

Assessment of Various Smile Attributes in Skeletal Class I and Class II Malocclusion in Males and Females

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Abstract

Aim: To evaluate components of smile among subjects with skeletal class I and class II malocclusion, in males and females.

Materials and Method: Frontal view digital photographs of 20 individuals with posed smile were divided into skeletal class I and class II and males and females. Six smile components were assessed in each photograph using Adobe Photoshop.

Statistics: Statistical evaluation was done using SPSS software (version 25.0). Pearson Chi-square test was carried out to analyze the data.

Results: For skeletal class I & II malocclusion, Smile line and Labiodental relationship had more statistically significant results. Buccal Corridor had a high statistically significant gender difference. Smile arc, Midline discrepancy, and Upper lip curvature had no statistically significant difference between malocclusions and genders.

Non-consonant smile arc, average smile line, absent buccal corridor, presence of midline discrepancy, and straight upper lip curvature with a not-touching labiodental relationship were most frequently noted.

Conclusion: Components of smile esthetics act as guidelines for orthodontic treatment planning and help in achieving an esthetically attractive smile to satisfy patient's expectations and to obtain successful treatment results in patients with Class I and Class II malocclusions as well as in males and females.

Keyword: Smile, Smile Components, Malocclusion, Esthetics

Introduction

Smile is a wonderful facial expression indicating happiness, friendliness and gratitude. In the present soft tissue paradigm, orthodontic treatment is primarily to bring about soft tissue adaptation and enhance facial esthetics with modern standards of beauty and functional occlusion being the secondary goal.¹ Orthodontic patients appraise the outcome of treatment by their pleasing smile and overall enhancement in facial appearance which in turn overcomes their psychological and social stigma caused by malocclusions.

Smile is broadly classified as, spontaneous and posed smile. A spontaneous smile is involuntary, natural and driven by emotions with all facial expressions involved. A posed smile is voluntary, is the expression made when introduced to someone and when taking photograph or orthodontic records, such a smile is reproducible. The eight major components/attributes of smile which have impact on orthodontic diagnosis and treatment planning are lip line, smile arc, upper lip curvature, buccal corridor, smile symmetry, occlusal frontal plane, dental components and gingival components.² It is essential to understand these components of esthetically attractive smile to satisfy patients expectations and to achieve successful treatment results. Correction of most of the smile attributes is in the skillful hands of orthodontists to bring about a pleasing smile.

Skeletal malocclusion affects components of smile and treatment planning could be built in to improve the smile considering these smile attributes in patients with class I and class II malocclusions and also based on gender.

The aim of the present study was to assess smile components in individuals with skeletal Class I and Class II malocclusion and comparing the gender differences.

Materials and Method

The present study aimed to assess smile components in individuals with skeletal Class I and Class II malocclusion and comparing the gender differences. The materials and method employed for this investigation included specific inclusion and exclusion criteria. Inclusion criteria involved good-quality, voluntarily posed smile photographs of individuals aged between 18-30 years with skeletal Class I or Class II malocclusion. Notably, only those who had not undergone previous orthodontic treatment were considered. Conversely, exclusion criteria comprised poor-quality photographs, skeletal Class III malocclusion, facial asymmetry, congenital defects, or maxillofacial trauma.

The materials utilized for data collection included frontal view digital photographs of 20 individuals, captured using a Canon EOS 1300D digital camera. The assessment of these images was meticulously conducted through Adobe Photoshop version 24.0.0. This comprehensive approach allowed for a thorough evaluation of smile components in this demographic region, enhancing study's precision and relevance. An informed written consent was obtained from the 20 individuals participating in the study for the use of digital photographs.

Utilizing Steiner's ANB values from lateral cephalometric analysis,³ participants were categorized into Class I and Class II (Fig. 1a), and were further divided by their gender (Fig. 1b). Smile components evaluated include Smile Arc, Smile Line, Buccal Corridor, Midline Discrepancy, Upper Lip Curvature² and Labiodental Relationship⁴ (Fig. 2).



Fig. 1a

Fig. 1b

Fig. 1: Classification of groups

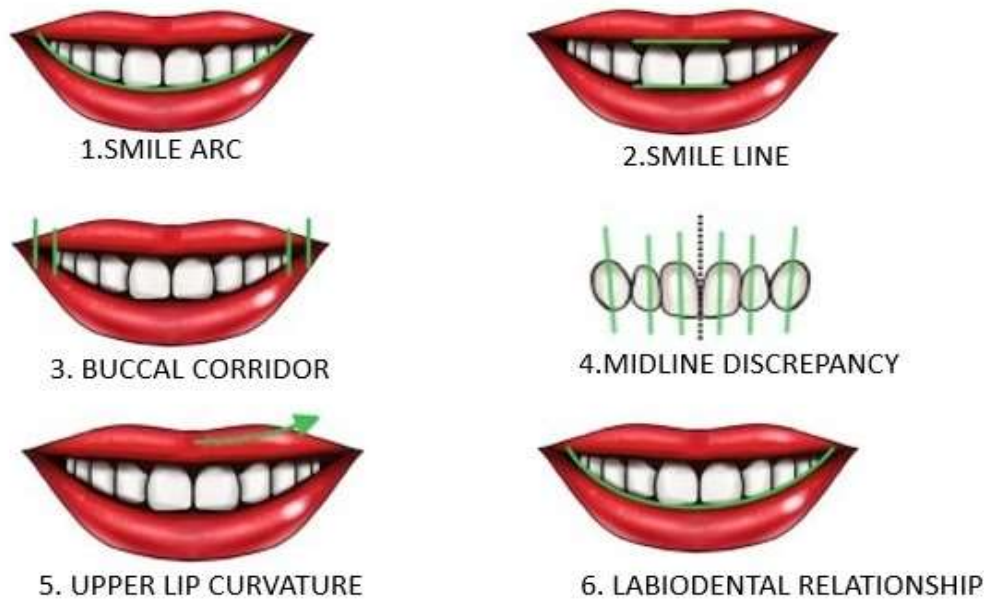


Fig. 2: Smile components

Smile Arc categorizes lip curvature into Consonant and Non-consonant based on the relationship of incisal edges of maxillary anterior teeth to the upper border of lower lip.^{2,4} In our study, the smile arc is defined by drawing a line from the maxillary central incisal edges to the cusp tips of the maxillary canines on either side, then comparing it to the upper border of the lower lip during a posed smile. When the line drawn follow the curvature of upper border of lower lip, it is referred to as a consonant smile (Fig. 3a), and it is called non-consonant smile, when the line does not follow or is flat to curvature of upper border of lower lip (Fig. 3b).^{2,4}

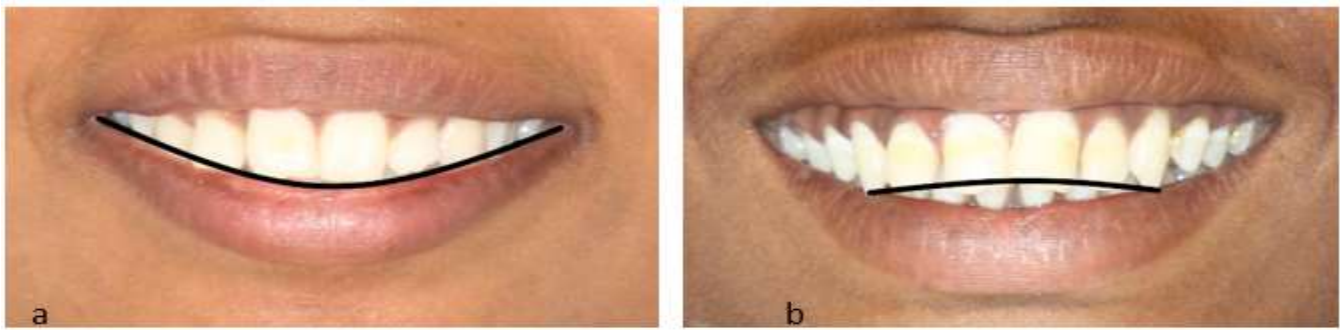


Fig. 3: Smile arc a) Consonant smile arc b) Non consonant smile arc

Smile line or lip line is the extent of vertical tooth display during smile which is the association of upper lip to the maxillary incisors and is demarcated by a line drawn along the lower border of upper lip.^{2,4} A high smile line displays all the maxillary anterior teeth with a significant amount of gingiva(Fig. 4a), whereas average smile line shows the complete maxillary anterior teeth with or without a thin band of gingiva(Fig. 4b) and low smile line displays less than two-thirds of maxillary anterior teeth(Fig. 4c).^{2,4}



Fig. 4: Smile line a) High b) Average c)Low

Buccal Corridor assesses the lateral negative space between posterior teeth and corner of the mouth during a smile.² Two vertical lines are drawn, one along the buccal margin of the maxillary first premolar and the other along the inner commissure of lips at the corner of the mouth on both sides and the horizontal distance between these two vertical lines is then measured. If there is a measurable horizontal distance, it indicates the presence of buccal corridor space (Fig. 5a). Conversely, if there is no measurable horizontal distance, it indicates the absence of buccal corridor space(Fig. 5b).

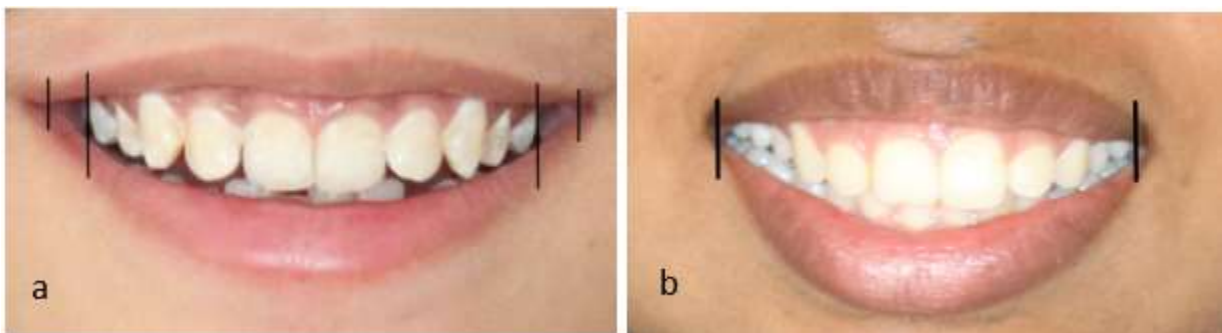


Fig. 5: Buccal corridor a) Presence of buccal corridor b) Absence of buccal corridor

The concept of midline discrepancy involves checking whether the dental midline aligns with facial midline.² This evaluation is typically done by drawing a straight line from the nose through philtrum (facial midline) and extending it to the midline between two maxillary central incisors (dental midline). When the lines fall in alignment, it indicates there's

no midline discrepancy (Fig. 6a).⁵ However, if there is any deviation between the dental midline and facial midline, then a midline discrepancy is considered to be present(Fig. 6b).



Fig. 6: Midline discrepancy a) Presence of midline discrepancy b) Absence of midline discrepancy

Upper Lip Curvature is evaluated from the central position of upper lip to the corner of the mouth during a smile.^{2,4} To assess the curvature of upper lip, a straight line was drawn through midpoint of the lower border of upper lip, and its relationship with the corner of the mouth was examined. Three categories were identified Upward, when the corner of the mouth is positioned above the horizontal line(Fig. 7a), Straight, where the corner of the mouth lies either directly on the line or within 1 mm of it(Fig. 7b), and Downward, when the corner of the mouth is situated below the horizontal line (Fig. 7c).^{2,4}



Fig. 7: Upper lip curvature a) Upward b) Straight c) Downward

Labiodental Relationship examines the distance between superior border of the lower lip and the incisal edge of maxillary anterior teeth.⁴ This relationship can be classified as: Covering: when the lower lip makes contact with the incisal edge of maxillary anterior teeth (Fig. 8a). Slightly touching: when the lower lip makes slight contact with the incisal edge of maxillary anterior teeth(Fig. 8b). Not touching: There is a visible space between the lower lip and the incisal edge of maxillary anterior teeth (Fig. 8c).⁴



Fig. 8: Labiodental relationship a) Covering b) Slightly touching c) Not touching

In the present study, these distinctions helped us in understanding the smile components for proper positioning of teeth which will have implications for various dental assessments and treatment planning.

Results

For smile line, a statistically significant difference between skeletal Class I & Class II was noticed (p value =0.002) with high smile line being prevalent in Class II subjects and average smile line in Class I subjects. Statistically significant difference was observed (p value= 0.036) in labiodental relationship between skeletal class I and class II malocclusions with not touching labiodental relationship noted most often in skeletal class II malocclusion whereas slightly touching and not touching type of relationship observed in class I malocclusion (Table 1).

Variables			Groups		Total	P value
			Skeletal class I	Skeletal class II		
Smile arc	Consonant	N	2	3	5	0.549
		%	20.0%	30.0%	25.0%	
	Non consonant	N	8	7	15	
		%	80.0%	70.0%	75.0%	
	Total	N	10	10	20	
%	100.0%	100.0%	100.0%			
Smile line	Average	N	5	3	8	0.002*
		%	50.0%	30.0%	40.0%	
	High	N	0	7	7	
		%	0.0%	70.0%	35.0%	
	Low	N	5	0	5	
%		50.0%	0.0%	25.0%		
Total	N	10	10	20		
%	100.0%	100.0%	100.0%			
Buccal corridor	Absent	N	6	6	12	1.000
		%	60.0%	60.0%	60.0%	
	Present	N	4	4	8	
		%	40.0%	40.0%	40.0%	
Total	N	10	10	20		
%	100.0%	100.0%	100.0%			
Variables			Groups		Total	P value
			Skeletal class I	Skeletal class II		
Midline discrepancy	Absent	N	2	0	2	0.136
		%	20.0%	0.0%	10.0%	
	Present	N	8	10	18	
		%	80.0%	100.0%	90.0%	
	Total	N	10	10	20	
%	100.0%	100.0%	100.0%			
Upper lip curvature	Downward	N	1	6	7	0.052
		%	10.0%	60.0%	35.0%	
	Straight	N	8	4	12	
		%	80.0%	40.0%	60.0%	
	Upward	N	1	0	1	
%		10.0%	0.0%	5.0%		
Total	N	10	10	20		
%	100.0%	100.0%	100.0%			
Labiodental relationship	Covering	N	1	0	1	0.036*
		%	10.0%	0.0%	5.0%	
	Not touching	N	5	10	15	
		%	50.0%	100.0%	75.0%	
	Slightly touching	N	4	0	4	
		%	40.0%	0.0%	20.0%	
Total	N	10	10	20		
%	100.0%	100.0%	100.0%			

Table 1: Comparison of variables between two skeletal groups – Chi square test

No statistically significant gender difference was noted with smile line and labiodental relationship. Buccal corridor was perceived to have a high statistically significant gender difference (p value<0.001). Wherein, most females presented with buccal corridors and males had the absence of the same. No statistically significant difference existed between skeletal malocclusions. Non consonant smile arc, midline discrepancy and straight upper lip curvature had no statistically significant difference between malocclusions and with both genders (Table).

Variables			Gender		Total	P value	Variables			Gender		Total	P value
			Females	Males						Females	Males		
Smile arc	Consonant	N	4	1	5	0.139	Midline discrepancy	Absent	N	2	0	2	0.136
		%	40.0%	10.0%	25.0%				%	20.0%	0.0%	10.0%	
	Non consonant	N	6	9	15			Present	N	8	10	18	
		%	60.0%	90.0%	75.0%				%	80.0%	100.0%	90.0%	
	Total	N	10	10	20			Total	N	10	10	20	
%		100.0%	100.0%	100.0%	%	100.0%	100.0%	100.0%	100.0%				
Smile line	Average	N	3	5	8	0.371	Upper lip curvature	Downward	N	5	2	7	0.270
		%	30.0%	50.0%	40.0%				%	50.0%	20.0%	35.0%	
	High	N	5	2	7			Straight	N	5	7	12	
		%	50.0%	20.0%	35.0%				%	50.0%	70.0%	60.0%	
	Low	N	2	3	5			Upward	N	0	1	1	
%		20.0%	30.0%	25.0%	%	0.0%	10.0%		5.0%				
Total	N	10	10	20	Total	N	10	10	20				
	%	100.0%	100.0%	100.0%	%	100.0%	100.0%	100.0%	100.0%				
Buccal corridor	Absent	N	2	10	12	<0.001*	Labiodental relationship	Covering	N	1	0	1	0.587
		%	20.0%	100.0%	60.0%				%	10.0%	0.0%	5.0%	
	Present	N	8	0	8			Not touching	N	7	8	15	
		%	80.0%	0.0%	40.0%				%	70.0%	80.0%	75.0%	
	Total	N	10	10	20			Slightly touching	N	2	2	4	
%		100.0%	100.0%	100.0%	%	20.0%	20.0%		20.0%				
					Total	N	10	10	20				
					%	100.0%	100.0%	100.0%	100.0%				

Table 2: Comparison of variables between males and females – Chi square test

Discussion

The value of an attractive smile is undeniable. An attractive smile in the modern society is an asset. According to Roy Sabri,² major components of smile and their impact on orthodontic diagnosis and treatment planning emphasis on improving smile esthetics.

The present study was carried out to evaluate the smile attributes among subjects with skeletal class I and class II malocclusion and in both the genders in a posed smile.

The smile components observed most frequently in the study were non consonant smile arc, average smile line, absence of buccal corridor, presence of midline discrepancy, straight upper lip curvature with a not touching labiodental relationship of maxillary anterior teeth with lower lip.

Non consonant smile arc was most commonly noted among the subjects of our study whereas consonant, which is considered most attractive was least frequently seen. This finding is in agreement with the results of study carried out by Maulik and Nanda.⁶ More females presented with consonant smile arc than males in our study similar to the study by Kaur et al.⁷ On the contrary, Khan et al,⁴ Tjan and Miller,⁸ Nold et al⁵ and Desai et al⁹ reported consonant smile arc as the most common finding in orthodontically treated and untreated nonorthodontic subjects. This difference in findings may be due to the fact that we have considered subjects with malocclusion who are willing to undergo orthodontic treatment. Non consonant smile arc which is unattractive might be the reason for the willingness to undergo orthodontic treatment.

Average smile line was observed most frequently among participants in this study, followed by high smile line. Studies carried out by Tjan et al,⁸ Khan et al⁴ and Nold et al⁵ have reported similar findings. Nold et al⁵ also reported low smile line to be least common among their study, this too is in agreement with the results of our study. Contrary to this, Khan et al,⁴ Tjan and Miller⁸ revealed high smile line were least common in their study participants. High smile line is more frequently observed in females and average being noted more commonly in males in the present study. This finding is

supported by the results of the study by Nold et al⁵. This may be because the subjects considered for our study are of both Class I and Class II malocclusion.

A consistent relationship exists between buccal corridor and smile attractiveness. The broader the smile with absence of buccal corridor, the more attractive the smile, similarly, the narrower the smile with presence of buccal corridor, the less attractive the smile. Ioi et al,¹⁰ Tikku et al¹¹ and Parekh et al¹² showed a significant effect of buccal corridor on esthetic perception of smile. In this study, presence of buccal corridor was more common in females compared to males. However, findings of Maulik and Nanda⁶ showed that females exhibited absence of buccal corridor than males. Study by Kaur et al⁷ suggested that there is difference among male and female buccal corridor space with females having more buccal corridor which is in concordance with our study.

Midline discrepancy is deviation of maxillary central incisor midline with facial midline. According to Beyer et al¹³ and Johnson et al,¹⁴ midline discrepancy of greater than 2 mm is not esthetically acceptable. However, Janson et al¹⁵ states that 2.2 mm of midline discrepancy is acceptable. In our study, presence of midline discrepancy was commonly noted in individuals of both Class I and Class II malocclusion with no gender difference which is similar to the study carried out by Kaur et al.⁷ On the contrary, Nold et al⁵ stated from his study that most of the subjects had coinciding dental and facial midline.

Straight upper lip curvature was most frequently observed component of smile in our subjects, which is in accordance with the study carried out by Liang et al.¹⁶ However, upward lip curvature was most common in the study done by Hulsey¹⁷ and Khan et al.⁴ Dong et al¹⁸ reported that straight to upward lip curvatures are considered more appealing than downward lip curvature, though this parameter cannot be altered by orthodontic corrections. This variation could be due the use of still photographs unlike videography or natural smile carried out in other studies.

Majority of participants in the present study, had a non touching labiodental relationship, this finding is similar to the results of study carried out by Khan et al⁴ and Nold et al.⁵ Nold et al⁵ and Dong et al¹⁸ stated that non touching type of relationship is most common and most esthetic of all. Contradictory to the observation of our study, Tjan et al,⁸ have observed a higher percentage of touching labiodental relationship in their study.

Limitations

Further studies can be carried out with increased sample size and increased number of smile components to help in diagnosis and treatment planning for bringing about beautiful smiles.

Conclusion

The smile components most frequently observed in both class I and Class II subjects and in both the genders are non-consonant smile arc, average smile line, absence of buccal corridor, presence of midline discrepancy, straight upper lip curvature with a not touching labiodental relationship. Attributes of smile esthetics act as guidelines for orthodontic diagnosis and treatment planning. Treatment planning should be formulated considering all the smile components, to improve the characteristics of smile in patients with Class I and Class II malocclusions as well as in males and females.

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