evaluate the patients' perception of the various smile features that is considered in any routine orthodontic diagnosis and treatment planning. The patient expectation and the orthodontist perspectives are two sides, the harmony between which brings an excellence in outcome. Orthodontist desires to bring an occlusal and functional balance wherein patients' considerations either deal with esthetics or function. Considering a patient with esthetic demands, it becomes essential to visualize the patient expectation.

With a shift in trend towards the soft tissue paradigm and analysis of micro and mini esthetic features helps in better understanding of an individuals' perception of these features and thereby help us evaluating and planning accordingly (Sarver, 2015).

Features of the smile considered in the study were gingival show in the anterior region, crown height of centrals with respect to the adjacent laterals, lateral negative space, midline discrepancies in upper and lower arch, midline diastema, Crown angulation of the centrals with respect to the adjacent central incisors. Totally 60

patients in the age group of 15-30 years participated in the study of which 30 patients were male and 30 were female. Overall, the results of the study showed no statistically significant differences in the perception between the male and female study population for the parameters considered.

**Gingival Show:** In the present study increase in gingival show of about 1-2 mm was considered to be more esthetic by most by both the male and female population

whereas increased show more than that was considered to be less esthetic. In a similar study by Talic et al in Saudi population it is shown that people there had lesser threshold for excessive gingival show. High gingival smile line was said to be unpleasant. But this concept is recently being disproved (Peck and peck, 1992; Talic et al., 2013) Age had an effect on the amount of gingival show in anterior region. With age the gingival show comparatively decreases and this was one of the pleasing characteristics according to elderly people.

Table 2. Smile Parameters Gingival exposure, Crown height of centrals, Lateral negative space.

FEATURE		GENDER	MEAN	STD. DEVIATION	P VALUE	
GINGIVAL EXPOSURE	GM 0	MALE	59.5000	7.11361	0.588*	
		FEMALE	58.50	7.089		
	GM 1	MALE	64.5000	7.11361	0.588*	
		FEMALE	63.50	7.089		
	GM 1.5	MALE	69.5000	7.11361	0.588*	
		FEMALE	68.50	7.089		
	GM 2	MALE	54.5000	7.11361	0.588*	
		FEMALE	53.50	7.089		
	GM 2.5	MALE	54.5000	7.11361	0.588*	
		FEMALE	53.50	7.089		
	CROWN HEIGHT OF CENTRALS	CH 0	MALE	69.5000	7.11361	0.588*
			FEMALE	68.5000	7.08933	
		CH 0.5	MALE	69.5000	7.11361	0.588*
			FEMALE	68.5000	7.08933	
CH 1		MALE	69.5000	7.11361	0.588*	
		FEMALE	68.5000	7.08933		
CH 1.5		MALE	64.5000	7.11361	0.588*	
		FEMALE	63.5000	7.08933		
CH 2		MALE	69.5000	7.11361	0.588*	
		FEMALE	58.5000	7.08933		
LATERAL NEGATIVE SPACE	LNS 0	MALE	69.5000	7.11361	0.588*	
		FEMALE	68.5000	7.08933		
	LNS 1	MALE	69.5000	7.11361	0.588*	
		FEMALE	68.5000	7.08933		
	LNS 2	MALE	64.5000	7.11361	0.588*	
		FEMALE	63.5000	7.08933		
	LNS 3	MALE	58.5000	8.21584	0.871*	
		FEMALE	58.1667	7.59802		
	LNS 4	MALE	53.5000	8.21584	0.631*	
		FEMALE	54.5000	7.80694		
	LNS 5	MALE	53.5000	8.21584	0.631*	
		FEMALE	54.5000	7.80694		

(\*P value > 0.05 hence statistically not significant)

On the contrary, young individuals consider visibility of the incisor upto a certain length to be more esthetic. (Sriphadungporn and Chamnannididha, 2017). Also in a recent study, ratter's in all age group have identified

reduced attractiveness of the smile with increased gingival show among both the gender (Tosun and Kaya, 2020). Reduction in the amount of upper incisor display and increased optimal display of the lower incisor were

believed to be more esthetic. In such a situation ensuring patient satisfaction becomes our utmost priority, treating the patients based on their likes and dislikes. (Table 2).

**Crown Height of Centrals:** Crown height measured from the incisal edge to the gingival margin was altered in increments of 0.5 mm. In the present study from the

values obtained, ability to identify the differences in the crown height was competitively low among the laypersons. In orthodontics, during treatment planning the average height differences considered in between the gingival levels of central and lateral was found to be 1.23mm, central being a at a higher position than the laterals (Hourfar et al., 2019).

Table 3: Smile Parameters Midline discrepancy (Upper and lower), Midline diastema, Crown Angulation

FEATURE		GENDER	MEAN	STD. DEVIATION	P VALUE
MIDLINE DISCREPANCY- UPPER	MD 0	MALE	88.5000	7.32850	0.858*
		FEMALE	89.5000	6.99137	
	MD 0.5	MALE	77.8333	8.06048	0.870*
		FEMALE	78.1667	7.59802	
	MD 1	MALE	58.5000	8.21584	0.871*
		FEMALE	58.1667	7.59802	
	MD 1.5	MALE	53.1667	10.94527	0.601*
		FEMALE	54.6667	11.13656	
MD 2	MALE	45.1667	13.42176	0.277*	
	FEMALE	41.1667	14.77902		
MIDLINE DISCREPANCY- LOWER	MD 0	MALE	87.3333	7.39680	0.858*
		FEMALE	87.6667	6.91492	
	MD 1	MALE	77.8333	8.06048	0.870*
		FEMALE	78.1667	7.59802	
	MD 2	MALE	58.5000	8.21584	0.871*
		FEMALE	58.1667	7.59802	
	MD 3	MALE	44.3333	14.66484	0.931*
		FEMALE	44.0000	15.10880	
MD 4	MALE	37.6667	13.87961	0.390*	
	FEMALE	34.5000	14.46458		
MIDLINE DIASTEMA	0MM	MALE	69.5000	7.11361	0.870*
		FEMALE	87.6667	6.91492	
	0.5MM	MALE	69.5000	7.11361	0.870*
		FEMALE	83.1667	7.59802	
	1 MM	MALE	64.5000	7.11361	0.871*
		FEMALE	78.1667	7.59802	
	1.5 MM	MALE	58.5000	8.21584	0.871*
		FEMALE	58.1667	7.59802	
2MM	MALE	53.5000	8.21584	0.631*	
	FEMALE	58.1667	7.59802		
2.5MM	MALE	53.5000	8.21584	0.897*	
	FEMALE	54.5000	7.80694		
CROWN ANGLATION	0 DEG	MALE	92.6667	5.04007	0.198*
		FEMALE	92.8333	4.85715	
	5 DEG	MALE	64.3333	6.53021	0.770*
		FEMALE	61.8333	8.25074	
	10 DEG	MALE	28.5000	6.03867	0.831*
		FEMALE	29.0000	7.11967	
	15 DEG	MALE	12.8333	6.25373	0.591*
		FEMALE	13.1667	5.79586	

(\*P value> 0.05 hence statistically not significant)

The discrepancies in the gingival show between the central and lateral incisor was a better tolerable feature by the lay person and most of them fail to appreciate this feature. The level of tolerance for this was noted to be 2mm (Ker et al., 2008). The labiolingual position of the incisors seem to be more evident when viewed by dentist or the layperson where dentist scored much lesser compared to the others(Jiang et al., 2020). Crown height measured from the incisal edge to the gingival margin was increased in increments of 0.5 mm. Increase in about 1 mm of the average crown exposure was considered to be normal. Increase in the height more than 1 mm is considered to be less esthetic.

Increase of more than 2 mm is considered to be the least attractive feature when smile is visualized which is similar to the results of the study by Talic et al where in Saudi population the layman perceived smile to be un-esthetic when it exceeds 2 mm than the average values (Talic et al., 2013).Also in a recent study, it had been evident that among the orthodontic patients, the width and height ratios were highly variable and doesn't correlate with the provided ideal values and the population are mostly unaware of such deviations that it doesn't make it a necessity for them to orthodontically correct such dental variations (Iftikhar and Roghani, 2020) (Table 2).

**Lateral Negative Space:** Lateral negative space is measured as the distance between the most posterior visible tooth to the corner of the lips during smile. Increase in the lateral negative space decreases the attractiveness of the smile for the patient. In an ideal smile the right and left side corridor spaces are equal. In men the negative space was comparatively larger than those in the female (Ritter et al., 2006). Moore et al described laypersons perception of an ideal smile was broader smile with ideal buccal corridor space (Moore et al., 2005; Ritter et al., 2006) . Descending perception of attractiveness was noted in the present study with increasing lateral negative space from 1 to 5 mm, this is in accordance to the study by Parekh et al (Parekh et al., 2006).

On the contrary in a study by Sabrina et al buccal corridor space was said to have a very little or almost no effect in the facial attractiveness of the patient (Zange et al., 2011). Gender differences in the amount of lateral negative space is present hence treatment formulation also varies between male and female population (Hadi et al., 2020). Also in a study among North Indian subjects, the more number of pleasing smiles were found in association of decreased buccal corridor space (Janu et al., 2020). Both dentist and the layperson perceive increase in the buccal corridor as an unaesthetic characteristic and such patients with increased lateral negative space were more ideal for undergoing orthodontic treatment on esthetic point (Golshah et al., 2020; Ioi et al., 2009, 2012; Ks et al., 2020). Also the lateral negative space was the most variable factors even in people with esthetically appealing smiles (Chen et al., 2020) (Table 2).

**Midline Diastema:** The presence of midline diastema was considered to be less esthetic than one without it. In patients increase in diastema of more than 2 mm was considered to be least esthetic than any feature deviations. The level of tolerance to midline diastema unlike any other dental anomaly was greatly increased. This was in accordance with few previous studies where in different population the appearance of the space between tooth was considered to be least tolerant un-aesthetic feature.(Bolas-Colvee et al., 2018) Diastema was a notable dental deformity and orthodontist seem to rate it better compared to laypersons(Tanaka et al., 2020) (Table 3).

**Dental Midline Discrepancy:** Minor deviations usually from the normal occurs in almost all the individuals. But in case of deviations more than certain acceptable levels are perceived to be un-aesthetic. Perception of esthetics varies among almost all individuals. Perception of the dentists have been studied so far concluding that dentists perceive even the minor deviation from the normal values. But decision regarding need for treatment is always in the patient view regarding every aspect of the malocclusion. The perception of the non-dentist regarding the upper dental midline shift showed that the upper dental midline shift was better perceived by the layperson. A deviation of more than 2mm was considered to be un-aesthetic. This is similar to a study by Talic et al among the Saudi population and Kokich et al among the American population where similar perception among laypersons were noted. The order of discrepancy of the midline is as follows, mandibular dental midline deviation was seen in 62% of patients, followed, in descending order of frequency, by lack of dental midline coincidence (46%), maxillary midline deviation from the facial midline (39%), molar classification asymmetry (22%), maxillary occlusal asymmetry (20%), mandibular occlusal asymmetry (18%), facial asymmetry (6%), chin deviation (4%), and nose deviation(3%)(Sheats et al., 1998).

Also, a threshold difference had been noted among the dentist and lay person regarding the perception of the upper dental midline deviation. Dentist in the previous studies have reported that they consider even 1mm of the midline deviation in the upper arch to be less esthetic. Even in those celebrities, who were said to have pleasing smile, persistence of the midline deviation was higher compared to any other dental asymmetry(Arroyo Cruz et al., 2020). This is probably because of the professional expertise of the dentist when compared to the patients in making out the minor deviations which in general are left unnoticed unless there is a notable deviation in the midlines. (Table 3).

**Crown Anglation:** Regarding the change in the inclination of the maxillary incisor tooth, 10 degrees and more than that from the normal inclination was rated to be comparatively unaesthetic. This is not in accordance to the similar study among the laypersons and dentists where only more than 15 degrees was considered to be unaesthetic by the Saudi population.(Talic et al., 2013)



This might be because of the increasing awareness among patients and their ability to judge even the minor disturbances in the dental esthetics. Also, these values are very similar to the dentist perception of the midline deviation where the even minor deviation in the axial inclination of the tooth was considered to be less esthetic(Williams et al., 2014).

## CONCLUSION

Within the limitations of the study, it can be concluded that attractiveness of face is inversely related to the presence of lateral negative space. Gingival show more than 1-2 mm, increase of 1 mm above the average crown exposure, presence of midline diastema was considered to be less esthetic. Difference in the perception between the male and female population was noted to be very minimal in the present study indicating an equally increasing awareness in both the genders. With increasing awareness among the laypersons, the decision regarding the treatment can be made a combined decision between the orthodontist and the layperson.

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