

An Evaluation of smile in different malocclusion of local population – A pilot study

Jignesh kakadiya¹, Barnanshu Pattnaik², Monika Kumari³, Pradeep Vishnoi⁴

Abstract: This pilot study was conducted to measure lip-tooth characteristics of adolescents. Pretreatment front view photograph of Class-I, Class II division 1, Class II division 2 and Class III dental patterns. After all inclusion criteria were applied, the final sample consisted of 77 patients (35 male, 42 female) with a mean age of 18 years. The raw digital camera stream of each patient was edited to select a single image representing the smile index (the ratio of the inter-commissure width divided by the interlabial gap), inter-commissure width, interlabial gap, upper incisor height and width, maximum upper central incisor display, gingival display of the upper incisor, philtrum length, visible maxillary dentition, left and right buccal corridor, smile arc, most posterior maxillary teeth visible, right and left commissure height. The data were analysed using SPSS 16.0 for Windows. Overall statistically significant differences were observed among malocclusion groups for parameters such as a maximum maxillary incisor exposure, interlabial gap, smile index, ratio of incisor display, intercommissure width and except for smile width in which no statistically significant difference was observed. The left and right buccal corridor space on the smile did not differ significantly among Class II div.1, Class II div.2 and Class III, left and right buccal corridor space was only significant in the Class I patient. The most frequently visible last maxillary tooth was the first premolar in the Class I, Class II div. 1, class II div.2 and class. The maximum no. of patient have parallel smile arc in all malocclusion. There was significant difference in the upper central incisor display ratio among the malocclusion groups. The left and right buccal corridor space during smile did not differ significantly among the malocclusion groups, but only in Class I group the difference was significant. The smile arc did not differ significantly among different malocclusion.

Key Words: Smile; Anterior tooth display; Digital camera.

I. Introduction:

Beautiful teeth, visible when smiling, are in line with the present ideal of beauty. Smile is one of the most important expressions contributing to facial attractiveness. An attractive or pleasing smile enhances the acceptance of individual in the society by improving interpersonal relationships. Facial attractiveness is highly correlated with increased quality of life and interpersonal success. People tend to focus attention on the mouth as well as the eyes in social relationships. In particular, the smile is the second most important factor, after the eyes, that is considered when estimating facial beauty.

Psychological studies have shown that facial attractiveness affects the way an individual is regarded by others. Infants considered to be unattractive by the general population and their own mothers tend to be perceived more negatively than attractive infants. The attractiveness halo extends from home to school. It can affect teacher – students and student – peer relations and academic attainment. The modern society, a pleasant smile is an advantage in job interviews, social interactions and even in the selection of a spouse. Adolescent patients and their parents except orthodontic treatment to improve oral and dental functions, health and aesthetics and to enhance self-confidence and the quality of their social life. With patients becoming increasingly conscious of a beautiful smile. Smile esthetics has become the primary objective of orthodontic treatment.

Cosmetic dentistry has long been interested in the esthetics of the smile. Recently, the topic has become important for orthodontists because more orthodontic patients evaluate the outcome of treatment by their smiles and the overall enhancement in their facial appearance. Although orthodontic treatment is based primarily on occlusal relationships, greater attention is now paid to enhancing dentofacial characteristics to produce optimal facial esthetics.

Thus, orthodontic treatment should carefully consider the patient's facial appearance and particularly his/her smile. Improvement in facial aesthetics is a powerful motivation for seeking treatments. The most important esthetic goal in orthodontics is to achieve a balanced smile, which can be best described as an appropriate positioning of teeth and gingival scaffold within the dynamic display zone.

Smile analysis is part of a facial analysis and allows dentistry to recognize positive and negative elements in each patient's smile. Depending on the types of malocclusion, facial pattern of the patient. Orthodontic treatment can prove either beneficial or harmful to smile esthetics. Thus it is reasonable to regard smile analysis as an important tool for diagnosis and orthodontic treatment planning.

Lip- tooth relationships during smiling are important aspects of facial aesthetics. Our aims was to evaluate the lip-tooth relation in subjects with different types of malocclusion, using clinical photographs taken during smiling.

II. Material and methods

Source of Data:

Sample will consist of 77 patients reporting to the Department of Orthodontics & Dentofacial Orthopedics, Darshan Dental College & Hospital, Udaipur, Rajasthan.

Inclusion Criteria:

1. Patient between 16 to 45 years of age
2. No missing teeth
3. Extraoral photograph of the smile
4. Have a full complement of teeth
5. No history of previous orthodontic therapy

Exclusion Criteria:

1. Pre-pubertal patient
2. Syndromic patient
3. Abnormality facial

Study design:

Before the study, 158 retention patients and dental students were carefully examined, and experimental sample consisted of 35 male and 42 female patient who presented for orthodontic treatment. The mean ages of the male and female patient were 19.0 ± 6.7 years and 18.1 ± 4.9 years, respectively. The 77 patient, 25 had class I malocclusion, 25 class II division 1 malocclusion, 18 class II division 2 malocclusion, and 9 class III malocclusion. The patient were seated facing a camera positioned one metres in front of them. The Frontal Facial photographs were taken of each participant during smiling (Fig 1). All photographs were taken by the same investigator at a constant object-to-lens distance with a Coolpix digital camera (Nikon Photo Products). Gtf



Fig 1 . sample frontal facial photographs.

The subject was then asked to smile, after calculating the magnification of the recorded images, a vernier caliper was used to measure the width of an upper central incisor. The facial photographs were cropped so that only the lower face was shown (Fig 2).



Fig 2. Images cropped so that only lower face is visible.

Measured parameters

For each subject, the height and width of an upper central incisor was measured on a frame that showed all of the central incisor crown, and the height-to-width ratio calculated.

The following parameters were measurements were measured on frontal view smiling photograph.

Table 1. Measurements used to evaluate smile esthetics on frontal photographs

Height of central incisor (mm)	Distance measured between marginal gingiva and incisal edges of maxillary central incisor crowns
Width of central incisor (mm)	Distance measured between most distal and mesial points of maxillary central incisor crowns
Height of central incisor during smiling (mm)	Distance measured between most superior and inferior points on maxillary central incisor crowns during smiling
Maxillary incisor display (ratio %)	Height of central incisor during smiling divided by actual height of central incisor
Smile height (mm) (interlabial gap)	Interlabial gap as measured by distance from upper stomion to lower stomion during smiling
Philtrum height (mm)	Distance from subnasale to inferior border of upper lip during smiling
Left and right commissure height (mm)	Distance between the outer commissures and a horizontal line passing through the subnasal point
Smile width or outer commissure width (mm)	As delineated by the outermost confluences of the vermilion border of the lips at the corner of the mouth
Smile index (ratio)	Smile width divided by smile height
Visible dentition width (mm)	Distance between most lateral left and right points of visible maxillary dentition during smiling
Maxillary gingival display (mm)	Amount of maxillary gingival exposure between inferior border of upper lip and marginal gingiva of maxillary central incisors
Inner commissure width (mm)	the inner commissure is formed by the mucosa overlying the buccinator muscle where it inserts with the orbicularis oris muscle fibres at the modiolus
Smile arc	which may be in one of three forms: consonant (i.e. parallel), flat or reverse
Left and right buccal corridors,	measured from the inner commissure to the last visible maxillary tooth.
Most posterior maxillary tooth visible.	In case of a discrepancy between the two sides, the most posterior tooth was entered.

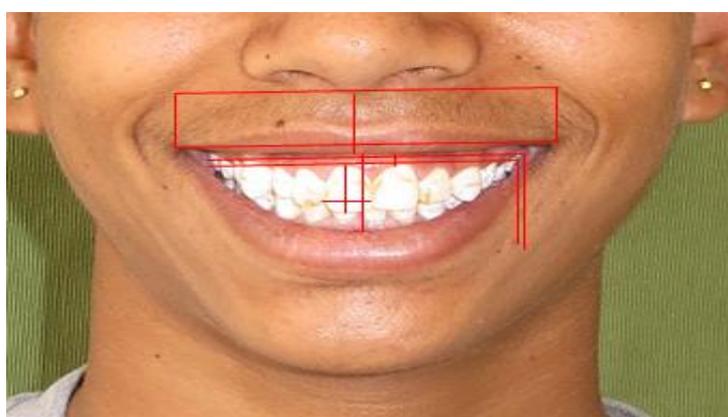


Fig 3 . Measurement of smile analysis frontal view photograph

III. Statistical analysis

Statistical analyses were performed with SPSS 16.0 for Windows. One-way analysis of variance (ANOVA) was Means, standard deviations, and significant value were calculated for the Smile measurements of all subjects.

The level of significance was established as $P < 0.05$ for all statistical tests.

IV. Results

Its most significant advantage is that the orthodontist can quantify such aspects of the smile as maxillary incisor display, buccal corridor ratio, interlabial gap, smile width, smile index, ratio of incisor exposure and intercommisure width during the smile.

The mean upper central incisor display ratio or percent of the visible crown height was 84 percent in the Class I, 79 percent in Class II div. 1, 63 percent in Class II div 2 and 57 percent in Class III during the smile.

Overall statistically significant different were observed among malocclusion groups for parameters such as a maximum maxillary incisor exposure ($p=0.001$), interlabial gap ($p=0.000$), smile index($p=0.000$), ratio of incisor display($p=0.001$), intercommisure width($p=0.000$) and except for smile width($p=0.147$) in which no statistically significant different was observed as shown in Table 2.

Table 2. Male and Female Combined (Mean ± SD)

Parameter	Class I	Class II division 1	Class II division 2	Class III	p value
Maximum incisor exposure	6.08 ± 1.28	5.80± 1.70	4.36± 1.81	4.11± 2.02	0.001
Interlabial gap	7.90± 2.11	6.08± 2.36	4.75± 2.17	5.11± 2.42	0.000
Smile width	41.24± 3.73	39.36± 3.62	40.61± 3.77	42.33± 3.67	0.147
Smile index	5.52± 1.53	7.58± 3.51	10.32± 4.48	10.20± 5.71	0.000
Ratio of incisor display	84.31 ± 17.32	79.49 ± 19.69	63.80 ± 26.16	57.00 ± 24.98	0.001
Inter commisure width	32.20 ± 3.50	34.68 ± 3.93	36.50 ± 3.65	37.56 ± 3.50	0.000

Table 3. Male only (Mean ± SD)

Parameter	Class I	Class II div 1	Class II div 2	Class III	p value
Maximum incisor exposure	6.27 ± 1.42	6.00 ± 2.09	4.00 ± 1.54	4.00 ± 2.30	0.024
interlabial gap	8.50 ± 2.50	6.03 ± 2.83	4.00 ± 1.54	5.28 ± 2.75	0.008
Smile width	41.18 ± 3.60	40.18 ± 3.48	41.33 ± 3.67	43.57 ± 2.93	0.264
Smile index	5.16 ± 1.27	7.73 ± 4.19	11.42 ± 3.69	10.68 ± 6.49	0.013
Ratio of incisor display	83.29 ± 18.11	79.27 ± 22.64	57.12 ± 21.68	53.56 ± 27.72	0.019
Philtrum height	9.91 ± 1.97	9.55 ± 2.11	10.83 ± 0.75	10.57 ± 1.61	0.469
Intercommisure width	32.27 ± 4.05	35.55 ± 4.03	36.67 ± 3.44	38.57 ± 3.10	0.011

The most specifically for Males statistically significant different were observed among malocclusion groups for parameters such as a Maximum maxillary incisor exposure($p=0.024$), Interlabial gap($p=0.008$), Rratio of incisor display($p=0.019$), Intercommisure width($p=0.011$), Smile index($p=0.013$) and except for Smile width($p=0.264$) and Philtrum height($p=0.469$) in which no statistically significant different was observed as shown in Table 3.

Table 4. Female only (Mean ± SD)

Parameter	Class I	Class II div.1	Class II div. 2	Class III	p value
Maximum incisor exposure	5.92 ± 1.20	5.64± 1.39	4.54± 1.97	4.50± 0.70	0.104
interlabial gap	7.42± 1.69	5.85± 1.99	5.12± 2.39	4.50± 0.70	0.025
Smile width	41.29± 3.97	38.71 ± 3.73	40.25± 3.93	38.00± 2.82	0.310
Smile index	5.81± 1.39	7.47± 3.05	9.77± 4.89	8.50± 0.70	0.034
Ratio of incisor display	85.11 ± 17.32	79.67 ± 17.95	67.15 ± 28.42	69.04± 3.36	0.179
Philtrum height	8.50 ± 1.09	10.21 ± 1.62	9.08 ± 1.24	10.50± 2.12	0.011
Inter commisure height	32.14 ± 3.15	34.00 ± 3.86	36.42 ± 3.89	34.00± 2.82	0.042

The most specifically for females statistically significant different were observed among malocclusion groups for parameters such as a Interlabial gap($p=0.025$), Intercommisure width($p=0.042$), Smile index($p=0.034$) and Philtrum height($p=0.011$) and except for Smile width($p=0.310$), Maximum maxillary incisor exposure($p=0.104$), and Ratio of incisor display($p=0.179$) in which no statistically significant different was observed as shown in Table 4.

Table 5. comparisons of the buccal corridor

Parameter	Class I Mean ± SD	Class II div.1 Mean ± SD	Class II div.2 Mean ± SD	Class III Mean ± SD	p value
Right	0.92 ± 0.99	0.80 ± 1.04	0.83 ± 0.85	0.67 ± 0.86	0.91
Left	0.52 ± 0.77	1.08 ± 0.95	0.89 ± 1.02	0.89 ± 0.92	0.19
p†	0.038	0.129	0.717	0.447	

On comparison of buccal corridor space in different malocclusion group no statistically significant observed in between different malocclusion group for both left and right buccal corridor space. Where as patient of Class I malocclusion group showed statistically significant different on comparison of right and left buccal corridor space among that as shown as Table 5.

The data were also stratified by sex to see whether the differences between the Maximum incisor exposure, Interlabial gap, Smile width, Smile index, Ratio of incisor display, Philtrum height, Intercommisure width in both male and female.

In intra group (table 6, table 7, table 8, & table 9) comparison of male and female patients, statistically significant difference was observed Philtrum height in class I (p= 0.033) and in class II div.2 (p=0.006) malocclusion groups & statistically significant difference was observed smile width in Class III (p=0.049) malocclusion group.

Table. 6 class 1 malocclusion with male and female

Parameter	Sex	Mean	Std. Deviation	P
Maximum incisor exposure	Male	6.273	1.4206	0.519
	Female	5.929	1.2067	
Ratio of incisor display	Male	83.2945	18.11406	0.800
	Female	85.1171	17.32755	
Interlabial gap	Male	8.500	2.5000	0.215
	Female	7.429	1.6968	
Philtrum height	Male	9.91	1.973	0.033
	Female	8.50	1.092	
Smile width	Male	41.18	3.601	0.947
	Female	41.29	3.970	
Smile index	Male	5.1618	1.27933	0.242
	Female	5.8114	1.39126	
Intercommisure width	Male	32.27	4.052	0.929
	Female	32.14	3.159	

Table 7 class II division 1 male and female

Parameter	sex	Mean	Std. Deviation	P
Maximum incisor exposure	Male	6.000	2.0976	0.614
	Female	5.643	1.3927	
Ratio of incisor display	Male	79.2727	22.64339	0.916
	Female	79.6743	17.92542	
Interlabial gap	Male	6.364	2.8381	0.605
	Female	5.857	1.9945	
Philtrum height	Male	9.55	2.115	0.380
	Mfemale	10.21	1.626	
Smile width	Male	40.18	3.488	0.326
	Female	38.71	3.730	
Smile index	Male	7.7309	4.19227	0.860
	Female	7.4729	3.05022	
Intercommisure width	Male	35.55	4.034	0.340
	female	34.00	3.863	

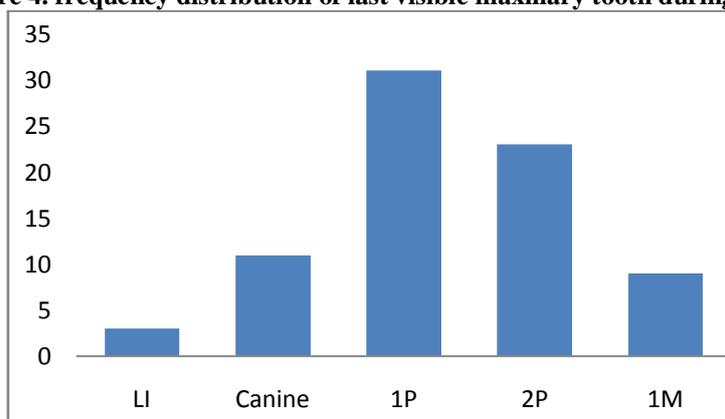
Table 8 class II division 2 male and female

Parameter	sex	Mean	Std. Deviation	P
Maximum incisor exposure	Male	4.000	1.5492	0.566
	Female	4.542	1.9709	
Ratio of incisor	Male	57.1233	21.68044	0.460
	Female	67.1500	28.42513	
Interlabial gap	Male	4.000	1.5492	0.314
	Female	5.125	2.3944	
Philtrum height	Male	10.83	.753	0.006
	Female	9.08	1.240	
Smile width	Male	41.33	3.670	0.582
	Female	40.25	3.934	
Smile index	Male	11.4267	3.69654	0.478
	Female	9.7717	4.89238	
Intercommisure width	Male	36.67	3.445	0.896
	Female	36.42	3.895	

Class 9 class III malocclusion male and female

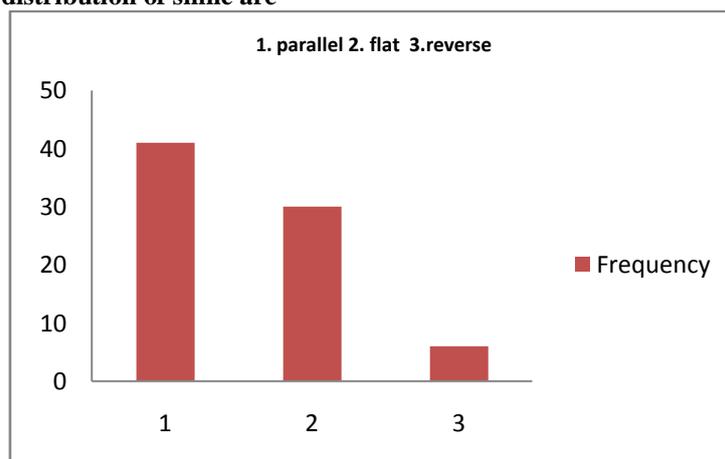
Parameter	sex	Mean	Std. Deviation	P
Maximum incisor exposure	Male	4.000	2.3094	0.781
	Female	4.500	.7071	
Ratio of incisor	Male	53.5686	27.72192	0.477
	Female	69.0400	3.36583	
Interlabial gap	Male	5.286	2.7516	0.713
	Female	4.500	.7071	
Philtrum height	Male	10.57	1.618	0.960
	Female	10.50	2.121	
Smile width	Male	43.57	2.936	0.049
	Female	38.00	2.828	
Smile index	Male	10.6857	6.49487	0.664
	Female	8.5000	.70711	
Inter commisure width	Male	38.57	3.101	0.105
	Female	34.00	2.828	

Figure 4. frequency distribution of last visible maxillary tooth during smile



As show in above bar chart (fig – 4) during the smile, the most frequently visible last maxillary tooth was the first premolar in the smile.

Figure 5. frequency distribution of smile arc



As show in above bar chart (fig – 5) maximum no. of pt present with a smile arc was parallel were as a reverse smile arc was observed in least no. of patient.

V. Discussion

The establishment of norms is important in orthodontics diagnosis and treatment planning , this study is the norms provide for maximum incisor exposure, smile arc, smile width, inter commissure width, buccal corridor space, the most posterior teeth visible , interlabial gap,smile width, ratio of incisor display & philtrum height studies used frontal view photographs. The upper central incisor display ratio or percent of the visible crown height was 84 percent in Class I, 79 percent in Class II div 1, 63 percent in Class II div 2 and 57 percent in Class III malocclusion group during smile.

Maximum no. of patient present with parallel smile arc. This agrees with the findings Tjan et al and Dong et al, who both found the parallel smile arc to be most frequent in their subjects and disagree with the findings Maulik and Nanda, who find the flat smile arc to be most frequent in their subject.

Measured the upper central incisor display ratio in defferent type of malocclusion and found more in females. Roozbeh Rashed and Farzin Heravi is found the upper central incisor display ratio in male and female during smile did not differ significantly among the malocclusion, although we reported that male patient with Class II div 2 and Class III malocclusion displayed less of their upper incisor during smile than patient with Class I and Class II div 1, and also reported that female patient with Class III malocclusion display less of their upper incisor during smile than patient with Class I and Class II div 1 and Class II div 2. A possible explanation for the similarity in the upper incisor display ratio among the malocclusions is that the soft tissues contribute more to incisor display than the underlying skeletal form.

We found a statistically significant ($P=0.038$) difference in the size of the buccalcorridors space between the right and left buccal corridor space in the Class I malocclusion group.The left and right buccal corridor space on the smile did not differe significant among Class II div.1, Class II div.2 and Class III because the buccal corridor space on right side was less than left side buccal corridor space. Roozbeh Rashed and Farzin Heravi found the buccal corridor during the unposed smile was less than that during the posed smile,but only the class division 2 group was significant different.As ackerman and Ackerman stated, the buccal corridor should be measured from the inner rather than the outer commissures. Burstone attributed the variability of this space among different types of smiles to the buccinator muscles.

Another objective was to compare the smile components between the sexes. We found a statistically significant difference between them in the smile component analyzed. Peck and Peck established that females display highest interlabial gap than males.We reported that male patient with Class II div 2 malocclusion group less of the Interlabial gap during smile than patient with Class I and Class II div 1 and Class III, andWe reposted that male patient display highest interlabial gap than female except in class II div 2 malocclusion group.& reported that female patient with Class III malocclusion display less of their upper incisor during smile than patient with Class I and Class II div 1 and Class II div 2. The importance of taking interlabial gap into account during treatment planning. We also found that the smile index differed significant during the smile, and attribute this to variability of soft tissue movement different smile width and interlabial gap. Isiksal and his colleagues reported that that the smile index had little impact on smile aesthetics. We found a consonant smile is present during a smile. The smile arc was similar in all malocclusion.

In agreement with maulik and nanda,and dong et al also found that the most frequently visible last upper teeth were the first and second premolar during the smile.

VI. Conclusion

There was significant difference in the upper central incisor display ratio among the malocclusion groups.

The left and right buccal corridor space during smile did not differ significant among the malocclusion groups, but only in Class I group the difference was significant

The smile arc did not differ significantly among different malocclusion. the most frequently visible last upper teeth were the first and second premolar during the smile.

References

- [1]. Roozbeh Rashed and Farzin Heravi. Lip- tooth relationships during smiling and speech: an evaluation of different malocclusion types. Australian orthodontic journal 2010;26:153-159.
- [2]. Ackerman MB, Ackerman JL. Smile analysis and design in the digital era. J Clin Orthodo 2002;36:221-36.
- [3]. Isiksal E, Hazar S, Akyalcin S. Smile aesthetics: perception and comparison of treated and untreated smile. Am J Orthod Dentofacial Orthop 2006;129:8-16.
- [4]. Maulik C, Nanda R. Dynamic smile analysis in young adults. Am J Orthod Dentofacial orthop 2007;132:307-15.
- [5]. Ackerman MB, Brensinger C, Landis JR. An evaluation of dynamic lip-tooth characteristics during speech and smile in adolescents. Angle Orthod 2004;74:43-50.
- [6]. Peck S, Peck L, Kataja M. the gingival smile line. Angle orthod 1992;62:91-100.