

To Compare and Evaluate the Different Smile Parameters among Boys and Girls Dental Students in the Central Region of India

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ABSTRACT

Background: Recently in cosmetic dentistry the coverage of smile makeover has increased public awareness for dental aesthetics. This awareness of aesthetic smile is increasing day-by-day and playing a key role in various aspects starting from the sense of self welfare & confidence, social acceptability, outstanding performance at work and in relationships. Smile design is defined as “a systematic process governed by the psychology, health, function and rules of natural aesthetics to bring about some changes in soft and hard oral tissue within anatomical, physiological and psychological limitation, thereby creating a positive influence on the overall aesthetics of a person’s face and personality as a whole.

Materials & Methods: Following smile parameters were quantified using AutoCAD Photoshop ruler software: Maxillary incisor exposure (MIE) (mm), smile index (SI) (mm), smile arc, buccal corridor ratio (%), most posterior maxillary tooth visible, anterior height of the smile (%) and posterior height of the smile (%). Statistical Analysis: The data were compiled and statistical analysis was done using the statistical package of social science (SPSS) software (version 12). To determine Maxillary Incisal exposure (MIE) and Smile index (SI) unpaired t-test was applied. Chi-square test was applied for assessment of most posterior maxillary tooth visible, smile arc, buccal corridor, the anterior height of smile & posterior height of smile.

Results: Mean value was found to be 7.9 mm in boys and 8.16 mm for girls. The low smile line was found to be predominant in boys, while a high smile was predominant in girls. More girls (72%) than boys (62%) have a consonant smile. Girls displayed the second premolar commonly in contrast to boys, who displayed the first premolar. Parallel smile arc was noted more frequently in girls, while boys displayed flat smile arc commonly.

Conclusion: Prosthodontist’s have the responsibility to design and create smiles following an organized and systematic approach. Smile analysis is an integral part of prosthodontic multifactorial treatment planning giving the best treatment outcome.

Keywords: Smile parameters, smile index, smile height, smile curve and buccal corridor.

INTRODUCTION

According to “Goldstein” ***“ESTHETIC DENTISTRY IS THE ART OF DENTISTRY IN ITS PUREST FORM”***. Smile is one of the most important facial expression.

It is essential in expressing the friendliness, agreement and appreciation. A radiant smile

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influences a great extent of attractiveness in the personality of each and every individual.¹

The goal of an esthetic makeover is to develop a peaceful and stable masticatory system, where the teeth, tissues, muscles, skeletal structures and joints all function in harmony (Peter Dawson). An organized and systematic treatment planning with comprehensive approach is essential in smile designing cases. A successful, healthy and functional result requires an understanding of the harmonious inter-relationship among all the supporting oral structures including the teeth, muscles, bones, joints, gingival tissues, and occlusion.²

Smile is defined as facial expression characterized by an upward curving of the corners of the mouth. Smiles are classified as stages I and II. Stage I smile is a posed smile, while stage II is an unposed (spontaneous) smile. The posed social smile is repeatable photographically in comparison with Duchenne (enjoyment) smile. Most studies refer to the posed smile as it is reproducible and can be used as a reference position.³

According to Tjan, *et al*, smile line classified into high, average and low. A high smile line shows the entire cervical-incisal length of maxillary anterior teeth and an adjoining band of the gingiva. An average smile reveals 75-100% of the maxillary anterior teeth and the interproximal gingiva only. Lastly, a low smile line shows less than 75% of the upper anterior teeth, without any display of gingiva. They also mentioned that an "optimum smile" is the one that displays full clinical crown of the six maxillary anterior teeth and also the premolars from a frontal view.⁴

Lip contact should be evaluated from the position of lips in the rest position, as well as the range of lip mobility when smiling. These determine the amount of tooth structure and gingival tissue being revealed during the comparison between the repose and full smile positions.⁵ The smile line is considered acceptable if it is within the range of 2mm apical to heights of the gingiva of maxillary central incisors. Keeping this principle in recreating a smile need not be limited to the six anterior teeth, but may extend to include the posterior teeth. The number of teeth involved in the aesthetic treatment plan will depend upon the patient's facial and dental esthetical analysis.⁶

It is therefore imperative to integrate the esthetical parameters with the functional parameters of the occlusion. The incisal edge and the occlusal plane must be symmetrical and pleasing in appearance and the form should follow the principles of occlusion to ensure the overall health of the dentition. The design of the maxillary and mandibular anterior teeth must attempt to establish anterior guidance, which will disclose the posterior teeth during protrusive and lateral excursive movements. This is important to ensure the longevity and success of the anterior restorations.⁴

Much attention is given in clinical examination to the display zone of a smile, which is determined by inter-commissural width, inter-labial gap, smile index, display of gingiva, smile arc.¹ Analyzing the smile and obtaining averages for various smile components give an idea about a standard of normalcy to serve as a guideline for the creation of an esthetic smile. Therefore, this study was undertaken to evaluate and compare different smile components which are beneficial in creating a beautiful smile.

AIM AND OBJECTIVES

Aim: To Evaluate and Compare Different Smile Parameters Among Boys and Girls Dental Students in Central region of India.

Objectives:

1. To Compare and Evaluate Maxillary Incisor Exposure in Boys and Girls
2. To Compare and Evaluate Smile Index in Boys and Girls
3. To compare and evaluate smile arc in Boys and Girls
4. To compare and evaluate the anterior and posterior height of smiles in Boys and Girls
5. To compare and evaluate the most posterior maxillary tooth visible

To compare and evaluate the buccal corridor space.

MATERIALS AND METHODS

A cross-sectional study was undertaken to analyze smiles in the central Indian population. Frontal view photographs of 100 subjects (50 boys and 50 girls) aged about 18-27 years with a pleasing smile were

taken from the students of Vidharbha Youth Welfare Society Dental College & Hospital, Amravati.

Following inclusion criteria were strictly followed:

1. Age between 18-27 years.
2. Pleasing soft tissue drape and good lip competence.
3. Straight profile
4. Molars and canines in Angle's class I
5. Each Subject's consent was taken before taking the frontal view photographs.

Following inclusion criteria were strictly followed:

1. No gross developmental aberrations of the head and face
2. No previous orthodontic treatment or maxillofacial surgery.
3. Complete permanent dentition except for third molars with no missing or supernumerary teeth.
4. No spacing, no crowding
5. No canting of the maxillary occlusal plane.

Armamentarium:

Canon Eos 1300D digital camera with 18-55mm optical zoom



Fig 1: Photography



Fig 2: Tripod with umbrella flashes.

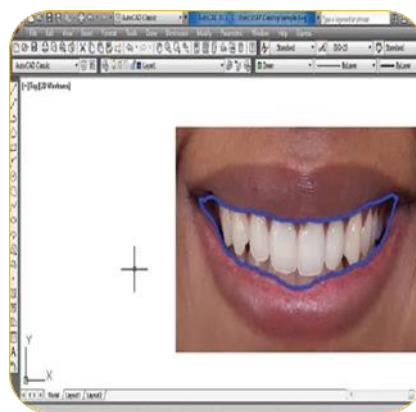


Fig 3: AutoCAD ruler software 2019.

Methodology

1. The subjects were photographed with posed smiles (because posed smiles are the most repeatable) after seating them in a Natural Head Position. Pictures were taken in the same environment with the same lighting conditions by using Canon EOS 1300D digital camera with 18-55mm optical zoom. (figure1)
2. The camera was fixed in position with a tripod maintaining 2 feet distance from the subject. (figure2)
3. The lens was positioned parallel to the true perpendicular of the face and the camera was raised to the level of the patient's lower facial third.
4. Apart from the built-in flash of the camera, umbrella flashes were also used for illumination of the subject. Because not all subjects have individually repeatable smiles, three smile images of each subject were taken and the most natural or representative smile for the application of the smile analysis was selected.
5. The photographs then transferred to AutoCAD ruler software 2019. The ruler in the same software was used to obtain all measurements for this study. (figure3)

RESULTS

Table 1: Sex Distribution of Subjects.

Sex	No. of patients	Percentages
Boys	50	50
Girls	50	50
Total	100	100

Table 2: Age distribution of subjects

Age group(years)	No of subjects
18-20	15
20-24	50
24-27	35
Total	100

Table 3: Master Chart for Parameter Studied.

Component	Gender	No of samples	P value	Results
Maxillary incisor exposure	Boys	50	0.523	Nonsignificant
	Girls	50		
Smile index	Boys	50	0.155	Nonsignificant
	girls	50		
Smile arc	Boys	50	0.005	Significant
	girls	50		
Most posterior maxillary tooth visible	Boys	50		Boys girls
	girls	50		
Buccal Corridor	Boys	50	0.0172	Nonsignificant
	Girls	50		
Anterior height of smile	Boys	50	0.010	Significant
	Girls	50		
Posterior height of smile	Boys	50	0.034	Significant
	Girls	50		

Data was statistically analyzed using the Statistical Package of Social Sciences (SPSS version 17.0). For MIE and SI, an unpaired t-test was applied. Chi-square test was applied for a most posterior maxillary tooth visible, smile arc, buccal corridor, the anterior height of smile and posterior height of smile [Table 3].

Maxillary incisor exposure:

The mean value of MIE was 7.9 mm in boys and 8.16 mm for girls. An unpaired t-test was applied, and the P-value was calculated. The P-value showed that there is no significant difference between boys and girls . [Table 3].

Smile index:

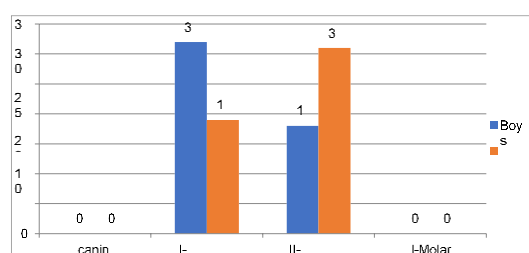
The mean value of SI was 8.26 mm in boys and 7.90 mm in girls. An unpaired t-test was applied and the P-value was calculated. The P-value showed that there is no significant difference for SI between boys and girls [Table 3].

Most posterior maxillary tooth visible:

In girls 62% of the samples displayed the second premolar most posterior maxillary tooth visible on a smile, whereas, in boys 64% displayed the first premolar [Table 4]. There was a significant difference between boys and girls. Girls (38%) showed first premolar teeth more commonly, whereas the second premolar tooth was more commonly displayed by boys (36%) [Graph1]. None of the subjects showed canine or first molar as most posterior maxillary teeth visible. A Chi-square test was applied and the P-value came out to be significant. P-value showed that there is a significant relationship between gender and most posterior maxillary teeth visible.

Table 4: Most posterior maxillary tooth visibility.

Most posterior maxillary tooth visible:	Boys	Girls	Total
Canine	-	-	-
Premolar	32	19	Boys - 64% 1premolar 36% 2 premolar
Premolar	18	31	Girls - 38% 1premolar 62% 2premolar
Molar	-	0	-
Total	50	50	100



Graph 1: Gender differences in most posterior tooth visible.

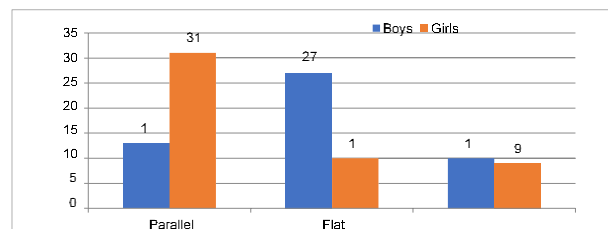
Smile arc:

In boys ,54% percent of the sample showed a flat smile arc, In girls 44% a parallel smile arc and 10% a reverse smile arc in both boys and girls 10% [Table 5] & [Graph 2]. A Chi-square test was applied

and the P-value was found to be nonsignificant [Table 3].

Table 5: Smile arch in different genders.

Smile arc	Boys	Girls	Total
Parallel	13	31	44%
Flat	27	10	54%
Reserve	10	9	10%
Total	50	50	100



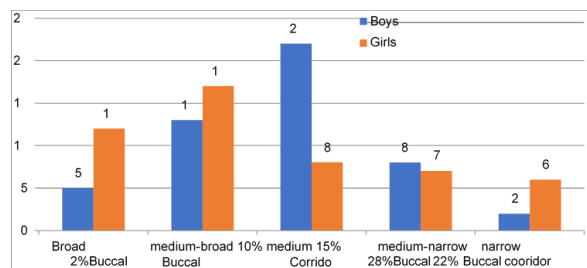
Graph 2: Gender differences in smile arc.

Buccal corridor ratio:

In girls 12% of total showed broad smile fullness and 7% showed medium-narrow smile fullness. Narrow smile fullness was seen least commonly in two percent of cases [Graph 3]. Medium smile fullness was most commonly found both in boys and girls, seen in 16% of boys and 44% girls. Medium-broad smile fullness was seen in 34% girls and 26% boys. The broad type was seen more commonly in girls (24%) than in boys (10%). Medium-narrow and narrow types were equally found in girls and boys constituting 14% -16% and 12%- 4% each, respectively [Table 5]. P-value showed that there is no significant relationship between.[table3]

Table 5: Gender difference in buccal corridor ratio.

Buccal corridor	Girls	Boys
Broad	24%	10%
Medium-Broad	34%	26%



Graph 3: Gender difference in buccal corridor ratio.

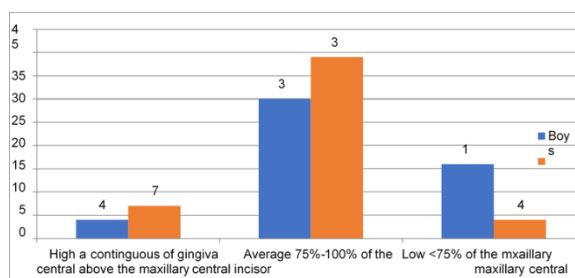
Anterior height of the smile:

In boys 66% of subjects showed average anterior height, followed by 36% subject showing a low anterior smile height and high anterior smile height was seen in 4% of boys .78% percent of girls showed an average anterior smile height followed by 22% subject showing a low anterior smile height and high anterior smile height was seen in 2% of girls [Table 6]& [Graph 4]. The Chi-square test was applied, and the P-value was found to be significant.

The P-value showed that there is a significant relationship between gender and the anterior height of the smile [Table 3].

Table 6: Gender difference in anterior height of smile.

Anterior smile height	Girls	Boys
Average	78%	66%
Low	22%	36%



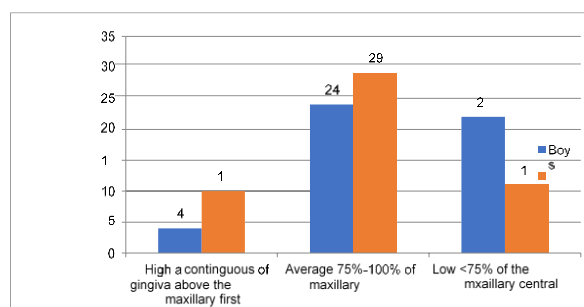
Graph 4: Gender difference in anterior height of smile

Posterior height of the smile:

In girls 48% percent showed an average posterior height of smile, 42% showed low type and 12% showed a high posterior height of smile. In boys, the average posterior height of smile was more commonly seen 58%, followed by the low posterior height of smile in 32% and 12% showed high posterior height of smile .[Table 7]& (Graph 5). A Chi-square test was applied, and the P-value was found to be significant. The P-value showed that there is a significant relationship between gender and the posterior height of the smile [Table 3].

Table 7: Gender difference in posterior height of smile

Posterior smile height	Girls	Boys
Average	48%	58%
Low	42%	32%
High	12%	12%



Graph 5: Gender difference in posterior height of smile.

DISCUSSION

The present study was undertaken to evaluate various parameters in an esthetic smile. In the present study, static photographs of a posed smile were taken in frontal view with canon 1300D digital camera.¹ Consideration of the criteria of a smile obtained from this study may be very useful in improving the esthetic value of restoration. For example, establishing the length of the maxillary teeth and the interincisal distances between the anterior teeth.

A correct interincisal distance among the centrals, laterals and canines is necessary to create an attractive incisal curvature that parallels the inner curvature of the lower lip and it also creates the esthetically required “dynamic negative space.”⁵ Artists use the “eye unit” (the unit of facial measurement) theory to describe the topographic interrelationship of facial features.

The most frequent type of smile is the average smile that reveals 75-100% of maxillary incisor length. In the present study mean value of MIE at a smile was 7.9mm for males and 8.16 mm for females. Geron and Atalia⁷ have concluded that 1 mm of upper-gingival exposure at smile and speech is within the esthetic range. However, smiles with the excessive upper and lower gingival display are considered

less attractive. In the present study, the mean value of MIE at a smile was 7.76 mm for males and 8.18 mm for females. Sixty-four percent of the subjects had an average anterior smile height, out of which 27% were boys, and 37% were girls, which is comparable to other studies.⁸ Our results agree with that of Tjan et al.⁴ who found a sexual dimorphism in that low-smile lines are predominantly male characteristic (2.5:1; M: F) and the high-smile line is predominantly a female characteristic (2:1; F: M). The present study showed that the low-smile line is common in males (M: F = 2.7:1), while the average smile line was more commonly observed in females. The mean value for the smile index was 8.3mm in boys and 8.1mm for girls. No statistical significance was found between gender and SI. Ackerman et al. reported a SI of 6.04 mm for boys and 6.29 mm for females.⁹ They also found no statistical significance between gender and SI. Schabel et al. noted a mean value of 5.3 mm for SI in their study.¹⁰

A key component of an esthetic smile is a consonance between the arcs formed between the incisal edges of the maxillary teeth and the curvature of the lower lip.¹ Consonance and no consonance in the smile arc were evaluated since it is well known that the consonance in the smile arc is more attractive of the two. Ackerman et al. also reported the flattening of the smile arc in 37% of treated patients when compared to only 5% in the untreated group.⁹ In the present study, the smile arc was parallel in 52% females while it was flat in 54% of males.

Ackerman et al. also reported the flattening of the smile arc in 37% of treated patients when compared to only 5% in the untreated group.⁹ In the present study, the smile arc was parallel in 44% females and flat in 54% of males. This was in agreement with Krishnan et al.,¹¹ who found a parallel smile arc to be more common in females (67%) than males (40%). Tjan et al.⁴ and Dong et al.¹² also found the parallel smile arc to be most frequent in their subjects (85%). The relationship between the patient’s arch form and the smile arc has been established. It has been suggested to maintain the patient’s original arch form as widening of the dental arches may flatten the smile arc.

Buccal corridors spaces have been discussed in previous studies. A minimal buccal corridor is

preferred esthetically in both males and females, and large buccal corridors should be considered as an undesirable trait. However, several perception studies have reported a lay person's reaction to buccal corridors and a strong relationship could not be established between these traits and smile esthetics.^{1,3,4,13,14,15} Hulse and Frush and Fisher¹⁶ described two different methods to measure the buccal corridor ratio. We followed the method described by Frush and Fisher¹⁶ and used later by Moore et al.¹⁷ They defined buccal corridors of 28% as narrow, 22% as medium-narrow, 15% as a medium, 10% as medium-broad, and 2% as broad smile fullness. In the present study, the subjects showed medium smile fullness followed by 26% showing medium broad smile fullness. About 12% of the subjects showed broad smile fullness and 10% displayed medium-narrow smile fullness. In our study, the largest buccal corridor was found to be 34% and the smallest was 3.10%.

Posterior smile height was first assessed by Maulik and Nanda¹⁸ by analyzing the dynamic smile. They found that more subjects (42.6%) showed a high posterior smile height than average or low. In the present study, an average posterior smile height (58%) was slightly more common the low smile height (32%) and high posterior smile height were least observed (12%). A low posterior height smile was more common in males as compared to females.

Sixty-two percent of the sample displayed maxillary second premolar as the most posterior maxillary tooth visible which is comparable to other studies. Dong¹² found 57% of the sample showing maxillary second premolar as the most posterior maxillary tooth visible while Maulik and Nanda¹⁸ reported this in 51% of the cases. None of the cases in our study showed maxillary first molar on smiling. Tjan⁴ found that only 4% of their subjects showed the maxillary first molar on smiling. In present studies, sixty-four percent of the sample displayed maxillary first premolar as the most posterior maxillary tooth visible. It was found that there is a statistically significant difference between males and females for the anterior smile height, the posterior smile height, and most posterior maxillary tooth visible. Maulik and Nanda¹⁸ found a statistically significant difference between them for parallelism of smile arc and buccal corridor percentage in addition to these three components.

The present study showed that girls display higher anterior and posterior smile height than boys which are comparable to the observation made and Maulik and Nanda¹⁸ Girls showed a higher percentage of parallel smile arc and boys showed a higher percentage of flat smile arc. Maulik and Nanda¹⁸ also found in their study a higher percentage of parallel smile arc in girls, while boys showed a higher percentage of reverse smile arc. Smile analysis is an important aspect of patient-driven diagnosis and treatment planning. The smile line is important for the reconstruction of the dentogingival relationship to produce an esthetic and functional harmony.

CONCLUSION

This study was undertaken to assess various parameters of an esthetic smile in the Central Indian population. There is a statistical significant difference between boys and girls with an average smile reveals 75-100% of Maxillary incisor height. The low smile was found to be predominantly boys characteristics while a high smile was predominantly girls characteristic. These important esthetical parameters must be considered in determining and executing an appropriate individual treatment goal. Its impact on the final facial and smile appearance can be quite dramatic. Smile analysis and smile design generally involve a compromise between two factors that are often contradictory: The esthetical desires of the patient and prosthodontists and the patient's anatomic and physiologic limitations. This demands that we rethink some of our prosthetic mechanics and concepts of treatment to be consistently build this factor into our diagnostics, treatment planning and treatment regimens so as to execute a perfect aesthetic smile with long term duration.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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